GROUNDWATER MONITORING PLAN

PLANT BRANCH
ASH POND E
PUTNAM COUNTY, GEORGIA

FOR

Georgia Power

NOVEMBER 2018

GOLDER

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CERTIFICATION

This *Groundwater Monitoring Plan, Georgia Power Company - Plant Branch Ash Pond AP-E* has been prepared to meet the requirements of the Georgia Solid Waste Management Rule by a qualified groundwater scientist or engineer with Golder Associates Inc. References to the appropriate 391-3-4 Rules are incorporated throughout this document.

I hereby certify that this *Groundwater Monitoring Plan, Georgia Power Company - Plant Branch Ash Pond AP-E* was prepared by, or under the direct supervision of, a "Qualified Groundwater Scientist," in accordance with the Rules of Solid Waste Management. According to 391-3-4-.01(57), a Qualified Groundwater Scientist is "a professional engineer or geologist registered to practice in Georgia who has received a baccalaureate or post-graduate degree in the natural sciences or engineering and has sufficient training and experience in groundwater hydrology and related fields that enable individuals to make sound professional judgments regarding groundwater monitoring, contaminant fate and transport, and corrective action." The design of the groundwater monitoring system was developed in compliance with the Georgia Environmental Protection Division (EPD) Rules of Solid Waste Management, Chapter 391-3-4.10(6).

Golder Associates Inc.

11/1/2018

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https://golderassociates.sharepoint.com/sites/11952g/shared documents/200 reports/groundwater monitoring plan/pond e/branch pond e gwmp_final_11.2018.docx

1.0 INTRODUCTION

Groundwater monitoring is required by the Georgia Environmental Protection Division (EPD) to detect and quantify potential changes in groundwater chemistry. This Groundwater Monitoring Plan (plan) describes the groundwater monitoring program for the site. This plan meets the requirements of EPD rules and uses EPD's Manual for Ground Water Monitoring dated September 1991 as a guide. Groundwater sampling locations are presented on Figure A1, Site Plan and Detection Monitoring Well Network in Appendix A for Ash Pond E (AP-E) at Plant Branch.

Monitoring will occur in accordance with 391-3-4-.10 of the Georgia Solid Waste Management Rules. If the monitoring requirements specified in this plan conflict with EPD rules (391-3-4), the EPD rules will take precedence.

In accordance with the United States Environmental Protection Agency (USEPA) Coal Combustion Rule (§257.90), which is incorporated by Georgia State CCR Rule by refernce, a detection monitoring well network for AP-E has been installed. The existing monitoring wells were installed following the guidelines presented herein. Additionally, this plan documents the methods for future monitoring well installation and/or replacement, and procedures for well abandonment. As required by 391-3-4.10(6)(g), a minor modification will be submitted to the EPD prior to the installation or decommissioning of monitoring wells. Well installation will be directed by a qualified groundwater scientist.

2.0 GEOLOGIC AND HYDROGEOLOGIC CONDITIONS

Geologic and hydrogeologic conditions for this site are described in a report, *Geologic and Hydrogeologic Summary Report*, prepared by Golder, October 2018 and submitted as part of this Design and Operations plan set. Key elements of this report are summarized below.

2.1 Site Geology

The site is underlain by biotite gneiss with local mafic lithologic variations represented by amphibolite/hornblende gneiss and diabase. Based on review of site-specific geologic mapping, the Plant property is primarily underlain by a fine- to medium-grained, poorly jointed biotite- quartz-feldspar gneiss that has been deeply and uniformly weathered. The gneiss is well-banded and well foliated with a planar, northeast-trending fabric and weathering develops a relatively thick, clay-rich, vermiculitic soil. The gneiss is locally interlayered with a zone of highly concentrated hornblende gneiss/amphibolite that trends northeast across the southern portion of Pond E.

Three small mafic intrusive masses were observed around Pond E as well: two occur southeast of the pond and the third occurs northwest of the pond. These discontinuous masses are resistant to weathering, standing out in relief relative to the surrounding differentially-weathered biotite gneiss. The intrusives consist of spheroidally-weathered, medium-grained, equigranular diabase that is well jointed and massive. Weathering of the diabase yields a massive, fat-clay with relict feldspar phenocrysts.

The southern end of the site is underlain by migmatitic gneiss with large amphibole crystals and discontinuous pods of amphibolilte as observed along with entrance road on the southern end of the property. Exposures of this unit are chaotically folded. Based on lack of exposure, contact relationship between the migmatitic gneiss and biotite gneiss was not determined.

Based on review of available information, micaceous, locally saprolitic soils, consisting primarily of clay, silty clay, silt, and sandy clay occur as a variably-thick blanket of residuum overlying bedrock across most of the site. The

thickness of residual soils encountered in the borings is variable, ranging from a minimum of 11 feet to as much as 74 feet. In the Piedmont, partially weathered rock (PWR) is described by Standard Penetration Test (SPT) blow counts that exceed 50 blows/foot. In the absence of SPT data, transitionally weathered rock (TWR) is defined based on the presence of saprolitic structures, rock fragments, and denser materials. W here data were available to determine the thickness of TWR, it is relatively thin (i.e., 10 feet or less), if present, except for a few locations where the thickness exceeds 20 feet.

2.2 Site Hydrogeology

A regional, unconfined aquifer system is present at the site, consisting of residual soils and transitionally weathered rock. Interconnected fractures in the transition zone transmit groundwater stored in the overburden soils to underlying bedrock, similar to the conceptual model for groundwater flow described in the Piedmont by LeGrand (2004). Overall, groundwater recharge is thought to occur in the uplands and groundwater discharge near onsite surface water bodies. The water level trends noted at Plant Branch are comparable to similar hydrogeologic settings in the Piedmont region of southeastern US (e.g., Chapman and others, 2007). Additionally, the relationship between groundwater levels and the site topography is consistent with the slope-aquifer conceptual model for groundwater flow in the Piedmont (Robinson and others, 1996; LeGrand, 2004).

The site is directly underlain by up to a 74-foot thick blanket of overburden, which is comprised of residual soils and transitionally weathered rock. Based on field hydraulic conductivity tests and laboratory permeability tests, the overburden is hydraulic conductivity ranges from 10^{-4} to 10^{-5} cm/s. Bedrock beneath the overburden is primarily characterized by poorly-jointed, feldspathic biotite gneiss with a localized zone of highly concentrated layers of amphibolite/hornblende gneiss interlayered with the biotite gneiss. Isolated diabase intrusive masses are also present on site. Lineaments identified around the site are consistent in orientation with structural features observed during geologic mapping, indicating that development of surface lineations is likely controlled by preferential weathering related to discontinuities in bedrock. The top of rock surface generally mimics site topography.

Boring logs and monitoring/piezometer installation logs were used to evaluate hydrostratigraphy of the site. Material types identified included residual soils, saprolitic soil, saprolitic and/or transitionally weathered rock (or PWR if blow counts were provided), and competent bedrock. Based on review of the logs, the screen/filter pack interval for most of the piezometers and monitoring wells installed on site provides connection to overburden that is saturated, indicating that the site is underlain by a regional groundwater aquifer that occurs within the overburden.

In general, the hydrogeology at the site is likely fairly uniform as noted by similar lithologic characteristics in the subsurface with the exception of local mafic units within the gneiss. These differing rock types are interlayered such that they are not likely to result in significant geochemical variation in the overburden and groundwater chemistry.

2.3 Uppermost Aquifer

The uppermost aquifer occurs within the overburden and TWR at the site. Although the degree of connection between the overburden/TWR and underlying bedrock aquifer systems is not known, the bedrock is massive with few joints available to receive groundwater from the overlying overburden. Consequently, groundwater flow within the uppermost aquifer is anticipated to occur primarily along the transitionally weathered rock zone which is located at the interface between the overburden residual soils and massive bedrock.

The potentiometric surface for the uppermost aquifer is generally eastward from the topographically high area upgradient of Pond E. In general, the groundwater flow is to the east, south, and west, respectively, where Pond E is situated north of Lake Sinclair (refer to Figure A2). Localized groundwater flow directions within this aquifer are influenced by the topography and top of rock variations on site. Locally, the potentiometric surface contours are also influenced by the pond dewatering activities. This pond was impounded on a topographic high within a former tributary that flowed eastward into Beaverdam Creek. A series of topographically high hilltops occur west of Pond E and appear to influence groundwater flow. Piezometer locations PZ-2I/S through PZ-5I/S exhibit groundwater elevations between approximately 438 and 452 feet, or around 12 to 26 feet higher than Pond E. These piezometer locations in turn are located east of the topographic divide between Pond E and the intermittent to permanently flowing creek to the west. Thus, these hilltops likely represent an upgradient groundwater divide on the property west of AP-E.

Recharge to the uppermost aquifer is primarily through precipitation. Data indicate that there is generally a downward gradient in topographically higher areas and an upward gradient in the topographic lows. Groundwater appears to be supporting surface water flow in these tributaries, as indicated by the local overlap in topographic and groundwater contours of similar elevation. Hydrogeologic conditions at the site indicate that the uppermost aquifer at the site is unconfined and is hydraulically connected to the bedrock through the transitionally-weathered zone.

Based on review of the potentiometric contours, horizontal hydraulic gradient is variable and reflects topography at the site. The horizontal gradient appears to be steeper around the downgradient perimeter of the ponds, particularly along embankments where groundwater flow lines are influenced by the constructed slopes for the dams. Generally, most of groundwater flow across the site occurs laterally in the TWR zone. Because the site is underlain by clay-rich residual soils and relatively massive bedrock, groundwater is expected to move laterally more than vertically within the TWR, which is considered to have a higher hydraulic conductivity relative to the overlying clay-rich and underlying massive bedrock material.

3.0 SELECTION OF WELL LOCATIONS

Groundwater monitoring wells are installed to monitor the uppermost aquifer beneath the site. Locations are selected based on site geologic and hydrogeologic considerations. Locations are chosen to serve as upgradient (BRGWA), lateral or downgradient (BRGWC) based on groundwater flow direction determined by potentiometric evaluation. A more detailed discussion of the conceptual model for groundwater flow and monitoring well placement as the site is included in the *Geological and Hydrogeological Summary Report*, prepared by Golder (October 2018).

Monitoring wells will generally be located outside of areas with frequent auto traffic; however, wells may be installed in heavily trafficked areas when necessary to meet the groundwater monitoring objectives of the EPD rules.

A map depicting monitoring well locations for monitoring AP-E is included in Appendix A, Monitoring System Details. Appendix A also includes a tabulated list of individual monitoring wells with well construction details such as location coordinates, top-of-casing elevation, well depths and screened intervals. A modification that involves the addition of or a change to the groundwater monitoring network will be made by a minor modification to the permit pursuant to 391-3-4-.02(3)(b)6.

4.0 MONITORING WELL DRILLING, CONSTRUCTION, ABANDONMENT & REPORTING

The existing monitoring well network for AP-E is in place. Existing monitoring wells were installed following Region 4 U.S. Environmental Protection Agency Science and Ecosystem Support Division Operating Procedure for Design and Installation of Monitoring Wells as a general guide for best practices. Monitoring well logs, for the existing monitoring well network, are included in Appendix A.

4.1 Drilling

A variety of well drilling methods are available for installing groundwater wells. Drilling methodology may include, but not be limited to: hollow stem augers, direct push, air rotary, mud rotary, or rotosonic techniques. The drilling method will minimize the disturbance of subsurface materials and shall not cause impact to the groundwater. Borings will be advanced using an appropriate drilling technology capable of drilling and installing a well in site-specific geology. Drilling equipment shall be decontaminated before use and between borehole locations using the procedures described in the latest version of the Region 4 U.S. Environmental Protection Agency Science and Ecosystem Support Division Operating Procedure for Field Equipment Cleaning and Decontamination as a guide.

Sampling and/or coring may be used to help determine the stratigraphy and geology. Samples will be logged under the oversight of a qualified groundwater scientist. Screen depths will be chosen based on the depth of the uppermost aquifer.

Drilling for any subsurface hydrologic investigation, installation or abandonment of groundwater wells will be performed by a driller that has, at the time of installation, a performance bond on file with the Water Well Standards Advisory Council.

Monitoring wells will be installed using the latest version of the Region 4 U.S. Environmental Protection Agency Science and Ecosystem Support Division Operating Procedure for Design and Installation of Monitoring Wells as a general guide for best practices.

4.2 Design and Construction

Well construction materials will be sufficiently durable to resist chemical and physical degradation and will not interfere with the quality of groundwater samples.

4.2.1 Well Casings and Screens

ASTM, NSF rated, Schedule 40, 2-inch polyvinyl chloride (PVC) pipe with flush threaded connections will be used for the well riser and screens. Compounds that can cause PVC to deteriorate (e.g., organic compounds) are not expected at this facility. If conditions warrant, other appropriate materials may be used for construction with prior written approval from the EPD.

4.2.2 Well Intake Design

The design and construction of the intake of the groundwater wells shall: (1) allow sufficient groundwater flow to the well for sampling; (2) minimize the passage of formation materials (turbidity) into the well; and (3) ensure sufficient structural integrity to prevent the collapse of the intake structure.

Each groundwater monitoring well will include a well screen designed to limit the amount of formation material passing into the well when it is purged and sampled. Screens with 0.010-inch slots have proven effective for the

earth materials at the site and will be used unless geologic conditions discovered at the time of installation dictate a different size. Screen length shall not exceed 10 feet without justification as to why a longer screen is necessary (e.g., significant variation in groundwater level). If the above techniques prove ineffective for developing a well with sufficient yield or acceptable turbidity, further steps will be taken to assure that the well screen is appropriately sized for the formation material. This may include performing sieve analysis of the formation material and determining well screen slot size based on the grain size distribution.

Pre-packed dual-wall well screens may be used for well construction. Pre-packed well screens combine a centralized inner well screen, a developed filter sand pack, and an outer conductor screen in one integrated unit composed of inert materials. Pre-packed well screens will be installed following general industry standards and using the latest version of the *Region 4 U.S. Environmental Protection Agency Science and Ecosystem Support Division Operating Procedure for Design and Installation of Monitoring Wells* as a general guide. If the dual-wall pre-packed-screened wells do not yield sufficient water or are excessively turbid after development, further steps will be taken to assure that the well screen is appropriately sized for the formation material. This may include performing sieve analysis of the formation material and determining well screen slot size based on the grain size distribution.

4.2.3 Filter Pack and Annular Seal

The materials used to construct the filter pack will be clean quartz sand of a size that is appropriate for the screened formation. Fabric filters will not be used as filter pack material. Sufficient filter material will be placed in the hole and measurements taken to ensure that no bridging occurs. Upon placement of the filter pack, the well may be pumped to assure settlement of the pack. If pumping is performed, the top of filter pack depth will be measured, and additional sand added if necessary. The filter pack will extend approximately one to two feet above the top of the well screen.

The materials used to seal the annular space must prevent hydraulic communication between strata and prevent migration from overlying areas into the well screen interval. A minimum of two feet of bentonite (chips, pellets, or slurry) will be placed immediately above the filter pack. The bentonite seal will extend up to the base of any overlying confining zone or the top of the water-bearing zone to prevent cementitous grout from entering the water-bearing or screened zone. If dry bentonite is used, the bentonite must be hydrated with potable water prior to grouting the remaining annulus.

The annulus above the bentonite seal will be grouted with a cement and bentonite mixture (approximately 94 pounds cement / 3 to 5 pounds bentonite / 6.5 gallons of potable water) placed via tremie pipe from the top of the bentonite seal. During grouting, care will be taken to assure that the bentonite seal is not disturbed by locating the base of the tremie pipe approximately 2 feet above the bentonite seal and injecting grout at low pressure/velocity.

4.2.4 Protective Casing and Well Completion

After allowing the grout to settle, the well will be finished by installing a flush-mount or above-ground protective casing as appropriate, and building a surface cap. The use of flush-mount wells will generally be limited to paved surfaces unless site operations warrant otherwise. The surface cap will extend from the top of the cement grout to ground surface, where it will become a concrete apron extending outward with a radius of at least 3 feet from the edge of the well casing and sloped to drain water away from the well.

Each well will be fitted with a cap that contains a hole or opening to allow the pressure in the well to equalize with atmospheric pressure. In wells with above-ground protection, the space between the well casing and the

protective casing may be filled with coarse sand or pea-gravel to within approximately 6 inches of the top of the well casing. A small weep hole will be drilled at the base of the metal casing for the drainage of moisture from the casing. Above ground protective covers will be locked.

Protective bollards may be installed around each above-grade groundwater monitoring well. Well construction in high traffic areas will generally be limited unless site conditions warrant otherwise.

The groundwater monitoring well detail attached in Appendix B, Groundwater Monitoring Well Detail, illustrates the general design and construction details for a monitoring well.

4.2.5 Well Development

After well construction is completed, wells will be developed by alternately purging and surging until relatively clear discharge water with little turbidity is observed. The goal will be to achieve a turbidity of less than 10 nephelometric turbidity units (NTUs); however, formation-specific conditions may not allow this target to be accomplished. Additionally, the stabilization criteria contained in Appendix C, Groundwater Sampling Procedures, should be met. A variety of techniques may be used to develop site groundwater monitoring wells. The method used must create reversals or surges in flow to eliminate bridging by particles around the well screen. These reversals or surges can be created by using surge blocks, bailers, or pumps. The wells will be developed using a pump capable of inducing the stress necessary to achieve the development goals. Development equipment will be decontaminated prior to first use and between wells.

In low yielding wells, potable water may be added to the well to facilitate surging of the well screen interval and removal of fine-grained sediment. If water is added, the volume will be documented and at minimum, an equal volume purged from the well.

Many geologic formations contain clay and silt particles that are small enough to work their way through the wells' filter packs over time. Therefore, the turbidity of the groundwater from the monitoring wells may gradually increase over time after initial well development. As a result, the monitoring wells may have to be redeveloped periodically to remove the silt and clay that has worked its way into the filter pack of the monitoring wells. Each monitoring well should be redeveloped when sample turbidity values have significantly increased since initial development or since prior redevelopment. The redevelopment should be performed as described above.

4.3 Well Abandonment

Monitoring wells will be abandoned using industry-accepted practices and using the *Manual for Groundwater Monitoring* (1991) and *Georgia Water Well Standards Act* (1985) as guides. The wells will be abandoned under the direction of a geologist or engineer registered in Georgia. Neat Portland cement or bentonite will be used as appropriate to complete abandonment and seal the well borehole.

4.4 Documentation

The following information documenting the construction and development of each well will be submitted to EPD by a qualified groundwater scientist within 30 days after completing planned well installations.

- Name of drilling contractor and type of drill rig
- Documentation that the driller, at the time the monitoring wells were installed, had a bond on file with the Water Well Advisory Council

- Dates of drilling and initial well emplacement
- Drilling method and drilling fluid if used
- Well location (± 0.5 ft.)
- Borehole diameter and well casing diameter
- Well depth (± 0.1 ft.)
- Lithologic logs
- Well casing materials
- Screen materials and design
- Screen length
- Screen slot size
- Filter pack material/size and volume
- Sealant materials and volume
- Documentation of ground surface elevation (± 0.01 ft.)
- Documentation of top of casing elevation (± 0.01 fl.)
- Schematic of the well with dimensions

5.0 GROUNDWATER MONITORING PARAMETERS AND FREQUENCY

The following describes groundwater sampling requirements with respect to parameters for analysis, sampling frequency, sample preservation and shipment, and analytical methods. Groundwater samples used to provide compliance monitoring data will not be filtered prior to collection.

Table 1, Groundwater Monitoring Parameters and Frequency presents the groundwater monitoring parameters and sampling frequency. A minimum of eight independent samples from each groundwater well will be collected and analyzed for 40 CFR 257, Subpart D, Appendix III and Appendix IV test parameters to establish a background statistical dataset. Subsequently, in accordance with 391-3-4-.10(6), the monitoring frequency for the Appendix III parameters will be at least semi-annual during the active life of the facility and the post-closure care period. If required, assessment monitoring will be performed per Georgia Chapter 391-3-4-.10, Rules for Solid Waste Management. GPC may petition for an alternate monitoring schedule for the site pursuant to applicable rules.

When referenced throughout this plan, Appendix III and Appendix IV parameters refer to the parameters contained in Appendix III and Appendix IV of 40 CFR 257, Subpart D, 80 Fed. Reg. 21468 (April 17, 2015).

As shown on Table 2, Analytical Method, the groundwater samples will be analyzed using methods specified in USEPA Manual SW-846, EPA 600/4-79-020, Standard Methods for the Examination of Water and Wastewater (SM18-20), USEPA Methods for the Chemical Analysis of Water and Wastes (MCAWW), American Society for Testing and Materials (ASTM), or other suitable analytical methods approved by the Georgia EPD. The method

used will be able to reach a suitable practical quantification limit to detect natural background conditions at the facility. Field instruments used to measure pH must be accurate and reproducible to within 0.1 Standard Units (S.U.).

Table 1: GROUNDWATER MONITORING PARAMETERS & FREQUENCY

MONITORING PARAMETER		GROUNDWATER MONITORING	
		BACKGROUND	SEMI-ANNUAL EVENT(S)
FIELD PARAMETERS	Temperature	X	X
	pH	X	X
	Specific Conductance	X	X
	ORP	X	X
	Turbidity	X	X
	Dissolved Oxygen	X	X
APPENDIX III (DETECTION)	Boron	X	X
	Calcium	X	X
	Chloride	X	X
	Fluoride	X	X
	pH (field)	X	X
	Sulfate	X	X
	Total Dissolved Solids	X	X
APPENDIX IV (ASSESSMENT)	Antimony	X	Assessment sampling frequency and parameter list determined in accordance with Georgia Chapter 391-3-4-.10(6)
	Arsenic	X	
	Barium	X	
	Beryllium	X	
	Cadmium	X	
	Chromium	X	
	Cobalt	X	
	Fluoride	X	
	Lead	X	
	Lithium	X	
	Mercury	X	
	Molybdenum	X	
	Selenium	X	
	Thallium	X	
	Radium 226 & 228	X	

Table 2: ANALYTICAL METHODS

PARAMETERS	EPA METHOD NUMBER
APPENDIX III	
Boron	EPA 6010B/6020
Calcium	EPA 6010B/6020
Chloride	EPA 300.0/300.1/9250/9251/9253/9056A
Fluoride	EPA 300.0/300.1/9214/9056A
pH	150.1 field
Sulfate	EPA 9035/9036/9038300.0/300.1/9056A
Total Dissolved Solids (TDS)	EPA 160/2540C
APPENIDX IV	
Antimony	EPA 7040/7041/6010B/6020
Arsenic	EPA 7060A/7061A/6010B/6020
Barium	EPA 7080A/7081/6010B/6020
Beryllium	EPA 7090/7091/6010B/6020
Cadmium	EPA 7130/7131A/6020
Chromium	EPA 7190/7191/6010B/6020
Cobalt	EPA 7200/7201/6010B/6020
Fluoride	EPA 300.0/300.1/9214/9056/9214
Lead	EPA 7420/7421/6010B/6020
Lithium	EPA 6010/6020B
Mercury	EPA 7470
Molybdenum	EPA 6010/6020B
Selenium	EPA 7740/7741A/6010B/6020
Thallium	EPA 7840/7841/6010/6020
Radium 226 and 228 combined	EPA 903/9320/9315

6.0 SAMPLE COLLECTION

During each sampling event, samples will be collected and handled in accordance with the procedures specified in Appendix C, Groundwater Sampling Procedures. Sampling procedures were developed using standard industry practice and USEPA Region 4 Field Branches Quality System and Technical Procedures as a guide. Low-flow sampling methodology will be utilized for sample collection. Alternative industry accepted sampling techniques may be used when appropriate with prior EPD approval.

For groundwater sampling, positive gas displacement Teflon or stainless-steel bladder pumps will be used for purging. If dedicated bladder pumps are not used, portable bladder pumps or peristaltic pumps (with dedicated or disposable tubing) may be used. When non-dedicated equipment is used, it will be decontaminated prior to use and between wells.

Groundwater wells that are determined to be dry for two consecutive sampling events should be replaced, unless an alternate schedule has been approved by EPD.

7.0 CHAIN-OF-CUSTODY

Samples will be handled under chain-of-custody (COC) procedures beginning in the field. The COC record will contain the following information:

- Sample identification numbers
- Signature of collector
- Date and time of collection
- Sample type
- Sample point identification
- Number of sample containers
- Signature of person(s) involved in the chain of possession
- Dates of possession by each individual

The samples will remain in the custody of assigned personnel, an assigned agent, or the laboratory. If the samples are transferred to other employees for delivery or transport, the sampler or possessor must relinquish possession and the samples must be received by the new owner.

If the samples are being shipped, a hard copy COC will be signed and enclosed within the shipping container.

Samplers must use COC forms provided by the analytical laboratory or use a COC form similarly formatted and containing the information listed above.

8.0 FIELD AND LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

Field quality control samples will be prepared the same as compliance samples with regards to sample volume, containers, and preservation. The following quality control samples will be collected during each sampling event:

Field Equipment Rinsate Blanks - Where sampling equipment is not new or dedicated, an equipment rinsate blank will be collected at a rate of one blank per 20 samples using non-dedicated equipment.

Field Duplicates - Field duplicates are collected by filling additional containers at the same location, and the field duplicate is assigned a unique sample identification number. One blind field duplicate will be collected for every 20 samples.

Field Blanks - Field blanks are collected in the field using the same water source that is used for decontamination. The water is poured directly into the supplied sample containers in the field and submitted to the laboratory for analysis of target constituents. One field blank will be collected for every 20 samples

The groundwater samples will be analyzed by licensed and accredited laboratories through the National Environmental Laboratory Accreditation Program (NELAP).

9.0 REPORTING RESULTS

A semi-annual groundwater report that documents the results of sampling and analysis will be submitted to EPD. Semi-annual groundwater monitoring reports will be submitted to the EPD within 90 days of receipt of the groundwater analytical data from the laboratory. At a minimum, semi-annual reports will include:

1) A narrative describing sampling activities and findings including a summary of the number of samples collected, the dates the samples were collected and whether the samples were required by the detection or assessment monitoring programs
2) A brief overview of purging/sampling methodologies
3) Discussion of results
4) Recommendations for the future monitoring consistent with the Rules
5) Potentiometric surface contour map for the aquifer(s) being monitored, signed and sealed by a Georgia-registered PG or PE
6) Table of as-built information for groundwater monitoring wells including top of casing elevations, ground elevations, screened elevations, current groundwater elevations and depth to water measurements
7) Groundwater flow rate and direction calculations
8) Identification of any groundwater wells that were installed or decommissioned during the preceding year, along with a narrative description of why these actions were taken
9) A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels
10) If applicable, semi-annual assessment monitoring results
11) Any alternate source demonstration completed during the previous monitoring period, if applicable
12) Laboratory reports
13) COC documentation
14) Field sampling logs including field instrument calibration, indicator parameters and parameter stabilization data
15) Documentation of non-functioning wells
16) Table of current analytical results for each well, highlighting statistically significant increases and concentrations above maximum contaminant level (MCL)
17) Statistical analyses
18) Certification by a qualified groundwater scientist.

10.0 STATISTICAL ANALYSES

Groundwater quality data from each sampling event will be statistically evaluated to determine if there has been a statistically significant change in groundwater chemistry. Historical background data will be used to determine statistical limits.

According to EPD rules (391-3-4-.10(6)(a), which incorporates the statistical analysis requirements of 40 CFR 257.93 by reference), the site must specify in the operating record the statistical methods to be used in evaluating groundwater monitoring data for each constituent. The statistical test chosen shall be conducted separately for each constituent in each well. As authorized by the rule, statistical tests that may be used include:

1) A prediction interval procedure in which an interval for each constituent is established from the distribution of the background data, and the level of each constituent in each compliance well is compared to the upper prediction limit. (§257.93(f)(3)).

2) A control chart approach that gives control limits for each constituent. ((§257.93(f)(4)).

3) Another statistical test method (such as prediction limits or control charts) that meets the performance standards of §257.93(g). A justification for an alternative method will be placed in the operating record and the Director notified of the use of an alternative test. The justification will demonstrate that the alternative method meets the performance standards of §257.93(g).

Based on site-specific conditions, statistical methods may be intra-well, inter-well, or combination of both.

A site-specific statistical analysis plan that provides details regarding the statistical methods to be used will be placed in the site's operating record pursuant to 391-3-4-.10(6). Figure 1, Statistical Analysis Plan Overview, includes a flowchart that depicts the process that will be followed to develop the site-specific plan. Figure 2, Decision Logic for Determining Appropriate Statistical Methods, depicts the decision logic that will be used to determine the appropriate method as required by 391-3-4-.10(6). Figure 3, Decision Logic for Computing Prediction Limits, presents the logic that will be used to calculate site-specific statistical limits and test compliance results against those limits.

Figure 1: STATISTICAL PLAN OVERVIEW

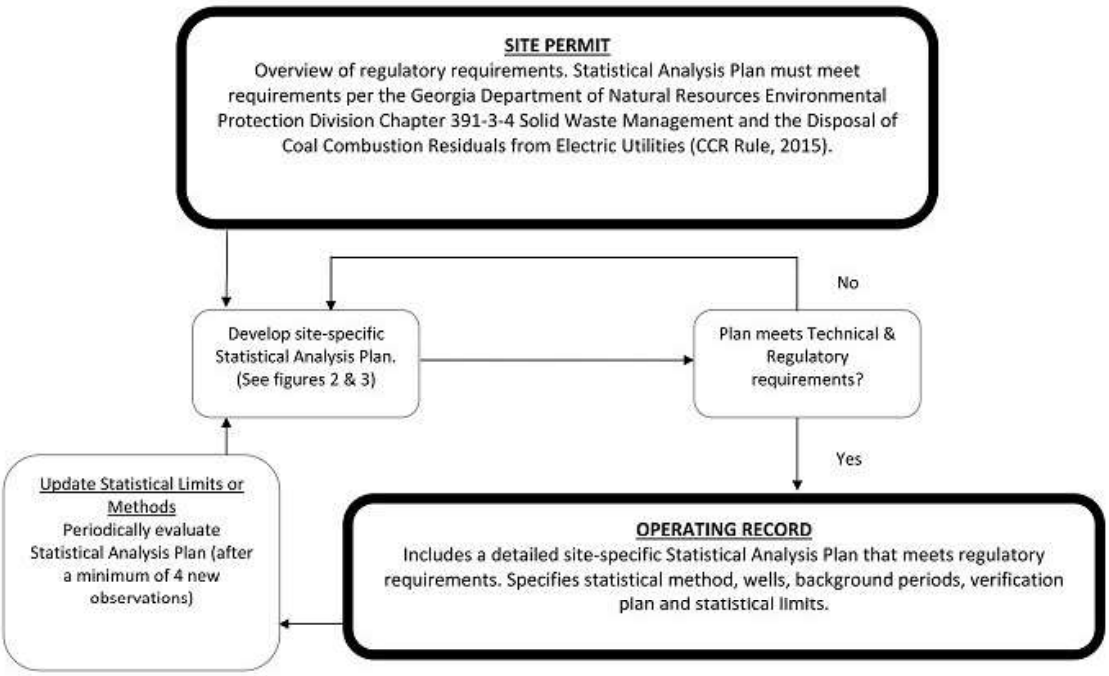


Figure 2: DECISION LOGIC FOR DETERMINING APPROPRIATE STATISTICAL METHOD

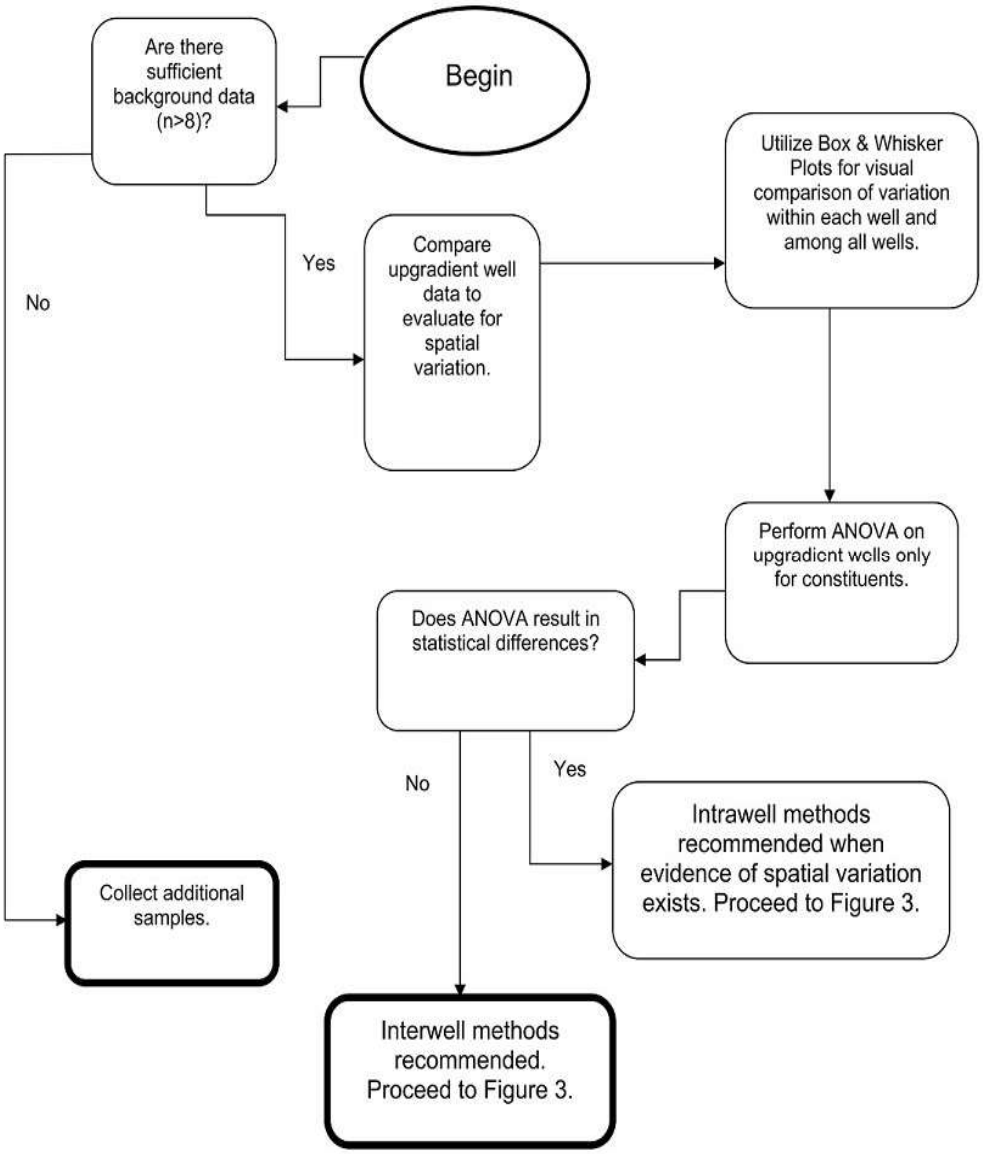
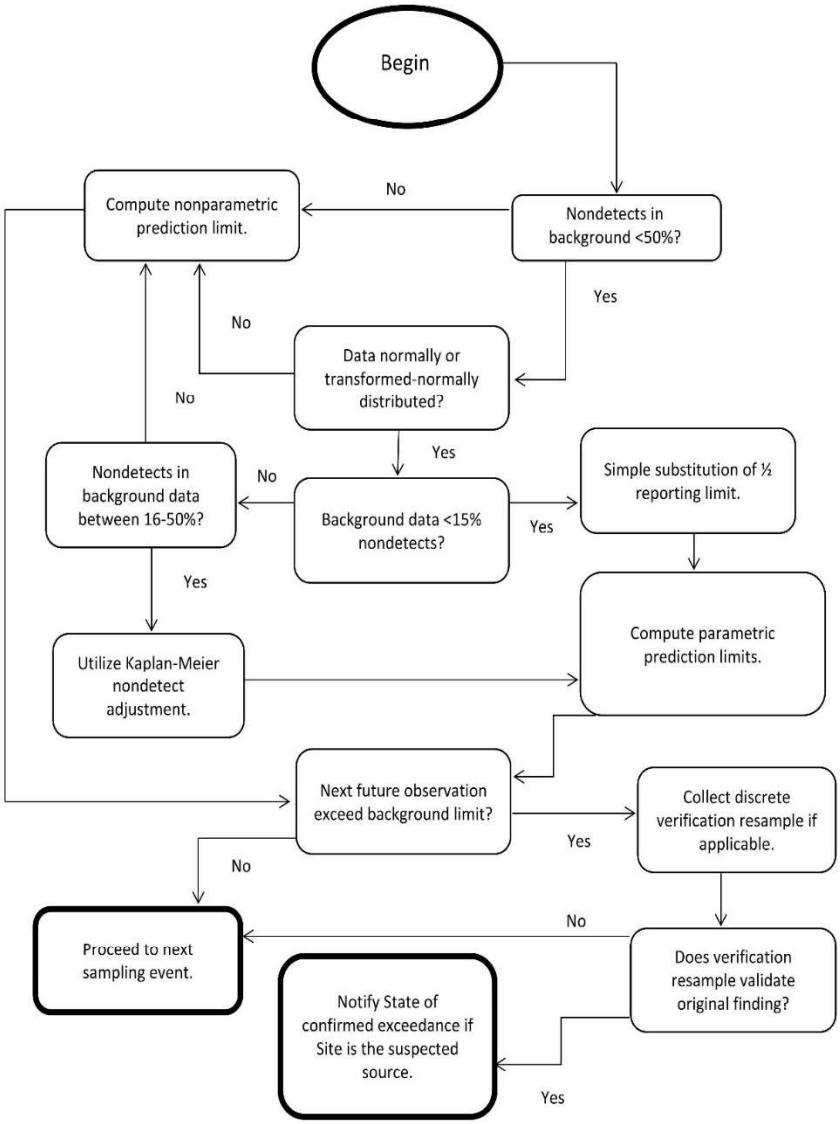


Figure 3: DECISION LOGIC FOR COMPUTING PREDICTION LIMITS



11.0 REFERENCES

American Society for Testing and Materials (ASTM)

Georgia (GA) Department of Natural Resources Environmental Protection Division, Rules of Solid Waste Management, Chapter 391-3-4-.10(6), Georgia Environmental Protection Division.

Georgia Water Well Standards Act (1985)

Golder Associates Inc., *Geological and Hydrogeological Summary Report – Plant Branch*, October 2018

Manual for Groundwater Monitoring (1991)

National Environmental Laboratory Accreditation Program (NELAP)

Region 4 U.S. Environmental Protection Agency Science and Ecosystem Support Division, Operating Procedure for Design and Installation of Monitoring Wells

Region 4 U.S. Environmental Protection Agency Science and Ecosystem Support Division, Operating Procedure for Field Equipment Cleaning and Decontamination

Region 4 U.S. Environmental Protection Agency, Field Branches Quality System and Technical Procedures

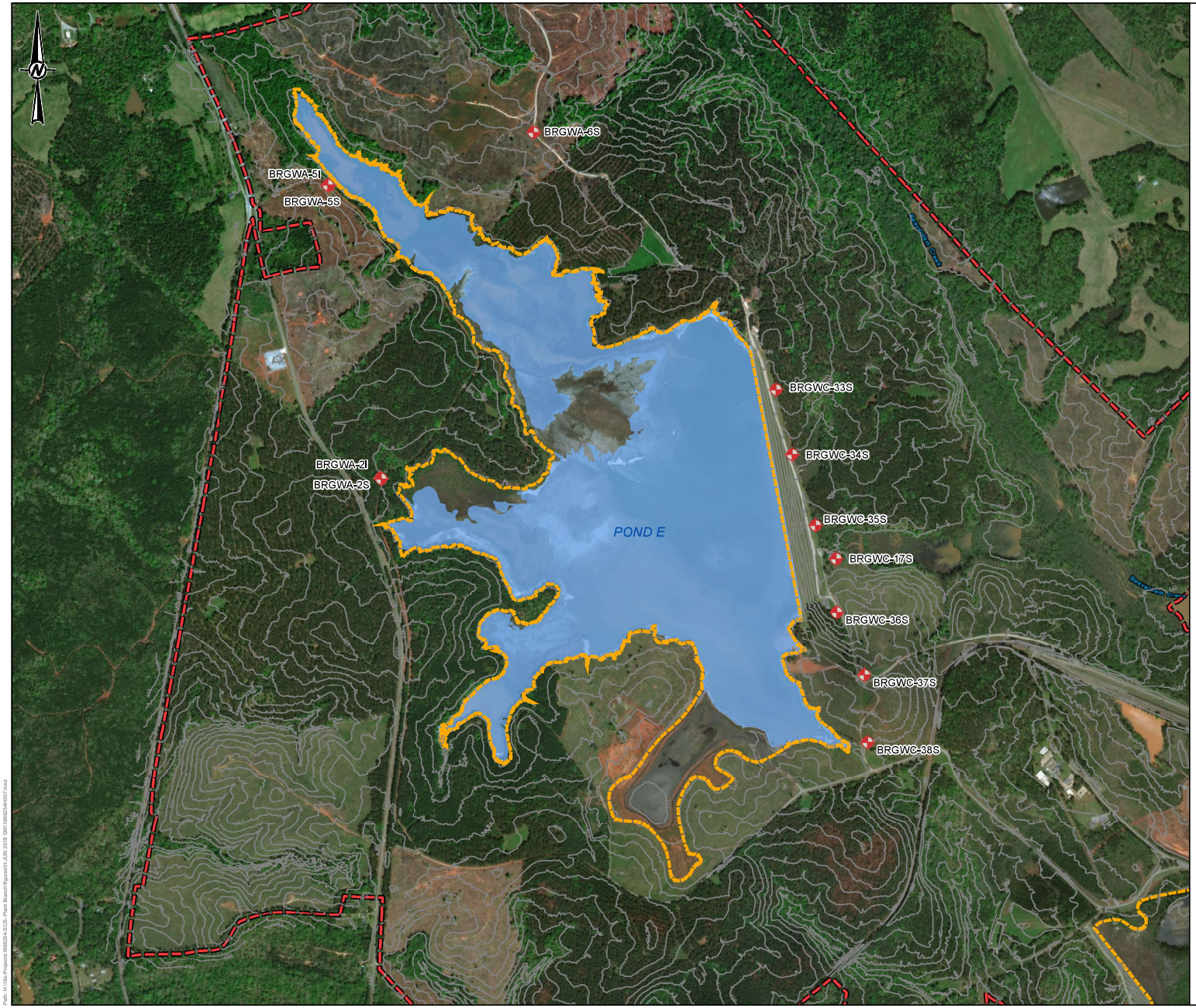
U.S. Environmental Protection Agency, 40 CFR 257, Subpart D, 80 Fed. Reg. 21468 (April 17, 2015).

U.S. Environmental Protection Agency, Manual SW-846, EPA 600/4-79-020, Standard Methods for the Examination of Water and Wastewater (SM18-20),

U.S. Environmental Protection Agency, Methods for the Chemical Analysis of Water and Wastes (MCAWW)

APPENDIX A

MONITORING SYSTEM DETAILS



LEGEND

- MONITORING WELL
- PROPERTY BOUNDARY
- APPROXIMATE ASH POND BOUNDARY
- APPROXIMATE SURFACE WATER LIMITS

REFERENCE

1. SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

2. COORDINATE SYSTEM: NAD 1983 STATE PLAN GEORGIA WEST (U.S. FEET).

3. BORING/PIEZOMETER LOCATIONS AND PROPERTY LINE PROVIDED BY SOUTHERN COMPANY SERVICES.

4. TOPOGRAPHIC CONTOURS PROVIDED BY GEORGIA POWER COMPANY (MARCH 2018).

KEY MAP

1000 500 0 1000
Feet

CLIENT
GEORGIA POWER COMPANY
PLANT BRANCH

Georgia Power

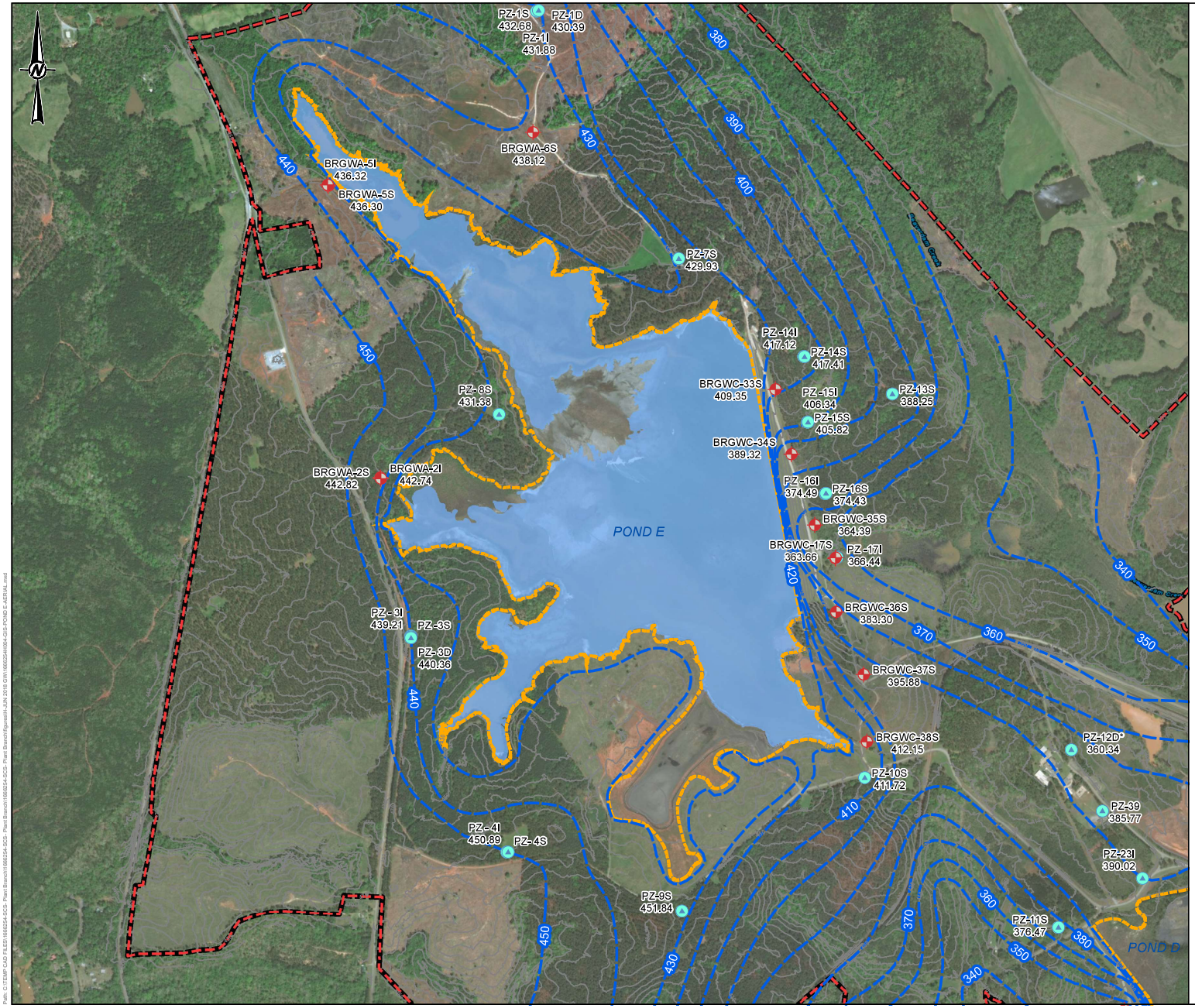
PROJECT
GROUNDWATER MONITORING PLAN

TITLE
SITE PLAN AND DETECTION MONITORING WELL LOCATION MAP

CONSULTANT
GOLDER

YYYY-MM-DD	2018-10-03
PREPARED	DJC
DESIGN	DLP
REVIEW	dlp
APPROVED	rpk

PROJECT No.	CONTROL	Rev.	FIGURE
1666254	1666254H007.mxd	0	A1



LEGEND

- MONITORING WELL AND GROUNDWATER ELEVATION (FEET AMSL)
- PIEZOMETER AND GROUNDWATER ELEVATION (FEET AMSL)
- ESTIMATED GROUNDWATER SURFACE CONTOUR (FEET AMSL)
- PROPERTY BOUNDARY
- APPROXIMATE ASH POND BOUNDARY

NOTES

1. GROUNDWATER SURFACE CONTOUR INTERVAL = 10 FEET
2. GROUNDWATER CONTOURS BASED ON LINEAR INTERPOLATION BETWEEN AND EXTRAPOLATION FROM KNOWN DATA, AND TOPOGRAPHIC CONTOURS. THEREFORE, CONTOURS MAY NOT REFLECT ACTUAL CONDITIONS.
3. AMSL=ABOVE MEAN SEA LEVEL.
4. GROUNDWATER CONTOURS BASED ON ELEVATIONS MEASURED ON JUNE 25, 2018.
5. PZ-12D* WATER LEVEL NOT USED FOR CONTOURING.

REFERENCE

1. SERVICE LAYER CREDITS: ESRI, HERE, GARMIN, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
2. COORDINATE SYSTEM: NAD 1983 STATE PLAN GEORGIA WEST (U.S. FEET).
3. BORING/PIEZOMETER LOCATIONS AND PROPERTY LINE PROVIDED BY SOUTHERN COMPANY SERVICES.
4. TOPOGRAPHIC CONTOURS PROVIDED BY GEORGIA POWER COMPANY (MARCH 2018).

KEY MAP

1000 500 0 1000 Feet

CLIENT
GEORGIA POWER COMPANY
PLANT BRANCH

Georgia Power

PROJECT
GROUNDWATER MONITORING PLAN

TITLE
POND E POTENTIOMETRIC SURFACE ELEVATION CONTOUR MAP

CONSULTANT
GOLDER

YYYY-MM-DD	2018-09-10
PREPARED	DJC
DESIGN	DLP
REVIEW	dlp
APPROVED	rpk

PROJECT No. 1666254 | CONTROL 1666254H004-GIS-POND E-AERIAL.mxd | Rev. 0 | FIGURE A2

ATTACHMENT A3
GROUNDWATER MONITORING NETWORK WELL DETAILS

Georgia Power - Plant Branch
Milledgeville, GA

Well-ID	Location	Geologic Unit Screened [3]	Latitude	Longitude	Ground Surface Elevation (feet msl)[1]	Top of Casing Elevation (feet msl)[1]	Total Depth (feet bgs)[2]	Screen Interval (feet bgs)		Top of Screen Elevation (feet msl)[1]	Screen Tip Elevation (feet msl)[1]	Screen Length	Date of Installation
POND E													
BRGWA-2S	Upgradient E	Saprolite	33.205938	-83.338280	454.94	458.02	44.6	34.6	44.6	420.34	410.34	10.0	4/2/2014
BRGWA-2I	Upgradient E	Amphibolite Gneiss	33.205916	-83.338260	454.89	457.85	64.3	54.3	64.3	400.59	390.59	10.0	3/14/2014
BRGWA-5S	Upgradient E	Saprolite	33.214293	-83.339970	445.23	448.53	40.0	30	40	415.23	405.23	10.0	4/3/2014
BRGWA-5I	Upgradient E	Amphibolite Gneiss	33.214313	-83.339989	445.51	448.44	61.2	51.2	61.2	394.31	384.31	10.0	4/3/2014
BRGWA-6S	Upgradient E	Saprolite	33.215775	-83.333001	460.16	463.63	49.7	39.7	49.7	420.46	410.46	10.0	4/1/2014
BRGWC-17S	Downgradient E	Alluvium	33.203526	-83.322836	366.57	370.25	7.1	2.1	7.1	364.47	359.47	5.0	3/13/2014
BRGWC-33S	Downgradient E	Saprolite/TWR/Biotite Gneiss	33.208371	-83.324829	414.14	416.92	26.0	16	26	398.14	388.14	10.0	7/26/2016
BRGWC-34S	Downgradient E	Saprolite	33.206518	-83.324304	389.04	392.06	23.0	13	23	376.04	366.04	10.0	7/25/2016
BRGWC-35S	Downgradient E	Saprolite	33.204484	-83.323523	363.68	366.54	27.0	17	27	346.68	336.68	10.0	7/23/2016
BRGWC-36S	Downgradient E	Saprolite	33.201997	-83.322831	382.94	386.00	28.7	18.7	28.7	364.24	354.24	10.0	7/26/2016
BRGWC-37S	Downgradient E	Saprolite/TWR	33.200202	-83.321916	444.2	447.23	63.6	53.6	63.6	390.60	380.60	10.0	7/24/2016
BRGWC-38S	Downgradient E	Saprolite/TWR	33.198278	-83.321817	429.55	432.33	37.8	27.8	37.8	401.75	391.75	10.0	7/22/2016

Notes:
1. feet msl = feet mean sea level
2. feet bgs = feet below ground surface
3. TWR = Transitionally Weathered Rock

GOLDER

ATTACHMENT A4
GROUNDWATER PIEZOMETER DETAILS
Georgia Power - Plant Branch
Milledgeville, GA

Well-ID	Location	Geologic Unit Screened [3]	Latitude	Longitude	Ground Surface Elevation (feet msl)[1]	Top of Casing Elevation (feet msl)[1]	Total Depth (feet bgs)[2]	Top of Screen Elevation (feet msl)[1]	Screen Tip Elevation (feet msl)[1]	Screen Length	Date of Installation
PIEZOMETERS											
PZ-1S	Upgradient E	Saprolite	33.219239	-83.332818	467.05	470.22	65.0	412.22	402.22	10.0	3/20/2014
PZ-1I	Upgradient E	Biotite Gneiss	33.219237	-83.332844	466.54	469.85	79.6	397.65	387.65	10.0	3/10/2014
PZ-1D	Upgradient E	Biotite Gneiss	33.219250	-83.332785	467.68	468.56	160.0	400.06	305.56	94.5	4/4/2014
PZ-3S	Upgradient E	Saprolite	33.201405	-83.337289	490.91	494.63	40.0	462.03	452.03	10.0	3/11/2014
PZ-3I	Upgradient E	Biotite Gneiss	33.201377	-83.337286	490.31	493.60	54.6	446.40	436.40	10.0	3/11/2014
PZ-3D	Upgradient E	Biotite Gneiss	33.201350	-83.337283	490.47	491.59	130.0	440.59	358.59	82.0	3/27/2014
PZ-4S	Upgradient E	Saprolite	33.195213	-83.334085	483.84	487.08	30.0	464.48	454.48	10.0	3/10/2014
PZ-4I	Upgradient E	Biotite Gneiss	33.195210	-83.334046	483.89	487.22	47.0	447.62	437.62	10.0	3/11/2014
PZ-7S	Downgradient E	Saprolite	33.212128	-83.328089	153.98	494.63	46.0	457.13	447.13	10.0	4/1/2014
PZ-8S	Upgradient E	Saprolite	33.207722	-83.334235	454.41	493.60	51.0	451.10	441.10	10.0	4/1/2014
PZ-9S	Upgradient BCD	Saprolite	33.193483	-83.328156	470.48	491.59	48.0	450.59	440.59	10.0	3/5/2014
PZ-10S	Downgradient E	Saprolite	33.197256	-83.321905	435.61	487.08	39.0	455.08	445.08	10.0	3/5/2014
PZ-12D	Upgradient BCD	Biotite Gneiss	33.198005	-83.314886	436.12	439.17	141.7	354.47	294.47	60.0	4/14/2014
PZ-13S	Downgradient E	Saprolite	33.208215	-83.320862	411.32	415.13	35.0	387.43	377.43	10.0	3/19/2014
PZ-14S	Downgradient E	Saprolite	33.209304	-83.323859	432.07	435.51	38.0	404.91	394.91	10.0	3/20/2014
PZ-14I	Downgradient E	Biotite Gneiss	33.209298	-83.323836	431.74	434.91	53.8	388.51	378.51	10.0	3/20/2014
PZ-15S	Downgradient E	Saprolite	33.207426	-83.323756	412.57	415.77	39.9	383.27	373.27	10.0	3/27/2014

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ATTACHMENT A4
GROUNDWATER PIEZOMETER DETAILS
Georgia Power - Plant Branch
Milledgeville, GA

Well-ID	Location	Geologic Unit Screened [3]	Latitude	Longitude	Ground Surface Elevation (feet msl)[1]	Top of Casing Elevation (feet msl)[1]	Total Depth (feet bgs)[2]	Top of Screen Elevation (feet msl)[1]	Screen Tip Elevation (feet msl)[1]	Screen Length	Date of Installation
PIEZOMETERS											
PZ-15I	Downgradient E	Amphibolite Gneiss	33.207426	-83.323743	412.63	415.90	88.7	334.60	324.60	10.0	3/25/2014
PZ-16S	Downgradient E	Saprolite	33.205386	-83.323168	383.42	386.97	19.1	374.87	364.87	10.0	3/18/2014
PZ-16I	Downgradient E	Amphibolite Gneiss	33.205394	-83.323145	383.54	386.89	38.6	355.69	345.69	10.0	3/14/2014
PZ-17I	Downgradient E	Biotite Gneiss	33.203558	-83.322786	366.63	370.07	43.5	333.57	323.57	10.0	3/17/2014

Notes:

1. feet msl = feet mean sea level
2. feet bgs = feet below ground surface
3. TWR = Transitionally Weathered Rock
4. Piezometers may be used to collect waters levels. They are not considered compliance monitoring locations.

GOLDER

SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 4/2/2014 **COMPLETED** 4/2/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger
DRILLED BY S. Denty **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 44.6 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 10.2 ft. after 288 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- See PZ-02 I for material descriptions			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10		▽			
15					
20					
25					
30					Annular Seal: bentonite pellets
35					Filter: silica filter sand
40					**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
45					Sump:0.399999999999999 ft.

Bottom of borehole at 44.6 feet.

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:49 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/13/2014 **COMPLETED** 3/14/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; Casing Advance; HQ Rock Core
DRILLED BY T. Milam **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 64.3 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 10.1 ft. after 288 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- CL: subsoil damp, medium stiff, silty CLAY, red and yellow-red			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10		▽ - CL: saprolite damp, medium stiff, silty CLAY, yellow-red with black mottles, micas			
15		- ML: saprolite very damp, soft, clayey SILT, soft, red-brown, micas			
20		- ML: saprolite very damp, soft, clayey SILT, soft, red-brown, micas, some sand			
25		- ML: saprolite very damp, soft, clayey SILT, red-brown, micas, some sand			
30		- ML: saprolite very damp, hard, sandy SILT, dark gray and dark brown with black and white mottles			
35		- SM: saprolite wet, dense, silty SAND, dark gray-brown			
40		- MH: saprolite wet, stiff, clayey SILT, stiff, gray-brown with black mottles, micas			

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:49 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
45		- SM: saprolite wet, very dense, silty SAND, very dense, dark gray with white mottles			Completion: protective aluminum cover with bollards; 4-foot square concrete pad (CONTINUED)
		- SM: saprolite wet, dense, silty SAND, very dense, dark gray			
50		- Hornblend-Biotite GNEISS: fine to medium grain, very hard, not weathered, flow banded, few fractures, hornblende, biotite, feldspar, quartz, trace pyrite, vertical quartz veins, fresh			Annular Seal: bentonite pellets
					Filter: silica filter sand
55		- fine to coarse grain, very hard, not weathered, flow banded, few fractures, hornblende, biotite, feldspar, quartz, trace pyrite and garnet, fresh			**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
60		- fine to coarse grain, very hard, not weathered, flow banded, few fractures, hornblende, biotite, feldspar, quartz, trace pyrite, fresh			Sump:0.399999999999999 ft.
65		Bottom of borehole at 64.3 feet.			
70					
75					
80					
85					
90					

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:49 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

BORING BRGWA-5S / PZ-05 S
PAGE 1 OF 1
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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 4/3/2014 **COMPLETED** 4/3/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger
DRILLED BY S. Denty **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 40 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 10 ft. after 250 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- See PZ-05 I for material descriptionsSee PZ-5 I for material descriptions			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10		▽			
15					
20					
25					Annular Seal: bentonite pellets
30					Filter: silica filter sand
35					**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
40					Sump:0.399999999999999 ft.
		Bottom of borehole at 40.0 feet.			

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 4/2/2014 **COMPLETED** 4/3/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; Casing Advance; HQ Rock Core
DRILLED BY S. Denty **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 61.2 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 10 ft. after 250 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- CL: residuum damp, very stiff, silty CLAY, red with yellow-red mottles			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10		▼ - CL: residuum damp, medium stiff, silty CLAY, red with yellow-red and black mottles			
15		- CL: saprolite very damp, soft, silty CLAY, yellow-red with black mottles, mica			
20		- MH: saprolite wet, soft, clayey SILT, red-yellow with black mottles			
25		- MH: saprolite wet, medium stiff, clayey SILT, yellow-brown with black mottles, mica			
30		- MH: saprolite wet, stiff, clayey SILT, brown-gray with black mottles			
35		- MH: saprolite wet, very stiff, sandy SILT, gray with white mottles			
40		- MH: saprolite wet, hard, sandy SILT, gray with white mottles			

(Continued Next Page)

SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
		(Con't)			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
45		- ----auger refusal----			(CONTINUED)
		Amphibolite GNEISS			
		- fine to medium grain, moderately weathered, massive, numerous fractures, black and white grains, boulder			Annular Seal: bentonite pellets
		Soft material, norecovery			
50		**Amphibolite GNEISS**			Filter: silica filter sand
		- fine to coarse grain, not to moderately weathered, massive, numerous fractures, light gray partially weathered rock, then coarse grained weathered amphibolite			
		- fine to medium grain, not to highly weathered, massive, numerous fractures, gray to dark gray, light gray banding			
55		- fine to medium grain, not to slightly weathered, massive, fractures 58-59 ft., gray, light gray banding, pyrite			**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
60		- fine to medium grain, not to slightly weathered, massive, fractures 60-61 ft., gray, light gray banding, pyrite			Sump:0.400000000000006 ft.
		Bottom of borehole at 61.2 feet.			
65					
70					
75					
80					
85					
90					

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 4/1/2014 **COMPLETED** 4/1/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger
DRILLED BY S. Denty **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 51 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 24.9 ft. after 300 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- CL: residuum dry, very stiff, CLAY, red			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10		- CL: residuum dry, medium stiff, silty CLAY, red with yellow-red mottles			
15		- ML: saprolite dry, medium stiff, clayey SILT, red with red-yellow and black mottles, micas			
20		- ML: saprolite dry, medium stiff, clayey SILT, red with red-yellow and black mottles, micas			
25		- MH: saprolite wet, soft, clayey SILT, brown-yellow with black mottles, micas			
30		- MH: saprolite wet, soft, clayey SILT, brown-yellow with black mottles, micas			
35		- MH: saprolite wet, medium stiff, clayey SILT, brown-yellow with black mottles, micas			Annular Seal: bentonite pellets; Filter: silica filter sand
40		- MH: saprolite wet, medium stiff, clayey SILT, brown-yellow with black mottles, micas			**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
45		*(Con't)*			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
		- MH: saprolite wet, stiff, clayey SILT, olive-yellow with gray mottles, sand			(CONTINUED)
50		- MH: saprolite wet, medium stiff, clayey SILT, olive-gray with brown mottles			**Standpipe:** **2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack Sump:0.400000000000006 ft. Cave-in to 49.7 ft.
		Bottom of borehole at 51.0 feet.			
55					
60					
65					
70					
75					
80					
85					
90					

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

BORING BRGWC-17S / PZ-17 S
PAGE 1 OF 1
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LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/13/2014 **COMPLETED** 3/13/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger
DRILLED BY S. Denty **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 7.1 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 1.5 ft. after 24 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		▼ - See PZ-17 I for material descriptions			Completion: protective steel cover; 4-foot square concrete pad Annular Seal: bentonite pellets Filter: silica filter sand **Standpipe: 2" OD PVC (SCH 40)** Screen: 5 ft; pre-pack Sump:0.399999999999999 ft.
		Bottom of borehole at 7.1 feet.			
10					
15					
20					
25					
30					
35					
40					

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

RECORD OF BOREHOLE BRGWC-33S/PZ-33S

SHEET 1 of 1

PROJECT: SCS Plant Branch
PROJECT NUMBER: 166-0939
DRILLED DEPTH: 26.50 ft
LOCATION: Milledgville, GA

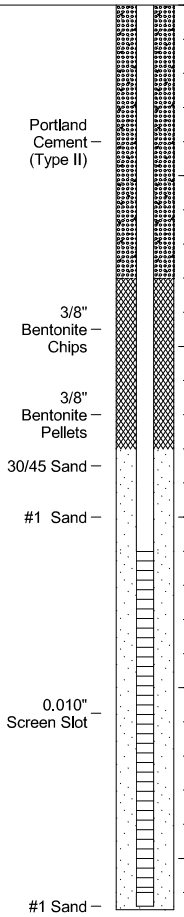
DRILL RIG: Full Size Track Mounted Sonic
DATE STARTED: 7/26/16
DATE COMPLETED: 7/26/16

NORTHING: 1,168,056.81
EASTING: 2,554,063.96
GS ELEVATION: 414.14
TOC ELEVATION: 416.92 ft

DEPTH W.L.: 5.16 (bgs)
ELEVATION W.L.: 411.76 (amsl)
DATE W.L.: 7/27/2016
TIME W.L.: 09:00

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLE NO.	TYPE	REC
0		0.00 - 0.40 TOPSOIL, Sandy SILT, non-plastic fines, fine sand, some organics (roots); light brown (5YR 5/6), residual soil (W6), non-cohesive, dry, loose	ML		0.40 412.64			
		0.40 - 1.50 non-plastic fines, fine sand, trace organics (roots); moderate reddish brown (10R 4/6), completely weathered (W5), weathered micaceous grains, quartz, SAPROLITE; non-cohesive, dry, compact			1.50	1		5.30 6.50
5	410	1.50 - 8.00 Sandy SILT, non-plastic fines, some low plasticity fines pockets, fine sand; moderate reddish brown (10R4/6), highly weathered to completely weathered (W4-W5), trace relict foliations, weathered micaceous grains, SAPROLITE; non-cohesive, moist, compact			406.14			
		8.00 - 11.00 SILTY SAND, fine to medium sub-angular sand, non-plastic to very low plasticity fines; light brown (5YR 5/6) to moderate reddish brown (10R 4/6) mottled dark yellowish brown (10YR 4/2), highly to completely weathered (W4 to W5), weathered micaceous grains, quatz, biotite, SAPROLITE; non-cohesive, wet, compact	SM		8.00 403.14			
10	405	11.00 - 24.50 some low plasticity fines; pale yellowish brown (10YR 6/2) mottled white (N9), black (N1) and light brown (5YR 5/6), highly weathered (W4), some relict foliations, weathered micaceous grains, bioitite, feldspar, quartz, SAPROLITE; non-cohesive, wet, compact			11.00	2		7.20 10.00
15	400					3		2.00 2.00
20	395					4		7.40 8.00
25	390	24.50 - 26.00 TRANSITIONALLY WEATHERED ROCK, fine to medium sub-angular sand, non-plastic fines, fine to coarse angular soft gravels (core stones); medium gray (N5), highly weathered (W4), some moderately weathered (W3) core stones, quartz, weathered micaceous grains, biotite, some relict foliations in core stones, non-cohesive, wet, dense	TWR		389.64 24.50 388.14			
			GNIESS		387.64			
30	385	26.00 - 26.50 BEDROCK, moderately weathered (W3), thin foliation bands, grayish orange (10YR 7/4), black (N1) and medium gray (N5), fine to medium grained, slightly porous, weak (R2), GNIESS, quartz, biotite, feldspar, weathered micaceous grains						
		Boring completed at 26.50 ft						
35	380							
40	375							
45	370							

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0'-16'
Material: Schedule 40 PVC
Diameter: 2"
Joint Type: Threaded

WELL SCREEN
Interval: 16'-26'
Material: Schedule 40 PVC
Diameter: 2"
Slot Size: 0.010"
End Cap: Schedule 40 PVC

FILTER PACK
Interval: 13.0'-26.5'
Type: 13.0'-14.0' 30/45 Sand - 14.0'-26.5' #1 Sand

FILTER PACK SEAL
Interval: 13.0'-8.0'
Type: 8.0'-11.0' 3/8" Bentonite Chips - 11.0'-13.0' 3/8" Bentonite Pellets

ANNULUS SEAL
Interval: 2'-8'
Type: Portland Cement (Type II)

WELL COMPLETION
Pad: 4'x4'x4"
Protective Casing: Anodized Aluminum

DRILLING METHODS
Soil Drill: 4-inch Sonic
Rock Drill: 4-inch Sonic

LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Cascade Drilling
DRILLER: Dale Osterburg

GA INSPECTOR: Jeffrey Ingram
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 9/29/17

Golder Associates

BOREHOLE RECORD PLAT BRANCH LOGS.GPJ PIEDMONT.GDT 9/18/17

RECORD OF BOREHOLE BRGWC-34S/PZ-34S

SHEET 1 of 1

PROJECT: SCS Plant Branch
PROJECT NUMBER: 166-0939
DRILLED DEPTH: 25.00 ft
LOCATION: Milledgville, GA

DRILL RIG: Mini-Sonic Track Mounted Rig
DATE STARTED: 7/24/16
DATE COMPLETED: 7/25/16

NORTHING: 1,167,383.97
EASTING: 2,554,230.23
GS ELEVATION: 389.04
TOC ELEVATION: 392.06 ft

DEPTH W.L.: 0.50 (bgs)
ELEVATION W.L.: 391.56 (amsl)
DATE W.L.: 07/25/2016
TIME W.L.: na

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES SAMPLE NO.	TYPE	REC	MONITORING WELL / PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0		0.00 - 5.00 CLAY, trace sand; red-orange; cohesive, moist	CL		384.04	1		4.50/5.00	Portland Cement – (Type II)	**WELL CASING** Interval: 0.0'-13.0' Material: Schedule 40 PVC Diameter: 2" Joint Type: Threaded
5	385	5.00 - 13.00 sandy SILT, micaceous; brown, SAPROLITE; cohesive, moist, firm	ML		5.00	2		5.00/5.00	3/8" Bentonite – Chips 3/8" Bentonite – Pellets	**WELL SCREEN** Interval: 13.0'-23.0' Material: Schedule 40 PVC Diameter: 2" Slot Size: 0.010" End Cap: Schedule 40 PVC
10	380				376.04	3		5.00/5.00	30/45 Sand – #1 Sand –	**FILTER PACK** Interval: 10.0'-25.0' Type: 10.0'-11.0' 30/45 Sand - 11.0'-25.0' #1 Sand **FILTER PACK SEAL** Interval: 5.0'-10.0' Type: 5.0'-8.0' 3/8" Bentonite Chips - 8.0'-10.0' 3/8" Bentonite Pellets
15	375	13.00 - 16.00 SILTY SAND, micaceous; brown, SAPROLITE; moist	SM		13.00 373.04					**ANNULUS SEAL** Interval: 3.0'-5.0' Type: Portland Cement (Type II)
20	370	16.00 - 23.00 sandy SILT, micaceous; black-brown, SAPROLITE; moist	ML		16.00	4		5.00/5.00	0.010" – Screen Slot	**WELL COMPLETION** Pad: 4'x4'x4" Protective Casing: Anodized Aluminum **DRILLING METHODS** Soil Drill: 4-inch Sonic Rock Drill: N/A
					366.04	5		5.00/5.00	#1 Sand –	
25	365	23.00 - 25.00 SILTY SAND, micaceous; brown-white, quartz and feldspar grains; moist	SM		23.00 364.04					
		Boring completed at 25.00 ft								
30	360									
35	355									
40	350									
45	345									

LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Cascade
DRILLER: Ray Whitt

GA INSPECTOR: Mike Smilley, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 9/29/17

Golder Associates

BOREHOLE RECORD PLAT BRANCH LOGS.GPJ PIEDMONT.GDT 9/18/17

RECORD OF BOREHOLE BRGWC-35S/PZ-35S

SHEET 1 of 1

PROJECT: SCS Plant Branch
PROJECT NUMBER: 166-0939
DRILLED DEPTH: 30.00 ft
LOCATION: Milledgville, GA

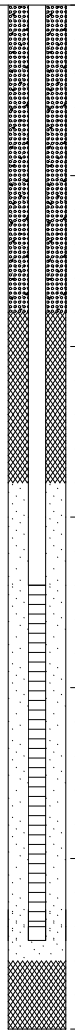
DRILL RIG: Mini-Sonic Track Mounted Rig
DATE STARTED: 7/22/16
DATE COMPLETED: 7/23/16

NORTHING: 1,166,645.80
EASTING: 2,554,475.19
GS ELEVATION: 363.68
TOC ELEVATION: 366.54 ft

DEPTH W.L.: 0.4 (bgs)
ELEVATION W.L.: 366.14 (amsl)
DATE W.L.: 7/25/2016
TIME W.L.: 07:20

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)	SAMPLE NO.	TYPE	REC
0	360	0.00 - 5.00 Sandy SILT, fine to medium sub-angular sand; brown-orange; dry, loose	ML	358.68	1		3.50/5.00
5	355	5.00 - 12.50 CLAY; brown/gray, cohesive, firm, moist	CH	5.00 351.18	2		5.00/5.00
10					3		4.50/5.00
	350	12.50 - 14.00 sandy SILTY CLAY; blue/gray; cohesive, moist, soft	CL	12.50 349.68			
15		14.00 - 30.00 Sandy SILT, fine to coarse sand, some loose cohesive clay balls; orange/brown, micaceous, SAPROLITE; moist, loose	ML	14.00	4		5.00/5.00
20	345				5		5.00/5.00
25	340	25.00: Wet core			6		5.00/5.00
30	335			333.68			
		Boring completed at 30.00 ft					
35	330						
40	325						
45	320						

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0.0'-17.0'
Material: Schedule 40 PVC
Diameter: 2"
Joint Type: Threaded

WELL SCREEN
Interval: 17.0'-27.0'
Material: Schedule 40 PVC
Diameter: 2"
Slot Size: 0.010"
End Cap: Schedule 40 PVC

FILTER PACK
Interval: 14.0'-28.0'
Type: 14.0'-15.0' 30/45 Sand - 15.0'-17.0' #1 Sand

FILTER PACK SEAL
Interval: 9.0'-14.0'
Type: 9.0'-12.0' 3/8" Bentonite Chips - 12.0'-14.0' 3/8" Bentonite Pellets

ANNULUS SEAL
Interval: 0.0'-9.0'
Type: Portland Cement (Type II)

WELL COMPLETION
Pad: 4'x4'x4"
Protective Casing: Anodized Aluminum

DRILLING METHODS
Soil Drill: 4-inch Sonic
Rock Drill: N/A

LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Cascade
DRILLER: Ray Whitt

GA INSPECTOR: Mike Smilley, P.G.
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 9/29/17

Golder Associates

BOREHOLE RECORD PLAT BRANCH LOGS.GPJ PIEDMONT.GDT 9/18/17

RECORD OF BOREHOLE BRGWC-36S/PZ-36S

SHEET 1 of 1

PROJECT: SCS Plant Branch
PROJECT NUMBER: 166-0939
DRILLED DEPTH: 28.70 ft
LOCATION: Milledgville, GA

DRILL RIG: Full Size Track Mounted Sonic
DATE STARTED: 7/25/16
DATE COMPLETED: 7/26/16

NORTHING: 1,165,743.30
EASTING: 2,554,694.19
GS ELEVATION: 382.94
TOC ELEVATION: 386.00 ft

DEPTH W.L.: 0.00 (bgs)
ELEVATION W.L.: 386.00 (amsl)
DATE W.L.: 08/6/2016
TIME W.L.: 10:00

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES SAMPLE NO.	TYPE	REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0		0.00 - 1.10 TOPSOIL, SILTY SAND, fine sand, non-plastic fines, some organics (roots); dark reddish brown (10YR 5/4), residual soil (W6), some weathered micaceous grains, non-cohesive, moist, loose	SM		381.84					
			ML		381.04 1.90					
		1.10 - 1.90 Sandy CLAYEY SILT, low plasticity fines, fine sand, some organics (roots); very dusky red (10R 2/2) to dark yellowish brown (10YR 4/2), residual soil (W6), some weathered micaceous grains, RESIDUUM; cohesive, w<PL, firm	SP-SM		379.94					
	380				3.00	1		3.20 6.50		
5		1.90 - 3.00 SAND, fine to medium sub-angular sand, some non-plastic fines, trace fine sub-angular gravel; dark yellowish brown (10YR 4/2), residual soil (W6), quartz, trace weathered micaceous grains, RESIDUUM; non-cohesive, moist, loose	CL						Portland Cement (Type II)	
	375	3.00 - 8.00 Sandy SILTY CLAY, moderate plasticity fines, fine sand, moderate yellowish brown (10YR 5/4), residual soil (W6), quartz, trace weathered micaceous grains, cohesive, w~PL, firm			374.94 8.00					
10		8.00 - 13.90 trace fine angular gravel; pale yellowish brown (10YR 6/2) mottled medium gray (N5), residual soil (W6), trace feldspars, quartz and weathered micaceous grains, cohesive, w~PL, firm				2		8.60 10.00	3/8" Bentonite Chips	
	370				369.04				3/8" Bentonite Pellets	
15		13.90 - 28.50 SAND, fine to medium sub-angular sand, trace non-plastic fines, some fine to coarse angular soft gravels (core stones); brownish gray (5YR 6/1) mottled light brown (5YR 5/6) white (N9) and black (N1), with feldspar, quartz, biotite, and weathered micaceous grains, highly weathered (W4) with moderately weathered (W3) core stones, relic foliations in core stones, non-cohesive, moist, compact, SAPROLITE			13.90				30/45 Sand	
									#1 Sand	
	365					3		5.00 5.00		
20			SP							
	360					4		5.00 5.00	0.010" Screen Slot	
25										
	355					5		2.00 2.00		
					354.44				#1 Sand	
		Boring completed at 28.70 ft			28.50					
30										
	350									
35										
	345									
40										
	340									
45										

WELL CASING
Interval: 0.0'-18.7'
Material: Schedule 40 PVC
Diameter: 2"
Joint Type: Threaded

WELL SCREEN
Interval: 18.7'-28.7'
Material: Schedule 40 PVC
Diameter: 2"
Slot Size: 0.010"
End Cap: Schedule 40 PVC

FILTER PACK
Interval: 14.80'-28.70'
Type: 14.8'-15.3' 30/45 Sand - 15.3'-28.7' #1 Sand

FILTER PACK SEAL
Interval: 9.5'-14.8'
Type: 9.5'-12.8' 3/8" Bentonite Chips - 12.8'-14.8' 3/8" Bentonite Pellets

ANNULUS SEAL
Interval: 2.0'-9.5'
Type: Portland Cement (Type II)

WELL COMPLETION
Pad: 4'x4'x4"
Protective Casing: Anodized Aluminum

DRILLING METHODS
Soil Drill: 4-inch Sonic
Rock Drill: N/A

LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Cascade Drilling
DRILLER: Dale Osterburg

GA INSPECTOR: Jeffrey Ingram
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 9/29/17

Golder Associates

BOREHOLE RECORD PLAT BRANCH LOGS.GPJ PIEDMONT.GDT 9/18/17

RECORD OF BOREHOLE BRGWC-37S/PZ-37S

PROJECT: SCS Plant Branch
PROJECT NUMBER: 166-0939
DRILLED DEPTH: 66.00 ft
LOCATION: Milledgville, GA

DRILL RIG: Full Size Track Mounted Sonic
DATE STARTED: 7/23/16
DATE COMPLETED: 7/24/16

NORTHING: 1,165,092.09
EASTING: 2,554,978.90
GS ELEVATION: 444.20
TOC ELEVATION: 447.23 ft

DEPTH W.L.: 43.40 (bgs)
ELEVATION W.L.: (amsl)
DATE W.L.: 7/25/2016
TIME W.L.: 06:45

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: SAMPLE NO.	TYPE	REC	MONITORING WELL / PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
0		0.00 - 0.60 TOPSOIL, Sandy SILT, non-plastic fines, fine rounded sand, some organics (roots); dark yellowish brown (10YR 6/2), residual soil (W6), non-cohesive, dry, loose	ML		443.6 0.60					
		0.60 - 2.40 Sandy SILT, non-plastic fines, fine sand; light brown (5YR 5/6), to moderate reddish brown (10R 4/6), residual soil to completely weathered (W6-W5), SAPROLITE, non-cohesive, dry, dense			441.8 2.40	1		6.00 6.00		
5	440	2.40 - 8.50 SAND and SILT, fine sand, non-plastic fines, some low plasticity fines, some soft fine to coarse angular gravels (core stones); moderate reddish brown (10R 4/6), completely weathered (W5), trace relic foliations in core stones, weathered micaceous grains, SAPROLITE, non-cohesive, dry, compact	SP & ML		435.7					
10	435	8.50 - 18.00 Sandy SILT, non-plastic to low plasticity fines, fine sand, some weak fine to coarse angular gravels (core stones); light brown (5YR 5/6) mottled moderate reddish brown (10R 4/6), highly to completely weathered (W4 to W5), trace relic foliations in core stones, weathered micaceous grains, SAPROLITE, cohesive, w<PL, firm	ML		8.50 426.2	2		7.70 10.00		
15	430									
20	425	18.00 - 25.00 SILTY SAND, fine sand, non-plastic to low plasticity fines, some soft fine to coarse angular gravels (core stones); pale yellowish brown (10YR 6/2) mottled white (N9) and black (N1) with some light brown (5YR 5/6) staining, frequent relic foliations, quatz, weathered micaceous grains, biotite, feldspar, SAPROLITE, non-cohesive, moist, compact	SM		18.00 419.2	3		5.70 10.00	Portland Cement – (Type II)	
25	420	25.00 - 25.10 0.1 foot layer of light brown (5YR 5/6) SILT	ML		25.10					
		25.10 - 33.50 SILTY SAND, fine sand, non-plastic to very low plasticity fines, trace angular weak fine to coarse gravels (core stones); pale yellowish brown (10YR 6/2), to very pale orange (10YR 8/2) mottled black (N1) and white (N9), highly weathered (W4), quartz, felsphar, weathered micaceous grains, biotite, trace relic foliations, SAPROLITE, non-cohesive, moist, compact	SM		410.7	4		7.20 10.00		
30	415	33.50 - 36.00 SILTY SAND, fine sand, non-plastic to very low plasticity fines, trace soft fine to coarse angular gravels (core stones); light brown (5YR 5/6) mottled black (N1) and white (N9), highly to completely weathered (W4 to W5), weathered micaceous grains, biotite, feldspar, SAPROLITE, non-cohesive, moist, dense			33.50 408.2					
35	410	36.00 - 38.00 SILTY SAND, fine sand, non-plastic fines; grayish orange (10YR 7/4), completely weathered (W5), quartz, weathered micaceous grains, SAPROLITE, non-cohesive, wet, compact			36.00 406.2					
40	405	38.00 - 42.00 SILTY SAND, fine sand, non-plastic to low plasticity fines, trace soft fine to coarse angular gravels (core stones); light brown (5YR 5/6) to pale yellowish brown (10YR 6/2), mottled white (N9) and black (N1), highly weathered (W4), weathered micaceous grains, biotite, quartz, SAPROLITE, non-cohesive, moist, dense			38.00 402.2	5		9.50 10.00		
45	400		SP & ML		42.00					

Log continued on next page

WELL CASING
Interval: 0.0'-53.6'
Material: Schedule 40 PVC
Diameter: 2"
Joint Type: Threaded

WELL SCREEN
Interval: 53.6'63.6'
Material: U-Pack Schedule 40 PVC
Diameter: 2"
Slot Size: 0.010"
End Cap: Schedule 40 PVC

FILTER PACK
Interval: 50.0'-64.0'
Type: 50.0'-51.0' 30/45 Sand - 51.0'-64.0' #1 Sand

FILTER PACK SEAL
Interval: 50.0'-45.0'
Type: 45.0'-48.0' 3/8" Bentonite Chips - 48.0'-50.0' 3/8" Bentonite Pellets

ANNULUS SEAL
Interval: 2'-45'
Type: Portland Cement (Type II)

WELL COMPLETION
Pad: 4'x4'x4"
Protective Casing: Anodized Aluminum

DRILLING METHODS
Soil Drill: 4-inch Sonic
Rock Drill: N/A

LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Cascade Drilling
DRILLER: Dale Osterburg

GA INSPECTOR: Jeffrey Ingram
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 9/29/17

Golder Associates

RECORD OF BOREHOLE BRGWC-37S/PZ-37S

PROJECT: SCS Plant Branch
PROJECT NUMBER: 166-0939
DRILLED DEPTH: 66.00 ft
LOCATION: Milledgville, GA

DRILL RIG: Full Size Track Mounted Sonic
DATE STARTED: 7/23/16
DATE COMPLETED: 7/24/16

NORTHING: 1,165,092.09
EASTING: 2,554,978.90
GS ELEVATION: 444.20
TOC ELEVATION: 447.23 ft

DEPTH W.L.: 43.40 (bgs)
ELEVATION W.L.: (amsl)
DATE W.L.: 7/25/2016
TIME W.L.: 06:45

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES SAMPLE NO.	TYPE	REC	MONITORING WELL / PIEZOMETER DIAGRAM and NOTES	WELL CONSTRUCTION DETAILS
45		42.00 - 53.00 SAND & SILT, fine sand, non-plastic to very low plasticity fines; some soft angular fine to coarse gravels (core stones); pale yellowish brown (10YR 6/2) mottled white (N9) and light olive gray (5Y 5/2), highly weathered (W4), some relic foliations, feldspar, quartz, weathered micaceous grains, biotite, SAPROLITE, non-cohesive, moist, dense *(Continued)* 46.00: highly weathered (W4) to moderately weathered (W3)	SP & ML			5			3/8" Bentonite Chips 3/8" Bentonite Pellets 30/45 Sand	**WELL CASING** Interval: 0.0'-53.6' Material: Schedule 40 PVC Diameter: 2" Joint Type: Threaded **WELL SCREEN** Interval: 53.6'63.6' Material: U-Pack Schedule 40 PVC Diameter: 2" Slot Size: 0.010" End Cap: Schedule 40 PVC **FILTER PACK** Interval: 50.0'-64.0' Type: 50.0'-51.0' 30/45 Sand - 51.0'-64.0' #1 Sand **FILTER PACK SEAL** Interval: 50.0'-45.0' Type: 45.0'-48.0' 3/8" Bentonite Chips - 48.0'-50.0' 3/8" Bentonite Pellets **ANNULUS SEAL** Interval: 2'-45' Type: Portland Cement (Type II) **WELL COMPLETION** Pad: 4'x4'x4" Protective Casing: Anodized Aluminum **DRILLING METHODS** Soil Drill: 4-inch Sonic Rock Drill: N/A
50	395					6		10.00 / 10.00		
					391.2					
		53.00 - 63.00 SAND, fine to medium sub-angular sand, non-plastic fines, some fine to coarse angular soft gravel (core stones); pale yellowish brown (10YR 6/2) to moderate yellowish brown (10YR 5/6) mottled black (N1) and white (N9), strong foliations in core stones, moderately to highly weathered (W3-W4), weathered micaceous grains, biotite, quartz, feldspar, SAPROLITE; non-cohesive, wet, dense			53.00					
55	390		SP			7		3.50 / 3.50	#1 Sand 0.010" Screen Slot	
60	385									
					381.2	8		6.50 / 6.50		
		63.00 - 66.00 TRANSITIONALLY WEATHERED ROCK, fine to medium sub-angular sand, non-plastic fines, trace fine to coarse soft gravels (core stones); pale yellowish brown (10YR 6/2) to yellowish gray (5Y 2/2) mottled white (N9) and black (N1), moderately weathered (W3), quartz, feldspar, weathered micaceous grains, biotite, PARTIALLY WEATHERED ROCK; non-cohesive, wet, very dense	TWR		63.00				#1 Sand #1 Sand Natural Cave In	
65	380				378.2					
		Boring completed at 66.00 ft								
70	375									
75	370									
80	365									
85	360									
90	355									

LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Cascade Drilling
DRILLER: Dale Osterburg

GA INSPECTOR: Jeffrey Ingram
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 9/29/17

Golder Associates

BOREHOLE RECORD PLAT BRANCH LOGS.GPJ PIEDMONT.GDT 9/18/17

RECORD OF BOREHOLE BRGWC-38S/PZ-38S

SHEET 1 of 1

PROJECT: SCS Plant Branch
PROJECT NUMBER: 166-0939
DRILLED DEPTH: 38.50 ft
LOCATION: Milledgville, GA

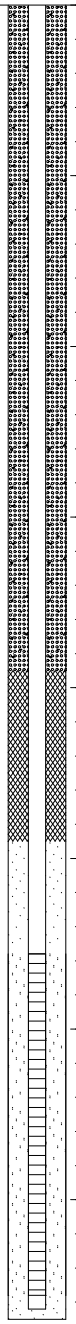
DRILL RIG: Full Size Track Mounted Sonic
DATE STARTED: 7/22/16
DATE COMPLETED: 7/22/16

NORTHING: 1,164,391.62
EASTING: 2,555,015.42
GS ELEVATION: 429.55
TOC ELEVATION: 432.33 ft

DEPTH W.L.: 16.70 (bgs)
ELEVATION W.L.: 415.63 (amsl)
DATE W.L.: 7/23/2016
TIME W.L.: 18:20

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLE NO.	TYPE	REC
0		0.00 - 10.00 (0.0-10.0) HYDROVAC (no recovery)	NA		419.55	1		0.00 / 10.00
10	420	10.00 - 10.60 Sandy SILT, low plasticity fines, fine sand; moderate reddish brown (10R 4/6) to light brown (5YR 5/6), completely to highly weathered (W4 to W5), some relict foliations, weathered micaceous grains, biotite, quartz, SAPROLITE; cohesive, w<PL, firm	ML SM		418.95 418.35			
		10.60 - 11.20 SILTY SAND, fine to coarse sub-angular sand, non-plastic fines; light brown (5YR 5/6), highly to completely weathered (W4 to W5), weathered micaceous grains, biotite, quartz, feldspar, SAPROLITE; non-cohesive, moist, compat	ML		11.20	2		4.60 / 6.00
15	415	11.20 - 18.00 Sandy SILT, low plasticity fines, fine sand; moderate reddish brown (10R 4/6) to light brown (5YR 5/6), completely to highly weathered (W4 to W5), some relict foliations, weathered micaceous grains, biotite, quartz, SAPROLITE; cohesive, w<PL, firm			411.55			
20	410	18.00 - 23.50 SAND and SILT, fine sand, low plasticity fines; light brown (5YR 5/6) to moderate reddish brown (10R 4/6), highly weathered (W4), some relict foliations, weathered micaceous grains, biotite, quartz, feldspar, SAPROLITE; cohesive, w~PL, firm	SP & ML		18.00 406.05	3		5.10 / 10.00
25	405	23.50 - 25.00 SILTY SAND, fine to medium sub-angular sand, non-plastic to low plasticity fines, moderate reddish brown (10R 4/6) to light brown (5YR 5/6), mottled black (N1) and white (N9), highly weathered (W4), weak relict foliations, weathered micaceous grains, biotite, quartz, feldspar, SAPROLITE; non-cohesive, moist, compact	SM SP-SM		23.50 404.55 25.00 403.55			
		25.00 - 26.00 SAND, fine to coarse angular sand, non-plastic fines, some angular fine gravels (core stones); yellowish gray (5Y 7/2) to very pale orange (10YR 8/2), highly to moderately weathered (W4 to W3), strong relict foliations, felsphar, quartz, weathered micaceous grains, biotite, SAPROLITE; non-cohesive, wet, compact	SP		26.00 400.55	4		6.70 / 10.00
30	400	26.00 - 29.00 SAND, medium sub-rounded sand, trace non-plastic fines; light brown (5YR 5/6), completely weathered (W5), quartz, feldspar, weathered micaceous grains, SAPROLITE; non-cohesive, wet, compact	SM		29.00 396.55			
		29.00 - 33.00 SILTY SAND, fine to medium sub-angular sand, low plasticity fines, trace fine angular gravels (core stones); pale yellowish brown (10YR 6/2) mottled black (N1) and light brown (5YR 5/6) and greenish gray (5GY 6/1), highly to moderately weathered (W4 to W3), strong relict foliations, quartz, weathered micaceous grains, biotite, feldspar, SAPROLITE; cohesive, w>PL, very stiff	ML		33.00 393.55			
35	395	33.00 - 36.00 SILT, low plasticity fines, fine to medium sub-angular sand, trace angular fine gravel (core stones); pale yellowish brown (10YR 6/2) mottled white (N9), black (N1) and greenish gray (5G 6/1), highly weathered (W4), weathered micaceous grains, biotite, quartz, feldspars, strong relict foliations, SAPROLITE; cohesive, w~PL, very stiff	TWR		36.00 391.05	5		2.50 / 2.50
40	390	36.00 - 38.50 TRANSITIONALLY WEATHERED ROCK, low plasticity fines, fine sand; light brown (5YR 5/6), white (N9) black (N1), some relict foliations, moderately weathered (W3), feldspar, biotite, quartz, weathered micaceous grains, cohesive, w~PL, hard						
45	385	Boring completed at 38.50 ft						

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: 0.0'-27.8'
Material: Schedule 40 PVC
Diameter: 2"
Joint Type: Threaded

WELL SCREEN
Interval: 27.8'-37.8'
Material: Schedule 40 PVC
Diameter: 2"
Slot Size: 0.010"
End Cap: Schedule 40 PVC

FILTER PACK
Interval: 24.5'-38.5'
Type: 24.5'-25.5' 30/45 Sand - 25.5'-38.5' #1 Sand

FILTER PACK SEAL
Interval: 19.5'-24.5'
Type: 19.5'-22.5' 3/8" Bentonite Chips - 22.5'-24.5' 3/8" Bentonite Pellets

ANNULUS SEAL
Interval: 3.0'-19.5'
Type: Portland Cement (Type II)

WELL COMPLETION
Pad: 4'x4'x4"
Protective Casing: Anodized Aluminum

DRILLING METHODS
Soil Drill: 4-inch Sonic
Rock Drill: N/A

LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Caribbean Drilling Services
DRILLER: Dale Osterburg

GA INSPECTOR: Jeffrey Ingram
CHECKED BY: Rachel P. Kirkman, P.G.
DATE: 9/29/17

Golder Associates

BOREHOLE RECORD PLAT BRANCH LOGS.GPJ PIEDMONT.GDT 9/18/17

SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/20/2014 **COMPLETED** 4/4/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; Casing Advance; HQ Rock Core
DRILLED BY T. Milam **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 160 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 49.5 ft. after 100 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
		Lean Clay (CL) - residuum dry, silty CLAY, red			
5		**Silt (ML)** - residuum dry, clayey SILT, yellow-red with yellow mottles, micas - ML: saprolite dry, clayey SILT, light red, then pale brown with yellow-red mottles, some sand, micas			
10		- ML: saprolite damp, clayey SILT, pale brown with black and white mottles, then pale red with black and white mottles			
15		- ML: saprolite damp, clayey SILT, brown with black mottles, micas, sand			
20		**Lean Clay (CL)** - saprolite damp, silty CLAY, brown and gray-brown with black mottles, micas			
25		**Silt (ML)** - saprolite damp, clayey SILT, pale red-brown with white and black mottles, quartz gravel seams, micas			
30		**Lean Clay (CL)** - saprolite dry, CLAY, yellow - CL: saprolite dry, CLAY, yellow and pale yellow			
35		**Silt (ML)** - saprolite dry, clayey SILT, light gray with red and black mottles, micas - ML: saprolite damp, clayey SILT, gray-brown, then light brown with red mottles, sand, micas			
40		- ML: saprolite damp, clayey SILT, brown with white and black mottles			
		Lean Clay (CL)			

(Continued Next Page)

SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
45		- saprolite damp, silty CLAY, light brown with white mottles, quartz gravel seams **Lean Clay (CL)** *(Con't)* - CL: saprolite damp, silty CLAY, light brown with white mottles, quartz gravel seams			(CONTINUED)
50					
55		- casing advance - no samples 50-65.5 ft., unconsolidated material			
60					
65		- Biotite GNEISS: fine grain, hard, not weathered, massive, numerous fractures, dark gray and white, biotite, feldspar, quartz			
70		- fine to coarse grain, hard, not weathered, massive, numerous fractures, dark gray and white, biotite, feldspar, quartz			
75		- fine to coarse grain, hard, not weathered, massive, numerous fractures, dark gray and white, biotite, feldspar, quartz			
80		- fine to coarse grain, hard to soft, not to highly weathered, flow banded, numerous fractures, dark gray, white bands, biotite, feldspar, quartz, fresh			
85		- fine to coarse grain, hard, not weathered, flow banded, numerous fractures, dark gray, white bands, biotite, feldspar, quartz, fresh			
90		- fine grain, hard, not weathered, massive, few fractures, dark gray, white bands, biotite, feldspar phenocrysts, quartz, micro-folds, fresh			

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:49 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA (CONTINUED)
		(Con't)			
		- fine grain, hard, not weathered, massive, few fractures, dark gray, white bands, biotite, feldspar phenocrysts, quartz, few micro-folds, fresh			
100		- fine grain, hard, not weathered, flow banded, few fractures, dark gray, white banding, biotite, feldspar phenocrysts, quartz, micro-folds, fresh			
105		- fine grain, hard, not weathered, massive, few fractures, dark gray, white bands, biotite, feldspar phenocrysts, quartz, dark gray, white bands, micro-folds, fresh			
110		- fine grain, hard, not weathered, massive, few fractures, dark gray and white, biotite, feldspar phenocrysts, quartz, micro-folds, fresh			
115		- coarse grain, hard, not weathered, massive, numerous fractures, dark gray, dark green, biotite (coarse), quartz			
120		- coarse grain, hard, not weathered, flow banded, few fractures, dark gray, white banding, biotite, feldspar phenocrysts, quartz, micro-folds, fresh			
125		- fine grain, hard, not weathered, massive, few fractures, dark gray, biotite, quartz			
130		- fine to coarse grain, hard, not weathered, massive, few fractures, dark gray and white, biotite, quartz, feldspar phenocrysts			
135		- fine to coarse grain, hard, not weathered, massive, numerous fractures, dark gray and white, biotite, quartz, feldspar phenocrysts			
140		- fine to coarse grain, hard, not weathered, massive, numerous fractures, dark gray and white, biotite, quartz, feldspar phenocrysts			
145		- fine grain, hard, not weathered, massive, few fractures, dark gray,			

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA (CONTINUED)
150		biotite, quartz *(Con't)*			
		- fine grain, hard, not weathered, massive, few fractures, dark gray, white bands, biotite, feldspar, quartz, fresh			
155		- fine grain, hard, not weathered, massive, few fractures, dark gray, white bands, biotite, feldspar, quartz, fresh			
160		Bottom of borehole at 160.0 feet.			
165					
170					
175					
180					
185					
190					
195					

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:49 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/18/2014 **COMPLETED** 3/19/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; Casing Advance; HQ Rock Core
DRILLED BY T. Milam **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 79.6 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 46.3 ft. after 100 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- CL: residuum dry, very stiff, silty CLAY, red with yellow-red mottles, micas			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10		- CL: residuum dry, stiff, silty CLAY, red, dark red and red-brown, yellow and black mottles, micas			
15		- ML: saprolite dry, stiff, SILT, red-yellow with white mottles			
20		- ML: saprolite dry, very stiff, clayey SILT, gray-brown, micas			
25		- ML: saprolite dry, very stiff, clayey SILT, gray-brown, micas			
30		- ML: saprolite dry, very stiff, clayey SILT, gray-brown with black mottles, micas			
35		- ML: saprolite dry, very stiff, clayey SILT, gray-brown with black mottles, micas			
40		- ML: saprolite dry, very stiff, clayey SILT, gray-brown with white and black mottles, micas			

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
		(Con't)			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
45		- ML: saprolite dry, very hard, clayey SILT, gray-brown with white and black mottles, micas			(CONTINUED)
50		- ML: saprolite dry, very hard, clayey SILT, gray-brown with dark gray mottles, sand, micas			
55		- SW: saprolite dry, very dense, SAND, gray and light gray, fine grained, gravel (pulverized rock fragments)			
60		- SW: saprolite dry, very dense, SAND, gray and light gray, fine grained, gravel (pulverized rock fragments)			
65		- No recovery			Annular Seal: bentonite pellets
		Biotite GNEISS - fine to coarse grain, hard, not weathered, massive, banded, numerous fractures, biotite, feldspar, quartz, gray			Filter: silica filter sand
70		- fine to coarse grain, hard, not weathered, massive, banded, few fractures, biotite, feldspar, quartz, dark gray and white			**Standpipe: 2" OD PVC (SCH 40)**
75		- fine to coarse grain, hard, not weathered, massive, banded, numerous fractures, biotite, feldspar, quartz, dark gray and white			Screen: 10 ft; pre-pack
80		Bottom of borehole at 79.6 feet.			Sump:0.400000000000006 ft.
85					
90					

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:49 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/19/2014 **COMPLETED** 3/20/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Casing Advance
DRILLED BY T. Milam **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 65 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 43.4 ft. after 96 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- See PZ-01 I and PZ-01 D for material descriptions			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10					
15					
20					
25					
30					
35					Annular Seal: bentonite pellets
40					Filter: silica filter sand

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:49 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

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SOUTHERN COMPANY

LOG OF TEST BORING

BORING PZ-01 S
PAGE 2 OF 2
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SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
45					Completion: protective aluminum cover with bollards; 4-foot square concrete pad (CONTINUED)
50					Filter: silica filter sand
55					
60					**Standpipe: 2" OD PVC (SCH 40)** Screen: 9.99999999999999 ft; pre-pack
65		Bottom of borehole at 65.0 feet.			Sump:0.400000000000006 ft.
70					
75					
80					
85					
90					

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:49 - \\ALTRCFP01\X2WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/11/2014 **COMPLETED** 3/27/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; HQ Rock Core; HQ Rock Core
DRILLED BY T. Milam **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 130 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 49.8 ft. after 288 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5					
10		**Silty Clay (CL-ML)** - residuum dry, CLAY, red, then clayey SILT red with red-yellow and black mottles, micas			
15		**Silty Sand (SM)** - saprolite silty SAND, light red with white and black mottles, micas - SM: saprolite damp, silty SAND, white with black mottles, micas			
20		**Lean Clay (CL)** - silty CLAY, red, yellow-red, dark red, micas **Silty Sand (SM)** - silty SAND, light red and white **Silt (ML)** - saprolite damp, clayey SILT, white and red, yellow-red, pink, black, micas, quartz sand and gravel, weathered amphibolite			
25		- ML: saprolite damp, clayey SILT, dark gray-brown, red-yellow, black and weak red, micas			
30		- ML: saprolite damp, clayey SILT, red-yellow, black and red, micas			
35		**Silty Sand (SM)** - saprolite dry, silty SAND, gray-brown, white, some gravel,			
40		**Partially Weathered Rock (PWR)** - saprolite dry, weathered GNEISS, black-white banding			

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
45					(CONTINUED)
50		**Horneblende/biotite GNEISS** - fine to medium grain, hard, not weathered, flow banded, few fractures, gray-brown, black-white banding, feldspar, quartz, horneblende, biotite, fresh - fine to medium grain, hard, not weathered, flow banded, few fractures, gray-brown, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh			
55		- fine to medium grain, hard, not weathered, flow banded, few fractures, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh			
60		- fine to medium grain, hard, not weathered, flow banded, few fractures, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh			
65		- fine to medium grain, hard, not weathered, flow banded, few fractures, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh			
70		- fine to coarse grain, hard, not weathered, flow banded, banded, few fractures, gray-brown, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh			
75		- fine to coarse grain, hard, not weathered, massive, banded, few fractures, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh			
80		- fine to coarse grain, hard, not weathered, massive, banded, few fractures, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh, highly fractured, 80-80.5			
85		- fine to coarse grain, hard, not weathered, massive, banded, few fractures, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh			
90		- fine to coarse grain, hard, not weathered, massive, banded, few fractures, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh			

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA (CONTINUED)
100		**Horneblende/biotite GNEISS** *(Con't)* - fine to coarse grain, hard, not weathered, flow banded, banded, few fractures, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh			
105		- fine to coarse grain, hard, not weathered, flow banded, banded, few fractures, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh, coarse schistose biotite			
110		- fine to coarse grain, hard, not weathered, flow banded, banded, few fractures, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh, coarse schistose biotite			
115		- fine to coarse grain, hard, not weathered, massive, banded, few fractures, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh			
120		- coarse grain, hard, not weathered, flow banded, banded, few fractures, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh, pink augen-shaped feldspar			
125		- fine to coarse grain, hard, not weathered, flow banded, banded, few fractures, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh			
130		- medium to coarse grain, hard, not weathered, flow banded, banded, few fractures, black-white banding, variable bedding thicknesses, feldspar, quartz, horneblende, biotite, fresh, pink augen-shaped feldspar			
		Bottom of borehole at 130.0 feet.			
135					
140					
145					

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/11/2014 **COMPLETED** 3/11/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; Casing Advance; HQ Rock Core
DRILLED BY T. Milam **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 54.6 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 49.1 ft. after 168 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- CL: residuum damp, hard, CLAY, red, some sand			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10		- CL-ML: saprolite dry, very stiff, clayey SILT, yellow-red, micas			
15		- CL-ML: saprolite dry, medium stiff, clayey SILT, yellow-red, black mottles, micas			
20		- CL-ML: saprolite dry, stiff, clayey SILT, red-brown, black mottles, micas			
25		- CL-ML: saprolite dry, medium stiff, clayey SILT, red-yellow and gray-brown, black mottles, micas			
30		- CL-ML: saprolite dry, medium stiff, clayey SILT, red-yellow and gray-brown, black mottles, micas			
35		- CL-ML: saprolite dry, medium stiff, clayey SILT, red-yellow and gray-brown, black mottles, micas, quartz gravel			
40		- ML: saprolite dry, hard, sandy SILT, gray, white mottles, quartz gravel			Annular Seal: bentonite pellets
		Biotite GNEISS - medium grain, medium hard to soft, moderately weathered, fractures, gray-brown, black-white banding, biotite, quartz, feldspar phenocrysts			Filter: silica filter sand

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
45		**Biotite GNEISS** *(Con't)* - No recovery			Completion: protective aluminum cover with bollards; 4-foot square concrete pad (CONTINUED)
50		**Felsic biotite GNEISS** - medium grain, very soft to hard, highly to not weathered, flow banded, occassional fractures, gray with black-white banding, partially weathred to 50 FT., then fresh, feldpsar phenocrysts			**Standpipe:** **2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
55		Bottom of borehole at 54.6 feet.			Sump:0.399999999999999 ft.
60					
65					
70					
75					
80					
85					
90					

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

BORING PZ-03 S
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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/11/2014 **COMPLETED** 3/11/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger
DRILLED BY T. Milam **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 40 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** Dry after 100 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- See PZ-03 D and PZ-03 I for material descriptions			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10					
15					
20					
25					Annular Seal: bentonite pellets
30					Filter: silica filter sand
35					**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
40					Sump:0.399999999999999 ft.
		Bottom of borehole at 40.0 feet.			

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/6/2014 **COMPLETED** 3/6/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; Casing Advance; HQ Rock Core
DRILLED BY T. Milam **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 47 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 30.6 ft. after 144 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- CL: residuum damp, stiff, silty CLAY red, some sand, micas			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10		- SM: saprolite very damp, loose, silty SAND, red-yellow with white and black mottles, clay, coarse quartz sand, micas			
15		- ML: saprolite damp, medium stiff, clayey SILT, yellow-red and red-brown with black mottles, micas			
20		- ML: saprolite very damp, stiff, sandy SILT, brown-yellow and red-brown with black mottles			
25		- SM: saprolite very damp, medium dense, silty SAND, medium dense, pale brown with white mottles			
30		- ML: saprolite wet, very stiff, sandy SILT, yellow-brown with white mottles, micas, clay			Annular Seal: bentonite pellets
35		- ---auger refusal---- - Felsic biotite GNEISS: fine to coarse grain, hard to soft, slightly weathered, dark gray, black-white banding, feldspar, quartz, biotite, some fractures			Filter: silica filter sand
40		- medium to coarse grain, medium hard to soft, moderately to highly weathered, banded, numerous fractures, dark gray with black-white banding, weathered zone 35-37 ft., feldspar phenocrysts, quartz, biotite, hornblende - Felsic hornblende/biotite GNEISS: medium to coarse grain, hard, not weathered, one fractrure, distinct black-white banding, feldspar phenocrysts, quartz, biotite, hornblende, fresh			**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

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LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
45		*(Con't)* - Felsic hornblende/biotite GNEISS: medium to coarse grain, hard, not weathered, distinct black-white banding, feldspar, quartz, biotite, hornblende, felspar phenocrysts, fresh			Completion: protective aluminum cover with bollards; 4-foot square concrete pad (CONTINUED) **Standpipe:** **2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack Sump:0.399999999999999 ft. Cave-in to 46.8 ft.
		Bottom of borehole at 47.0 feet.			
50					
55					
60					
65					
70					
75					
80					
85					
90					

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/10/2014 **COMPLETED** 3/10/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger
DRILLED BY T. Milam **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 30 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** Dry after 100 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- See PZ-04 I for material descriptions			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10					
15					Annular Seal: bentonite pellets
20					Filter: silica filter sand
25					**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
30		Bottom of borehole at 30.0 feet.			Sump:0.399999999999999 ft.
35					
40					

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LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 4/1/2014 **COMPLETED** 4/1/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger
DRILLED BY S. Denty **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 46 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 20.5 ft. after 300 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- CL: residuum dry, CLAY, red, trace micas			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10		- ML: saprolite dry, clayey SILT, red with yellow-red mottles, micas			
15		- ML: saprolite dry, clayey SILT, red-yellow with black and white mottles, micas			
20		▽ - ML: saprolite damp, sandy SILT, weak red with gray and white mottles, micas			
25		- ML: saprolite damp, clayey SILT, yellow-brown with red-brown and black mottles, sand			
30		- ML: saprolite damp, clayey SILT, yellow-brown with red-brown and black mottles, sand			Annular Seal: bentonite pellets
					Filter: silica filter sand
35		- ML: saprolite damp, SILT, gray with black mottles, micas			
					Standpipe: 2" OD PVC (SCH 40)
40		- ML: saprolite damp, SILT, dark gray-brown, micas			Screen: 10 ft; pre-pack
45		- ML: saprolite damp, SILT, gray-brown with white mottles, micas			Sump:0.399999999999999 ft.
					Cave-in to 44.5 ft.

Bottom of borehole at 46.0 feet.

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 4/1/2014 **COMPLETED** 4/1/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger
DRILLED BY S. Denty **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 51 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 21.5 ft. after 300 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- CL: residuum dry, stiff, silty CLAY, red, micas			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10		- ML: saprolite dry, stiff, SILT, dark red with black and white mottles, micas			
15		- ML: saprolite dry, stiff, sandy SILT, red with pale red and black mottles, micas			
20		- ML: saprolite dry, stiff, sandy SILT, red with pale red and black mottles, micas			
25		- MH: saprolite damp, medium stiff, sandy SILT, red and yellow-brown, white mottles, micas			
30		- MH: saprolite wet, medium stiff, clayey SILT, gray-brown with white mottles, micas			
35		- MH: saprolite wet, medium stiff, clayey SILT, brown with white and black mottles			Annular Seal: bentonite pellets Filter: silica filter sand
40		- MH: saprolite wet, medium stiff, clayey SILT, brown with white and black mottles			**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
					Completion: protective aluminum cover with bollards; 4-foot square concrete pad
					(CONTINUED)
45		*(Con't)* - MH: saprolite wet, medium stiff, clayey SILT, brown with white and black mottles			**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
50		- MH: saprolite wet, stiff, clayey SILT, brown with white and black mottles			Sump:0.399999999999999 ft. ← Cave-in to 49.5 ft.
		Bottom of borehole at 51.0 feet.			
55					
60					
65					
70					
75					
80					
85					
90					

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LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/5/2014 **COMPLETED** 3/5/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; Casing Advance
DRILLED BY T. Milam **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 50.5 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 36.1 ft. after 170 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- CL: residuum dry, very stiff, silty CLAY, red, yellow-red mottles			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10		- ML: saprolite dry, stiff, clayey SILT, yellow-red with pink mottles, micas			
15		- ML: saprolite dry, medium stiff, SILT, pale brown, red-yellow and white mottles, micas, schistose			
20		- ML: saprolite dry, stiff, SILT, pale brown with white mottles, sand, micas			
25		- ML: saprolite dry, stiff, sandy SILT, pale gray-brown with yellow-brown mottles, micas			
30		- ML: saprolite damp, stiff, clayey SILT, stiff, pale brown with dark brown mottles, sand, micas			Annular Seal: bentonite pellets
35		- ML: saprolite damp, very stiff, sandy SILT, dark gray-brown with pale yellow and light gray-brown mottles, micas			Filter: silica filter sand
40		- ML: saprolite damp, very stiff, sandy SILT, gray-brown with red-yellow and light gray mottles, micas			**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
					Completion: protective aluminum cover with bollards; 4-foot square concrete pad
		(Con't)			(CONTINUED)
45		- ML: saprolite damp, very stiff, clayey SILT, gray-brown with white mottles, sand, micas			**Standpipe:** **2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack Sump:0.399999999999999 ft. Cave-in to 48 ft.
50		- ML: saprolite very damp, hard, clayey SILT, gray with white mottles, micas			
		Bottom of borehole at 50.5 feet.			
55					
60					
65					
70					
75					
80					
85					
90					

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/4/2014 **COMPLETED** 3/5/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; Casing Advance
DRILLED BY T. Milam **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 41 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 21.4 ft. after 192 hrs.
NOTES

DEPTH (ft)	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5	- CL: residuum dry, medium dense, silty SAND, red-yellow with pale yellow mottles			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10	- ML: saprolite damp, stiff, sandy SILT, pale gray-brown with pale yellow and light red mottles, micas			
15	- ML: saprolite damp, stiff, sandy SILT, stiff, dark gray-brown with red mottles, micas			
20	- ML: saprolite damp, medium stiff, sandy SILT, medium stiff, yellow-red with white and gray-brown mottles, micas			
25	- ML: saprolite wet, stiff, sandy SILT, gray and white with yellow, mottles, micas			Annular Seal: bentonite pellets Filter: silica filter sand
30	- ML: saprolite wet, stiff, SILT, dark gray and white with red-brown mottles, micas, some sand and clay			**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
35	- ML: saprolite damp, very stiff, sandy SILT, gray and white, clay			Sump:0.399999999999999 ft.
40	- ML: saprolite damp, hard, clayey SILT, gray and white, micas, sand			Cave-in to 39 ft.
	Bottom of borehole at 41.0 feet.			

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 4/1/2014 **COMPLETED** 4/14/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; Casing Advance; HQ Rock Core
DRILLED BY T. Milam **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 143.2 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 56 ft. after 200 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
		Lean Clay (CL) - dry, silty CLAY, red with pale yellow mottles			
5		- CL: damp, silty CLAY, red with red-yellow mottles, sand, trace micas			
10		- CL: damp, silty CLAY, red with red-yellow mottles, sand, trace micas			
		- ML: dry, clayey SILT, red-yellow and red with white and pink mottles, some quartz gravel, micas			
15		- ML: dry, clayey SILT, pale red and red with yellow-red mottles, then gray-brown and olive-yellow with white mottles, occasional quartz sand, micas			
20		- ML: dry, clayey SILT,yellow-brown and pale red with white and black mottles, white felsic seam with quartz sand 23-24 ft., micas			
25		- ML: dry, sandy SILT, dry, gray-brown, red and yellow-red with black mottles, micas, white felsic sand seam 28-29 ft.			
30		- ML: dry, sandy SILT, pale gray-brown with white mottles, yellow-red with black mottles, micas			
35		- ML: dry, sandy SILT, pale gray-brown with white mottles, yellow-red with black mottles, micas			
40		- ML: dry, clayey SILT, dry to damp, dark gray to black, red and pale gray-brown with white mottles, sand, micas			

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
		(Con't)			(CONTINUED)
45		- ML: very damp, sandy SILT, gray-brown and gray with white mottles, sand seams, very wet 44-45 ft.			
50		**Silty Sand (ML)** - wet, silty SAND, gray-brown with white mottles, mica			
55		- ----sampler refusal----			
60		- Felsic biotite GNEISS: fine to medium grain, soft to medium hard, slightly weathered, flow banded, few fractures, gray and white banding, partially weathered - ----auger refusal---- - fine to coarse grain, hard, not weathered, flow banded, few fractures, dark gray and white banding, fresh			←Annular Seal:
65					
70		- medium to coarse grain, hard, flow banded, few fractures, dark gray and white banding, fresh			
75		- medium to coarse grain, hard, flow banded, few fractures, dark gray and white banding, fresh			←Filter:
80		- medium to coarse grain, hard, flow banded, few fractures, dark gray to black with white banding, fresh			
85		- medium to coarse grain, hard, flow banded, few fractures, dark gray to black with white banding, fresh			**Standpipe:** **4" OD PVC (SCH 40)** Screen: 60 ft;
90		- medium to coarse grain, hard, flow banded, few fractures, dark gray to black with white banding, fresh			

SIMPLE GEOLOGY WITH WELL - ESEE DATABASE.GDT - 4/29/14 10:50 - \\ALTRCFP01\X2\WSHAUG$\DESKTOP\BRANCH\PLANT BRANCH PIEZOMETERS.GPJ

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
		(Con't)			(CONTINUED)
		- medium to coarse grain, hard, flow banded, few fractures, dark gray to black with white banding, fresh			
100		- medium to coarse grain, hard to medium hard, flow banded, few fractures, dark gray to black with white banding, fresh			
105		- medium to coarse grain, hard, flow banded, few fractures, dark gray to black with white banding, fresh			
110		- medium to coarse grain, hard, flow banded, few fractures, dark gray to black with white banding, fresh			
115		- medium to coarse grain, hard to medium hard, flow banded, few fractures, dark gray to black with white banding, micro-folds, fresh			**Standpipe:** **4" OD PVC (SCH 40)** Screen: 60 ft;
120		- medium to coarse grain, hard to medium hard, flow banded, few fractures, dark gray to black with white banding, fresh			
125		- medium to coarse grain, hard to medium hard, flow banded, few fractures, dark gray to black with white banding, feldspar phenocrysts, fresh			
130		- medium to coarse grain, hard to medium hard, flow banded, one fracture, dark gray to black with white banding, fresh			
135		- medium to coarse grain, hard to medium hard, flow banded, several fractures, dark gray to black with white banding, fresh			
140		- medium to coarse grain, hard to medium hard, flow banded, several fractures, dark gray to black with white banding, fresh			Sump:0.399999999999977 ft. Cave-in to 141.7 ft.
145		Bottom of borehole at 143.2 feet.			

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LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/18/2014 **COMPLETED** 3/19/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger
DRILLED BY S. Denty **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 36 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 19.9 ft. after 170 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- CL: residuum dry, very stiff, silty CLAY, red with yellow-red mottles, sand, micas			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10		- ML: saprolite dry, medium stiff, clayey SILT, medium stiff, red-yellow with pale yellow mottles, micas			
15		- ML: saprolite dry, medium stiff, clayey SILT, yellow-brown, white and brown with black mottles, micas			
20		- MH: saprolite wet, soft, clayey SILT, gray-brown and red-brown with black mottles, sand, micas			Annular Seal: bentonite pellets; Filter: silica filter sand
25		- MH: saprolite wet, soft, clayey SILT, gray-brown and red-brown with black mottles, sand, micas			
30		- MH: saprolite wet, stiff, sandy SILT, brown, white and pale brown, micas			**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
35		- MH: saprolite wet, very stiff, sandy SILT, brown, white and pale brown, micas			Sump:0.400000000000006 ft. Cave-in to 34.7 ft.
		Bottom of borehole at 36.0 feet.			
40					

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LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/19/2014 **COMPLETED** 3/20/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; Casing Advance; HQ Rock Core
DRILLED BY S. Denty **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 53.8 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 11.4 ft. after 130 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- CL: residuum dry, stiff, silty CLAY, red, micas, sand			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10		- ML: saprolite dry, stiff, sandy SILT, yellow-red, red-brown			
15		- MH: saprolite wet, soft, sandy SILT, gray-brown, white, yellow-brown with black mottles, micas, clay			
20		- MH: saprolite wet, medium stiff, sandy SILT, white, pale brown with black mottles, micas			
25		- SM: saprolite wet, loose, silty SAND, pale brown with red-brown mottles, trace micas, fine grained			
30		- SC-SM: saprolite wet, loose, SAND, brown with red-brown mottles, micas, clay, silt			
35		- SC-SM: saprolite wet, loose, SAND, brown with red-brown mottles, micas, clay, silt			
40		- MH: saprolite wet, hard, sandy SILT, dark gray-brown and white with black mottles, micas			Annular Seal: bentonite pellets
		- Felsic biotite GNEISS: coarse grain, soft to hard, moderately to not weathered, flow banded, Several fractures, dark brown, white bands, partially weathered to 41.5 ft., then fresh, black and white banding, pink			Filter: silica filter sand

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
45		and white felspar phenocrysts *(Con't)* - hard, not weathered, flow banded, no fractures, black and white bands, fresh, pink and white feldspar phenocrysts			Completion: protective aluminum cover with bollards; 4-foot square concrete pad (CONTINUED)
50		- hard, not weathered, flow banded, no fractures, black and white bands, fresh, pink and white feldspar phenocrysts			**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
					Sump:0.399999999999999 ft.
55		Bottom of borehole at 53.8 feet.			
60					
65					
70					
75					
80					
85					
90					

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/20/2014 **COMPLETED** 3/20/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger
DRILLED BY S. Denty **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 38 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 12.5 ft. after 48 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- SeePZ-14 I for material descriptions			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10		▼			
15					
20					
25					Annular Seal: bentonite pellets
30					Filter: silica filter sand
35					**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
40		Bottom of borehole at 38.0 feet.			Sump:0.399999999999999 ft.

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LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/24/2014 **COMPLETED** 3/25/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; Casing Advance; HQ Rock Core
DRILLED BY S. Denty **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 88.7 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 15 ft. after 240 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- CL: residuum damp, stiff, silty CLAY, red with light red mottles, micas			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10		**Fat Clay (CH)** - residuum wet, soft, silty CLAY, red with light red mottles, micas			
15		**Elastic Silt (MH)** - saprolite wet, soft, sandy SILT, light brown and light red, micas			
20		- MH: saprolite wet, soft, clayey SILT, brown-yellow, micas			
25		- MH: saprolite damp, medium stiff, clayey SILT, brown and red-brown with white mottles, micas			
30		**Poorly-graded Sand (SP)** - saprolite wet, medium dense, silty SAND, light brown with white mottles, micas			
35		- SP: saprolite wet, dense, silty SAND, light brown with white mottles, micas			
40		- SP: saprolite wet, dense, silty SAND, light brown with white mottles, micas			

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
45		**Poorly-graded Sand (SP)** *(Con't)* - SP: saprolite wet, very dense, silty SAND, light brown with white mottles			Completion: protective aluminum cover with bollards; 4-foot square concrete pad (CONTINUED)
50		**Fat Clay (CH)** - saprolite wet, very dense, sandy CLAY, gray-brown, micas			
55		**Well-graded Sand (SP)** - saprolite wet, very dense, clayey SAND, dark gray-brown with black mottles, micas			
60		- CH: saprolite wet, very dense, sandy CLAY, gray-brown, micas			
65		- SP: saprolite wet, very dense, sandy SILT, dark gray with brown mottles, gravel			
70		- SP: saprolite wet, very dense, sandy SILT, dark gray with brown mottles, gravel			
75		- ----auger refusal---- **Biotite/amphibolite GNEISS** - fine to coarse grain, soft to hard, highly to not weathered, flow banded, several fractures, black and white banding, weathered zone 76-77.5 ft., then fresh, feldspar, biotite, quartz, hornblende, feldspar phenocrysts - GRAVEL, pulverized rock			Annular Seal: bentonite pellets Filter: silica filter sand
80		- Biotite/amphibolite GNEISS: fine to coarse grain, hard, not weathered, flow banded, few fractures, black and white banding, fresh, feldspar, biotite, quartz, hornblende, feldspar phenocrysts			**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
85		- fine to coarse grain, hard, not weathered, flow banded, few fractures, black and white banding, fresh, feldspar, biotite, quartz, hornblende, feldspar phenocrysts			Sump:0.400000000000006 ft.
90		Bottom of borehole at 88.7 feet.			

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/25/2014 **COMPLETED** 3/27/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger
DRILLED BY S. Denty **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 39.9 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 6 ft. after 240 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		▼ - See PZ-15 I for material descriptions			Completion: protective aluminum cover with bollards; 4-foot square concrete pad
10					
15					
20					
25					Annular Seal: bentonite pellets
30					Filter: silica filter sand
35					**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
40		Bottom of borehole at 39.9 feet.			Sump:0.399999999999999 ft.

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SOUTHERN COMPANY

LOG OF TEST BORING

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EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/13/2014 **COMPLETED** 3/14/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; Casing Advance; HQ Rock Core
DRILLED BY S. Denty **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 39.2 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 6.6 ft. after 150 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- CL: residuum dry, very stiff, silty CLAY, yellow-brown and red-yellow with black mottles			Completion: protective steel cover; 4-foot square concrete pad
10		- MH: saprolite wet, stiff, sandy SILT, olive-brown with white and black mottles			
15		- MH: saprolite wet, stiff, clayey SILT, dark gray-brown, brown, micas			
20		- MH: saprolite wet, hard, clayey SILT, olive-brown and brown with white mottles, sand			
25		- MH: saprolite wet, hard, clayey SILT, olive-brown and brown with white mottles, sand - MH: **Amphibolite GNEISS** - medium to coarse grain, soft to hard, highly to not weathered, numerous fractures, dark gray-brown, weathered, then fresh dark gray			Annular Seal: bentonite pellets Filter: silica filter sand
30		- medium to coarse grain, soft to hard, highly to not weathered, numerous fractures, alternating partially weathered rock and fresh rock			**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
35		- medium to coarse grain, soft to hard, highly to not weathered, numerous fractures, alternating partially weathered rock and fresh rock			Sump:0.399999999999999 ft. Cave-in to 38.6 ft.
40		Bottom of borehole at 39.2 feet.			

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SOUTHERN COMPANY

LOG OF TEST BORING

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/18/2014 **COMPLETED** 3/18/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger
DRILLED BY S. Denty **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 19.8 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 6.5 ft. after 48 hrs.
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5		- See PZ-16 I for material descriptions			Completion: protective steel cover; 4-foot square concrete pad
10					Annular Seal: bentonite pellets
15					Filter: silica filter sand
20					**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack
25					Sump:0.400000000000002 ft.
30					Cave-in to 19.1 ft.
35					
40					

Bottom of borehole at 19.8 feet.

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SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Plant Branch Hydrogeologic Study
LOCATION Milledgeville, GA

DATE STARTED 3/11/2014 **COMPLETED** 3/12/2014 **SURF. ELEV.** Not Surveyed **COORDINATES:**
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; Casing Advance; HQ Rock Core
DRILLED BY S. Denty **LOGGED BY** W. Shaughnessy **CHECKED BY** **ANGLE** **BEARING**
BORING DEPTH 43.5 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 0.1 ft. after 24 hrs.
NOTES

DEPTH (ft)	MATERIAL DESCRIPTION	HCL REACTION (Weak / Moderate / Strong)	GROUNDWATER OBSERVATIONS	WELL DATA
5	- CH: alluvium wet, very soft, silty CLAY, dark brown and blue-gray, gravel			Completion: protective steel cover; 4-foot square concrete pad
10	**Amphibolite GNEISS** - fine grain, hard, slightly weathered, massive, dark gray - SM: residuum wet, loose, silty SAND, brown-yellow with light brown mottles			
15	**Amphibolite GNEISS** - fine grain, hard, slightly weathered, massive, dark gray - casing advance - no samples, unconsolidated material			
20	**Amphibolite GNEISS** - fine grain, hard, slightly weathered, massive, fractures 15-18 ft., dark gray - casing advance - no samples, unconsolidated material			
25	- SM: saprolite wet, medium dense, silty SAND, dark brown with pale yellow mottles			
30	- SM: saprolite wet, very dense, silty SAND, brown with pale yellow mottles			Annular Seal: bentonite pellets Filter: silica filter sand
35	**Amphibolite GNEISS** - medium grain, medium hard, moderately weathered, massive, dark gray and dark gray-brown			
40	**Amphibolite GNEISS** - medium grain, medium hard, moderately weathered, massive, dark gray and dark gray-brown - casing advance - no samples, unconsolidated material - refusal, no recovery			**Standpipe: 2" OD PVC (SCH 40)** Screen: 10 ft; pre-pack Sump:0.399999999999999 ft.

Bottom of borehole at 43.5 feet.

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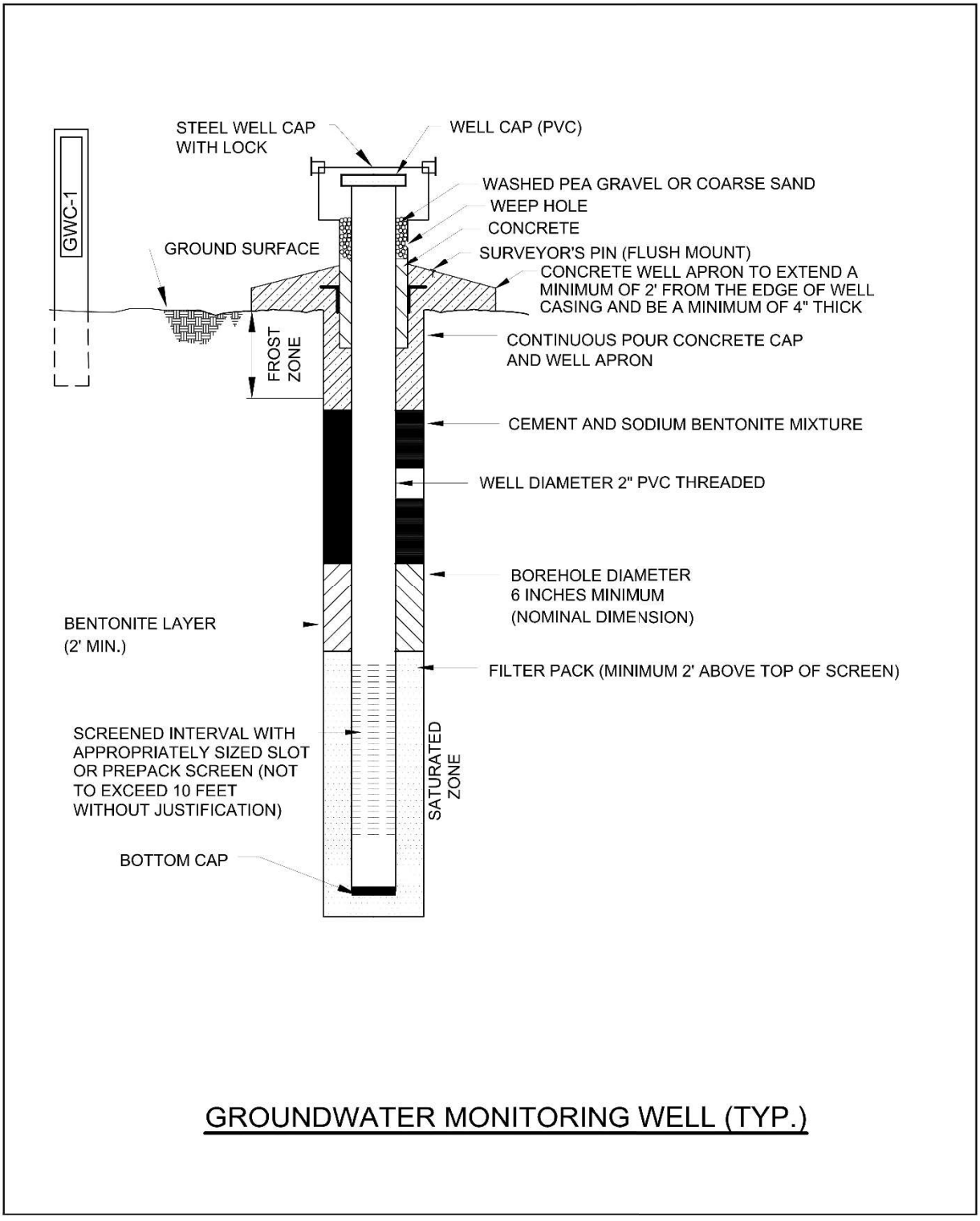
APPENDIX B

GROUNDWATER MONITORING WELL DETAIL

B. GROUNDWATER MONITORING WELL DETAIL



GROUNDWATER MONITORING WELL (TYP.)

APPENDIX C

GROUNDWATER SAMPLING PROCEDURES

C. GROUNDWATER SAMPLING PROCEDURES

Groundwater sampling will be conducted using USEPA Region 4 Field Quality and Technical Procedures as a guide. The following procedures describe the general methods associated with groundwater sampling at the site. Prior to sampling, the well must be evacuated (purged) to ensure that representative groundwater is obtained. Any item coming in contact with the inside of the well casing or the well water will be kept in a clean container and handled only with gloved hands.

GPC will follow the procedures below at each well to ensure that a representative sample is collected:

1) Check the well, the lock, and the locking cap for damage or evidence of tampering. Record observations and notify GPC if it appears that the well has been compromised.

2) Measure and record the depth to water in all wells to be sampled prior to purging. Static water levels will be measured from each well, within a 24-hour period. The water level measuring device will be decontaminated prior to lowering in each well.

3) Install Pump: If a dedicated pump is not present, slowly lower the pump into the well to the midpoint of the well screen or a depth otherwise approved by the hydrogeologist or project scientist. The pump intake must be kept at least two (2) feet above the bottom of the well to prevent disturbance and suspension of any sediment present in the bottom of the well. Record the depth to which the pump is lowered. Non-dedicated pumps and wiring will be decontaminated before use and between well locations using procedures described in the latest version of the *Region 4 U.S. Environmental Protection Agency Science and Ecosystem Support Division (SESD) Operating Procedure for Field Equipment Cleaning and Decontamination* as a guide.

4) Measure Water Level: Immediately prior to purging, measure the water level again with the pump in the well. Leave the water level measuring device in the well.

5) Purge Well: Begin pumping the well at approximately 100 to 500 milliliters per minute (ml/min). Monitor the water level continually. Maintain a steady flow rate that results in a stabilized water level with 0.3 ft. or less of variability. Avoid entraining air in the tubing. Record each adjustment made to the pumping rate and the water level measured immediately after each adjustment.

6) Monitor Indicator Parameters: Monitor and record the field indicator parameters (turbidity, temperature, specific conductance, pH, ORP, and DO) approximately every three to five minutes. The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings at a minimum:

   - ± 0.1 S.U. for pH
   - ± 5% for specific conductance (conductivity)
   - ± 10% for DO where DO>0.5 mg/L. If DO<0.5 mg/L no stabilization criteria apply
   - ≤ 10 NTUs for turbidity
   - Temperature – Record only, not used for stabilization criteria
   - ORP – Record only, not used for stabilization criteria.

7) Collect samples at a flow rate between 50 and 250 ml/min and such that drawdown of the water level within the well is stable. Flow rate must be reduced if excessive drawdown is observed during sampling. Sample

containers should be filled with minimal turbulence by allowing the groundwater to flow from the tubing gently down the inside of the container.

8) Compliance samples will be unfiltered; however, to determine if turbidity is affecting sample results, duplicate samples may be filtered in the field prior to being placed in a sample container, clearly marked as filtered and preserved. Filtering will be accomplished by the use of 0.45-micron filters on the sampling line. At least two filter volumes of sample will pass through before filling sample containers. Filtered samples are not considered compliance samples and are only used to evaluate the effects of turbidity and the potential need for well re-development.

9) Sample bottles will be filled, capped, and placed in an ice containing cooler immediately after sampling where temperature control is required. Samples that do not require temperature control will be placed in a clean and secure container.

10) Sample containers and preservative will be appropriate for the analytical method being used.

11) Information contained on sample container labels will include:

    a) Name of facility

    b) Date and time of sampling

    c) Sample description (well number)

    d) Sampler's initials

    e) Preservatives

    f) Analytical method(s)

12) After samples are collected, samplers will remove non-dedicated equipment. Upon completion of field activity the well will be closed and locked.

13) Samples will be delivered to the laboratory following appropriate chain-of-custody (COC) and temperature control requirements. The goal for sample delivery will be within 48 hours of collection. If delivery is delayed, samples should not be analyzed after the method-prescribed hold time.

Throughout the sampling process new nitrile gloves will be worn by the sampling personnel. A clean pair of new, disposable gloves will be worn each time a different location is sampled, and new gloves donned prior to filling sample bottles. Gloves will be discarded after sampling each well and before sampling the next well.

The goal when sampling is to attain a turbidity of less than 5 NTUs however, samples may be collected where turbidity is less than 10 NTUs and the stabilization criteria described above are met.

If sample turbidity is greater than 5 NTUs and other stabilization criteria have been met, samplers will continue purging for 3 additional hours in order to reduce the turbidity to 5 NTUs or less.

- If turbidity remains above 5 NTUs but is less than 10 NTUs, and other parameters are stabilized, the well can be sampled.
- Where turbidity remains above 10 NTUs, an unfiltered sample will be collected followed by a filtered sample that has passed through an in-line 0.45-micron filter attached to the discharge (sample collection) tube. Data from filtered samples will only be used to quantify the effects of turbidity on sample results.

Samplers will identify the sample bottle as containing a filtered sample on the sample bottle label and on COC form.

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