GROUNDWATER MONITORING PLAN

PLANT HAMMOND – ASH POND 1 (AP-1)
FLOYD COUNTY, GEORGIA

FOR

Georgia Power

SUBMITTED NOVEMBER 2018
REVISED JANUARY 2020

Geosyntec consultants

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I. CERTIFICATION

This *Groundwater Monitoring Plan, Georgia Power Company - Plant Hammond Ash Pond 1 (AP-1)* has been prepared by a qualified groundwater scientist or engineer with Geosyntec Consultants, Inc. (Geosyntec) to meet the requirements contained in Chapter 391-3-4-.10 of the Georgia Environmental Protection Division Rules of Georgia, Solid Waste Management, Coal Combustion Residuals (i.e., State CCR Rule). References to the appropriate sections of the State CCR Rule are incorporated throughout this document.

I hereby certify that this Groundwater Monitoring Plan was prepared by, or under the direct supervision of, a "Qualified Groundwater Scientist," in accordance with the State of Georgia 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 Georgia Environmental Protection Division (EPD) Rules of Solid Waste Management, Chapter 391-3-4.10(6).

Signature: _____

Date: Jan 16, 2020

Signature: _____

Date: 1-16-2020

1. 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 Ash Pond 1 (AP-1 or Site) at Georgia Power Company's (GPC's) Plant Hammond. This plan meets the requirements of EPD rules and uses EPD's Manual for Ground Water Monitoring dated September 1991 as a guide. Groundwater monitoring well locations are presented on Figure A-1 of **Appendix A** and well construction details on Table A-1 of **Appendix A**.

Groundwater 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 precedent.

In accordance with the United States Environmental Protection Agency (USEPA) Coal Combustion Rule (§257.90), which is incorporated by Georgia State CCR Rule by reference, a detection monitoring well network for AP-1 has been installed and certified by a qualified professional engineer. This certification has been placed in the facility's operating record and is included in Part B of the permit application. 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 unscheduled installation or abandonment of monitoring wells. Well installation and/or abandonment must be directed by a qualified groundwater scientist.

2. GEOLOGIC AND HYDROGEOLOGIC CONDITIONS

The following section presents the geologic and hydrogeologic conditions for the Site as described in the *Hydrogeologic Assessment Report (Revision 1)* (HAR) (Geosyntec, 2019) tab in Section 2 of Part B of this permit application.

2.1 SITE GEOLOGY

AP-1 is located within the Great Valley and Ridge Physiographic Province (Valley and Ridge) in northwest Georgia which is characterized by Paleozoic sedimentary rocks that have been folded and faulted into the ridges and valleys that gave this region its name. Geologic mapping performed at the Site by Petrologic Solutions, Inc. (Golder, 2018) indicates that the Site is underlain by the middle units of the Cambrian age Conasauga Formation (Ccls), consisting of mostly shaley limestone. Subsurface investigations at the Site describe the bedrock as limestone or shaley limestone. AP-1 is underlain primarily by five lithologic units; (i) fill, (ii) terrace alluvium, (iii) residuum, (iv) highly weathered/fractured shaley limestone bedrock, and (v) competent shaley limestone bedrock.

Based on subsurface investigations the fill material is composed of lean clay or gravelly lean clay with sand. The terrace alluvium consists of unconsolidated sediments associated with deposition from the Coosa River and Cabin Creek. Alluvium was variously described as well sorted and poorly sorted sand, clayey sand, sandy gravel, clayey gravel, or gravelly clay. The residuum clay layer or native soils have been derived from the in-place weathering of the shaley limestone bedrock. The residuum is generally described as a lean to fat clay, sometimes silty with some sand, and rarely gravel. Just below the residuum clay layer is a gradational zone of varying proportions of clayey residuum and sand, gravel, and cobble-sized angular pieces of partially weathered limestone, grading into a zone of fractured shaley limestone, before grading into unweathered, fresh shaley limestone bedrock. The upper highly weathered zone appears more as residuum with various sized rock fragments. The lower zone becomes less clayey with depth and is estimated to be approximately 10 feet thick. The limestone is described as medium to dark gray, very finely laminated with lighter and darker gray layers, and also contains interbeds of calcareous shale.

2.2 SITE HYDROGEOLOGY

The uppermost aquifer at the Site is a regional groundwater aquifer that occurs in the residuum and the highly weathered and fractured bedrock. Under natural conditions the water table surface would be expected to be a subdued reflection of the surface topography. Groundwater recharge is by precipitation falling onto bedrock outcrop areas and then percolating through alluvial and residual soils to the bedrock. Based on observations of residuum soil types and horizontal conductivity values, the movement of groundwater in the residuum, and to a degree the highly weathered bedrock zone, can be characterized as low-permeability, porous media flow. The shallow bedrock groundwater flow in the underlying bedrock is characterized as fracture flow. The regional groundwater flow direction is expected to be from north to south; however, the constant head maintained in AP-1 influences the groundwater flow in the vicinity of AP-1. The groundwater flow direction is shown on the potentiometric surface map in **Appendix A**. The potentiometric surface map represents data recorded in June 2018.

The representative groundwater hydraulic gradient for AP-1, based on June 2018 water level data, is 0.049 feet per foot (ft/ft). The horizontal hydraulic conductivity (K_h) estimated by slug testing in wells screened

in the alluvium/residuum was 8.26 x 10^{-4} to 2.35 x10^{-2} centimeters per second (cm/sec), with a geometric mean of 4.11 x 10^{-3} cm/sec. The K_h values across the residuum/highly weathered bedrock interface ranged from 2.68 x 10^{-3} to 1.14 x 10^{-2} cm/sec, with a geometric mean of 5.24 x 10^{-3} cm/sec. The range of vertical hydraulic conductivity (K_v) values for undisturbed soil samples collected from fill, alluvium, or residuum layers was from 1.50 x 10^{-8} to 8.63 x 10^{-7} cm/sec, with a geometric mean of 1.13 x 10^{-7} cm/sec (Geosyntec, 2019).

3. SELECTION OF WELL LOCATIONS

Groundwater monitoring wells were installed to monitor the uppermost occurrence of groundwater beneath the Site. Locations were selected based on the AP-1 footprint and geologic and hydrogeologic considerations. GPC follows the recommendation as stated in Chapter 2 of the *Manual for Groundwater Monitoring* (EPD, 1991) to establish well spacings based on site-specific conditions. A map depicting the monitoring well network for AP-1 is included in **Appendix A**, Monitoring System Details. A more detailed discussion of the hydrogeological investigation conducted in support of monitoring well placement is provided in the HAR (Geosyntec, 2019).

The groundwater monitoring network locations were chosen to monitor upgradient (HGWA), and downgradient (HGWC) conditions at the Site based on groundwater flow direction determined by potentiometric evaluation. The potentiometric surface map in **Appendix A** depicts the groundwater flow direction from AP-1, based on June 2018 conditions. Three wells (HGWA-1, HGWA-2, and HGWA-3) are designated for monitoring of upgradient conditions and seven wells (HGWC-7, HGWC-8, HGWC-9, HGWC-10, HGWC-11, HGWC-12, and HGWC-13) are designated for monitoring of downgradient conditions. Wells are positioned to provide adequate coverage to detect potential impacts from the CCR impoundment. The majority of the wells, both upgradient and downgradient of AP-1, are screened in the uppermost aquifer, in the alluvium and/or residuum above the bedrock.

Monitoring wells are generally 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. In addition to the potentiometric surface map, **Appendix A** also includes a tabulated list of location coordinates for the individual monitoring wells. Additional well construction details (i.e., top-of-casing elevation, well depths, and screened intervals) are also provided on this table.

4. MONITORING WELL DRILLING, CONSTRUCTION, ABANDONMENT AND REPORTING

The AP-1 monitoring well network described in this plan is already in place. The existing monitoring wells were installed following USEPA Region 4 Science and Ecosystem Support Division (SESD) *Operating Procedure for Design and Installation of Monitoring Wells* (USEPA, SESDGUID-101-R1) as a general guide for best practices. Details regarding the installation of compliance wells are described in the *Wells Design, Installation, and Development Report* (ERM, 2017). The boring and well construction logs associated with the report have been included in **Appendix A**. Additional monitoring wells, if necessary, will be installed in accordance with the following procedures.

4.1 DRILLING

A variety of well drilling methods are available for the purpose of installing groundwater monitoring wells. Drilling methodologies include but are not limited to: hollow stem augers, direct push, air rotary, mud rotary, and rotosonic techniques. The drilling method will be selected to minimize the disturbance of subsurface materials and not cause impacts to groundwater. Borings will be advanced using an appropriate drilling technology capable of drilling and installing a well in the site-specific geology. Monitoring wells will be installed using the most current version of the USEPA SESD SESDGUID-101-R# as a general guide for best practices. Also, drilling equipment will be decontaminated before use and between borehole locations using the procedures described in the most current version of USEPA SESD *Operating Procedure for Field Equipment Cleaning and Decontamination* (EPA, SESDGUID-205-R#). Well installation will be directed by a qualified groundwater scientist.

Sampling and/or coring may be used to help determine the stratigraphy and geology at the well location. Samples and cores will be logged by a qualified groundwater scientist. Screen depths will be chosen based on the depth to the uppermost aquifer.

All drilling for any subsurface hydrologic investigation, or for installation or abandonment of groundwater monitoring 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.

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.

WELL CASINGS AND SCREENS

American Society for Testing and Materials (ASTM), National Science Foundation (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.

WELL INTAKE DESIGN

Intake for groundwater monitoring wells will be designed and constructed to: (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 will not exceed 10 feet without justification as to why a longer screen is necessary (e.g., significant variation in groundwater level). If these specifications 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. If utilized, pre-packed well screens will be installed following general industry standards and using the current version of USEPA SESDGUID-101-R# 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.

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 boring 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 elevation of filter pack depth will be monitored, 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 in the boring above the well pack 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 cementitious grout from entering the water-bearing or screened zones. 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 two feet above the bentonite seal and injecting grout at low pressure/velocity.

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 cementitious grout to ground surface, where it will become a concrete apron extending outward with a radius of at least 2 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 air 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 will 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 will 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.

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 5 nephelometric turbidity units (NTUs); however, formation-specific conditions may not allow this target to be accomplished. Additionally, the stabilization criteria contained in **Appendix C** 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. All 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 a well's filter pack over time. Therefore, the turbidity of the groundwater from the monitoring wells may gradually increase over time after initial well development. As a result, monitoring wells may need to be redeveloped periodically to remove the silt and clay that has worked its way into the filter packs of the 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 ABANDONMENT

Monitoring wells will be abandoned using industry-accepted practices and using the EPD Manual for Groundwater Monitoring (1991) and Georgia's Well Water Standards Act of 1985 [Official Code of Georgia

Annotated (O.C.G.A.) § 12-5-120, 1985] as guides. The wells will be abandoned under the direction of a professional geologist (P.G.) or engineer (P.E.) registered in Georgia. Neat Portland cement or bentonite will be used as appropriate to complete abandonment and seal the well borehole. Any piezometers or groundwater wells located within the footprint of AP-1 will be over-drilled prior to abandonment.

4.4 DOCUMENTATION

Within 60 days of the construction, development or abandonment of each new groundwater monitoring well completed under the direction of a qualified groundwater scientist or engineer, a well installation/abandonment report will be submitted to the EPD. The following information will be documented in this report.

- Well identification
- 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
- Narrative of drilling technique applied, well construction details, and well development procedures, including dates, drilling fluids used (if applicable), well casing and screen materials, screen slot size, and joint type
- Details of filter pack material/size, emplacement method (narrative), and volume
- Seal emplacement method and type/volume of sealant
- Borehole diameter and well casing diameter
- Type of protective well cap
- Surface seal and volumes/mix of annular seal material
- Screen length and interval reported in feet below ground surface and elevation
- Well location given to within an accuracy of 0.5 feet based upon survey from acceptable survey point
- Well depth given to within an accuracy of 0.01 feet based upon survey from acceptable survey point
- Lithologic logs
- Documentation that water quality field parameters meet well development criteria (Section 4.2)
- Documentation of ground surface elevation (±0.01 feet)
- Documentation of top of casing elevation (±0.01 feet)
- Schematic of the well with dimensions for all components (e.g., casing, screen, sump, well pad)

5. 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 were collected between May 2016 and May 2017 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 closure activities and the post-CCR removal monitoring period. Pursuant to 391-3-4-.10(6), an assessment monitoring program was established for AP-1 based on statistically significant increases documented in the *2017 Annual Groundwater Monitoring and Corrective Action Report* (dated January 31, 2018) (ERM, 2018). Georgia Power will complete assessment monitoring activities as required in Georgia Chapter 391-3-4-.10(6), Rules for Solid Waste Management.

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 Methods, the groundwater samples will be analyzed using methods specified in EPA Manual SW-846, EPA 600/4-79-020, Standard Methods for the Examination of Water and Wastewater (SM18-20), EPA Methods for the Chemical Analysis of Water and Wastes (MCAWW), ASTM, or other suitable analytical methods approved by EPD. The method used will be able to reach a suitable practical quantification limit to detect natural background conditions at the facility. The groundwater samples will be analyzed by licensed and accredited laboratories through the National Environmental Laboratory Accreditation Conference (NELAC). 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 Events
Field Parameters	Temperature	X	X
	pH	X	X
	ORP	X	X
	Turbidity	X	X
	Specific Conductance	X	X
	Dissolved Oxygen	X	X
Appendix III (Detection)	Boron	X	X
	Calcium	X	X
	Chloride	X	X
	Fluoride	X	X
	pH	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	USEPA Method Number
Boron	6010B/6020B
Calcium	6010B/6020B
Chloride	300.0/300.1/9250/9251/9253/9056A
Fluoride	300.0/300.1/9214/9056A
pH	150.1 field
Sulfate	9035/9036/9038/300.0/300.1/9056A
Total Dissolved Solids (TDS)	160/2540C
Antimony	EPA 7040/7041/6010B/6020B
Arsenic	EPA 7060A/7061A/6010B/6020B
Barium	EPA 7080A/7081/6010B/6020B
Beryllium	EPA 7090/7091/6010B/6020B
Cadmium	EPA 7130/7131A/6020B
Chromium	EPA 7190/7191/6010B/6020B
Cobalt	EPA 7200/7201/6010B/6020B
Fluoride	300.0/300.1/9214/9056A
Lead	EPA 7420/7421/6010B/6020B
Lithium	6010/6020B
Mercury	7470
Molybdenum	6010/6020B
Selenium	EPA 7740/7741A/6010B/6020B
Thallium	EPA 7840/7841/6010/6020B
Radium 226 and 228 combined	EPA 903/9320/9315

6. 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. The applied groundwater purging and sampling methodologies will be discussed in the groundwater semi-annual monitoring reports submitted to EPD.

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.

Per Georgia Rule 391-3-4-.10(6)(g) monitoring wells require replacement after two consecutive dry sampling events. Well installation must be directed by a qualified groundwater scientist. A minor modification shall be submitted in accordance with Rule 391-3-4-.02(3)(b)(6) prior to the installation or decommissioning of monitoring wells.

7. CHAIN-OF-CUSTODY

All 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
- Notated date(s) and time(s) of sample transfer between individuals

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

8. FIELD QUALITY ASSURANCE / QUALITY CONTROL

All field quality control samples will be prepared the same as compliance samples with regard 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 10 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).

Calibration of field instruments will occur daily and follow the recommended (specific) instrument calibration procedures provided by the manufacturer and/or equipment manual specific to each instrument. Daily calibration will be documented on field forms and these field forms will be included in all groundwater monitoring reports. Instruments will be recalibrated as necessary (e.g., when calibration checks indicate significant variability), and all checks and recalibration steps will be documented on field calibration forms. Calibration of the instruments will also be checked if any readings during sampling activities are suspect. Replacement probes and meters will be obtained as a corrective action in the event that recalibration does not improve instrument function. Calibration field forms will be provided with the semi-annual groundwater monitoring reports.

9. 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 P.G. or P.E.

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 abandoned 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. Field logs and forms for each sampling event to include, but not limited to, well signage, well access, sampling and purging equipment condition, and any site conditions that may affect sampling.

16. Documentation of non-functioning wells.

17. Table of current analytical results for each well, highlighting statistically significant increases and concentrations above maximum contaminant level (MCL).

18. Statistical analyses.

19. Certification by a qualified groundwater scientist.

10. STATISTICAL ANALYSIS

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. Statistical analysis techniques are consistent with the USEPA document *Statistical Analysis of Groundwater Data at RCRA Facilities Unified Guidance* (Unified Guidance) (USEPA, 2009).

According to EPD rules (391-3-4-.10(6)(a)), the Site must specify in the operating record the statistical methods to be used in evaluating groundwater monitoring data for each hazardous constituent. The statistical test chosen shall be conducted separately for each hazardous constituent in each well. As authorized by the rule, statistical tests that will 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) [§257.93(f)(5)]. 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).

An interwell statistical method will be used to compare Appendix III groundwater monitoring data to background conditions. Confidence intervals will be constructed for each downgrardient well and used to compare Appendix IV groundwater monitoring data to groundwater protection standards.

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 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 ANALYSIS PLAN OVERVIEW

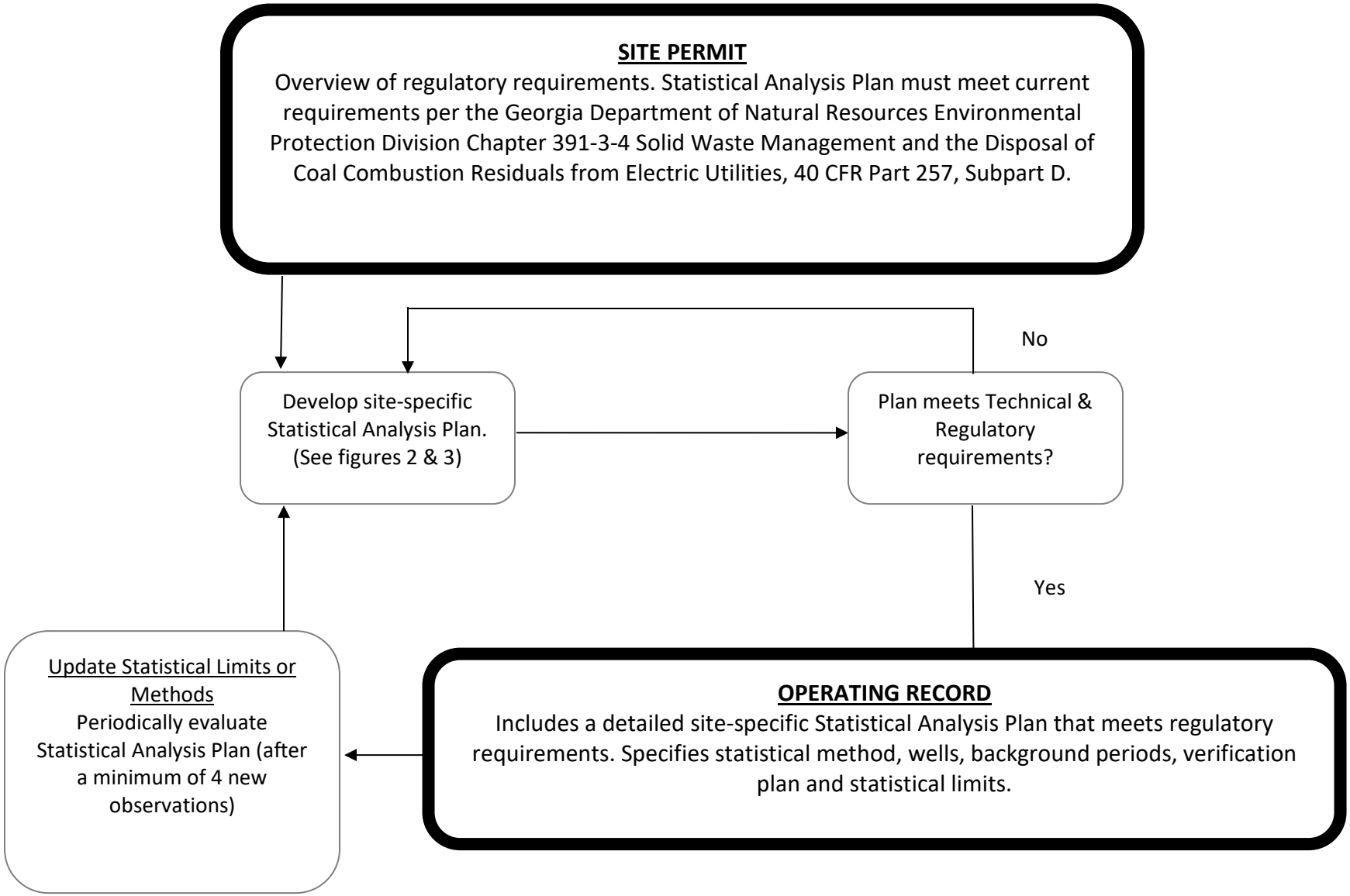
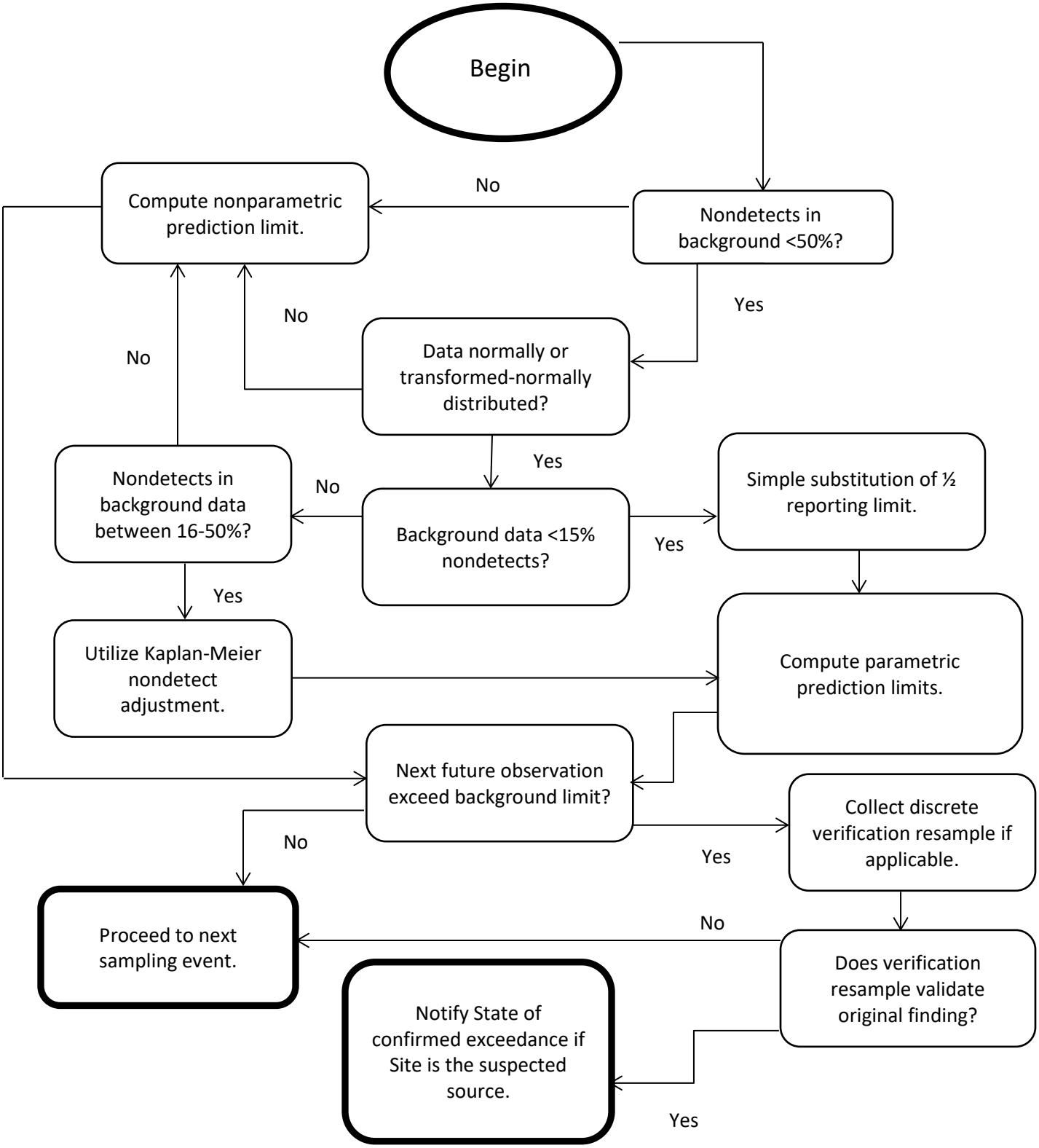


FIGURE 2. DECISION LOGIC FOR COMPUTING PREDICTION INTERVALS



11. REFERENCES

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APPENDIX

A. MONITORING SYSTEM DETAILS
B. GROUNDWATER MONITORING WELL DETAIL
C. GROUNDWATER SAMPLING PROCEDURE

A. MONITORING SYSTEM DETAILS

N

LEGEND

- Compliance Monitoring Well
- Groundwater Level Monitoring Piezometer

Note:
1. Aerial photograph source: Google Earth Pro, February 2018.

0 300 600

SCALE IN FEET

MONITORING WELL NETWORK MAP

GEORGIA POWER COMPANY
PLANT HAMMOND AP-1
ROME, FLOYD COUNTY, GEORGIA

Prepared For: Georgia Power

Prepared By: Geosyntec consultants

KENNESAW, GA | JANUARY 2020

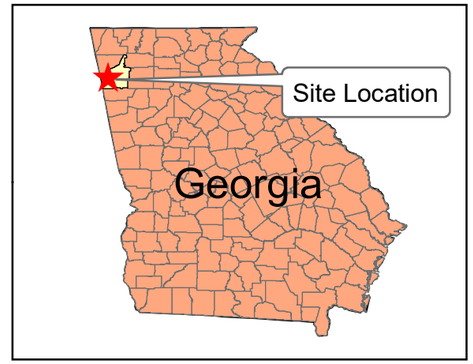
FIGURE A-1

N:\GA Power\Plant Hammond GW Services\GIS\mxd\Hammond\2019\GWMP\AP1\A1_WellMap.mxd 1/22/2020 11:27:16 PM

N

LEGEND

- Compliance Monitoring Well
- Groundwater Level Monitoring Piezometer
- Surface Water Staff Gauge
- Groundwater Elevation Iso-Contour (inferred where dashed)
- Approximate Groundwater Flow Direction



Note:
1. Water level elevation recorded on June 4, 2018. Elevation provided in feet mean sea level (ft MSL) in North American Vertical Datum (NAVD) 88.
2. Ash pond free water surface elevation measured at 584.55 ft MSL on June 4, 2019, from the AP-1 staff gauge.
3. Aerial photograph source: Google Earth Pro, February 2018.

0 300 600

SCALE IN FEET

POTENTIOMETRIC SURFACE MAP (JUNE 2018) AP-1 GROUNDWATER MONITORING PLAN

GEORGIA POWER COMPANY
PLANT HAMMOND AP-1
ROME, FLOYD COUNTY, GEORGIA

Prepared For: Georgia Power

Prepared By: Geosyntec consultants

KENNESAW, GA | JANUARY 2020

FIGURE A-2

N:\GA Power\Plant Hammond GW Services\GIS\mxd\Hammond\2019\GWMP\AP1\A2_PotMap_June2018.mxd 1/22/2020 11:26:40 PM

Table A-1
AP-1 Monitoring Network Well Details
Plant Hammond, Floyd County, Georgia

Well ID	Boring ID	Purpose	Northing [1]	Easting [1]	Ground Surface Elevation [2] (ft MSL)	Top of Casing Elevation [2] (ft MSL)	Well Depth [3] (ft BTOC)	Top of Screen Elevation [2] (ft MSL)	Bottom of Screen Elevation [2] (ft MSL)	June 2018 Groundwater Elevation [4] (ft MSL)	Screened Media
Compliance Monitoring Well											
HGWA-1	APA-2/MW-20	Monitoring, upgradient	1550423.69	1940773.31	592.60	595.50	32.50	573.40	563.40	579.16	Highly weathered shaley limestone, Competent shaley limestone
HGWA-2	APA-3S	Monitoring, upgradient	1549796.40	1939845.20	585.23	588.18	27.95	570.23	560.23	581.76	Terrace alluvium
HGWA-3	APA-3D	Monitoring, upgradient	1549793.93	1939833.46	585.19	588.06	44.87	553.19	543.19	581.81	Highly weathered shaley limestone
HGWC-7	AP1-C1	Monitoring, downgradient	1549520.39	1942319.97	576.32	579.49	28.17	561.32	551.32	575.26	Residuum, Highly weathered shaley limestone
HGWC-8	AP1-C2	Monitoring, downgradient	1549114.34	1942392.75	576.93	580.08	26.65	563.43	553.43	577.09	Terrace alluvium
HGWC-9	AP1-C3	Monitoring, downgradient	1548692.82	1942215.01	577.62	580.60	46.98	543.62	533.62	569.93	Terrace alluvium, Residuum, Highly weathered shaley limestone, Competent shaley limestone
HGWC-10	AP1-C4	Monitoring, downgradient	1548469.50	1941644.41	576.66	579.66	23.00	566.66	556.66	568.87	Residuum, Highly weathered shaley limestone
HGWC-11	AP1-C5S	Monitoring, downgradient	1548477.54	1941146.65	577.88	580.96	25.78	565.48	555.48	569.56	Residuum, Highly weathered shaley limestone
HGWC-12	AP1-C5D	Monitoring, downgradient	1548475.82	1941152.08	577.83	581.01	35.68	555.33	545.33	569.51	Residuum, Highly weathered shaley limestone, Competent shaley limestone
HGWC-13	AP1-C6	Monitoring, downgradient	1548628.52	1940900.41	591.76	594.83	45.07	559.76	549.76	578.07	Terrace alluvium, Residuum

Notes:
ft BTOC = feet below top of casing
ft MSL = feet mean sea level
(1) Coordinates in North American Datum (NAD) 1983, State Plane, Georgia-West, feet.
(2) Vertical elevations are in North American Vertical Datum (NAVD) 1988.
(3) Total well depth accounts for sump if data provided on well construction logs.
(4) Groundwater elevations calculated from data recorded by Geosyntec Consultants on June 4, 2018.

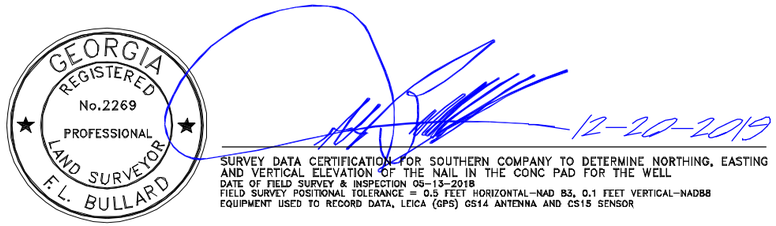
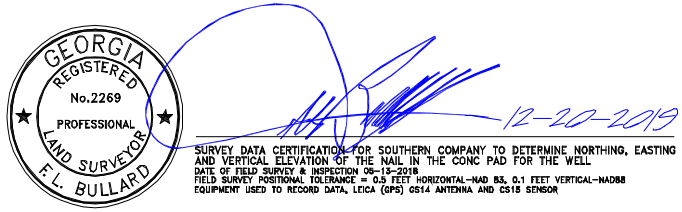


Table A-2
AP-1 Water Level Monitoring Network Piezometer Details
Plant Hammond, Floyd County, Georgia

Well ID [1]	Boring ID	Purpose	Northing [1]	Easting [1]	Ground Surface Elevation [2] (ft MSL)	Top of Casing Elevation [2] (ft MSL)	Well Depth [3] (ft BTOC)	Top of Screen Elevation [2] (ft MSL)	Bottom of Screen Elevation [2] (ft MSL)	June 2018 Groundwater Elevation [4] (ft MSL)	Screened Media
AP1A-1	AP1A-1	Gauge water levels	1550080.50	1941613.87	585.11	587.72	21.85	576.17	566.17	579.73	Terrace alluvium
MW-1	AP01-MW01	Gauge water levels	1549936.35	1941590.63	585.80	588.82	31.12	568.10	558.10	579.97	Residuum, Moderately to highly weathered shaley limestone, Competent shaley limestone
MW-5	AP01-MW05	Gauge water levels	1548430.93	1942445.51	577.90	581.02	33.94	560.60	550.60	567.62	Terrace alluvium, Residuum
MW-6	AP01-MW6	Gauge water levels	1548381.08	1941686.62	579.20	581.90	35.70	559.30	549.30	568.23	Terrace alluvium, Highly weathered shaley limestone
MW-7	AP01-MW7	Gauge water levels	1548230.07	1941084.33	575.20	577.90	29.50	561.50	551.50	568.29	Terrace alluvium, Highly weathered shaley limestone
MW-8	MW08	Gauge water levels	1548174.39	1940014.36	584.70	587.37	32.27	565.50	555.50	569.31	Terrace alluvium, Residuum

Notes:
ft BTOC = feet below top of casing
ft MSL = feet mean sea level
(1) Coordinates in North American Datum (NAD) 1983, State Plane, Georgia-West, feet.
(2) Vertical elevations are in North American Vertical Datum (NAVD) 1988.
(3) Total well depth accounts for sump if data provided on well construction logs.
(4) Groundwater elevations calculated from data recorded by Geosyntec Consultants on June 4, 2018.



SOUTHERN COMPANY

LOG OF TEST BORING

BORING MW20
PAGE 1 OF 1
ECS37736

HGWA-1

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Ash Pond Piezometers
LOCATION Plant Hammond

DATE STARTED 12/3/2014 **COMPLETED** 12/3/2014 **SURF. ELEV.** 592.6 **COORDINATES:** N:34.256407 E:-85.344210
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; HQ Rock Core
DRILLED BY T. Milam **LOGGED BY** W. Shaughnessy **CHECKED BY** L. Millet **ANGLE** _____ **BEARING** _____
BORING DEPTH 29.7 ft. **GROUND WATER DEPTH: DURING** _____ **COMP.** _____ **DELAYED** 17.1 ft. after 24 hrs.
NOTES Well installed. Refer to well data sheet.

DEPTH (ft)	GRAPHIC LOG	STRATA DESCRIPTION	ELEV.	SAMPLE TYPE NUMBER	SAMPLE DEPTH (ft.)	BLOW COUNTS (N-VALUE) / PERCENT RECOVERY (RQD)	COMMENTS
		Clayey Gravel (GC)					
5		- brown and light brown, dry, dense		SS -1	3.5-5.0	7-13-18 (**31**)	
			586.6				
		Silty Clay (CL)					
10		- pale gray-brown, dry, very stiff, with red and yellow-brown mottling		SS -2	8.5-10.0	7-10-12 (**22**)	
15		- brown, dry, stiff, with gray mottling		SS -3	13.5-15.0	6-6-6 (**12**)	
			574.1				
20		**SHALEY LIMESTONE**					Auger refusal at 18.5 ft.
		- gray and dark gray, not to highly weathered, shale seams less than 1/2 inch, shear/fracture zone fabric, near vertical bedding, water staining		RC -1	18.7-25.2	**95** (23)	
25				RC -2	25.2-29.7	**98** (9)	
			562.9				

Bottom of borehole at 29.7 feet.

SOUTHERN COMPANY

RECORD OF WELL CONSTRUCTION

WELL: MW20
PAGE 1 OF 1
ECS37736

HGWA-1

SOUTHERN COMPANY SERVICES, INC.
EARTH SCIENCE AND ENVIRONMENTAL ENGINEERING

PROJECT Ash Pond Piezometers
LOCATION Plant Hammond

DATE STARTED 12/3/2014 **COMPLETED** 12/3/2014 **SURF. ELEV.** 592.6 **COORDINATES:** N:34.256407 E:-85.344210
CONTRACTOR SCS Field Services **EQUIPMENT** CME 550 **METHOD** Hollow Stem Auger; HQ Rock Core
DRILLED BY T. Milam **LOGGED BY** W. Shaughnessy **CHECKED BY** L. Millet **ANGLE** **BEARING**
BORING DEPTH 29.7 ft. **GROUND WATER DEPTH: DURING** **COMP.** **DELAYED** 17.1 ft. after 24 hrs.
NOTES Well installed. Refer to well data sheet.

BOREHOLE DATA ELEV.	Strata	DEPTH (ft)	WELL DATA	ELEV. (DEPTH)	COMMENTS
			Surface: protective aluminum cover with bollards; 4-foot square concrete pad		
			Surface Seal: concrete	590.6 (2.0)	
			Well: 2" OD PVC (SCH 40)		
586.6		5	Annular Fill: Cement-Bentonite Grout (2 - 94lbs. bags, 22 gal.)		
		10		582.7 (9.9)	
			Annular Seal: 3/8 bentonite pellets (1 - 50lbs. bucket)		
		15		578.0 (14.6)	
			Filter: #1A silica filter sand (2 - 50lbs. bags)		
574.1		20		573.4 (19.2)	
		25	Screen: 10 ft. 0.010" slot pre-pack		
562.9				563.4	
			Sump:0.40 ft.	563.0	
			Backfill:Silica Sand		

RECORD OF BOREHOLE HGWA-2/ APA-3S

SHEET 1 of 1

PROJECT: SCS Hammond
PROJECT NUMBER: 1545812
DRILLED DEPTH: 27.00 ft
LOCATION: Rome, GA

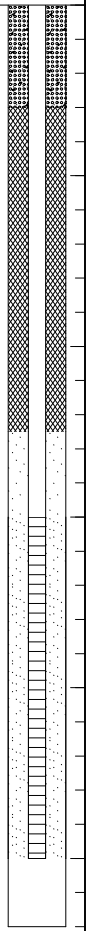
DRILL RIG: Pro Sonic 150
DATE STARTED: 12/2/15
DATE COMPLETED: 12/2/15

NORTHING: 1,549,796.40
EASTING: 1,939,845.20
GS ELEVATION: 585.23
TOC ELEVATION: 588.18 ft

DEPTH W.L.: 8.19 (bgs)
ELEVATION W.L.: (amsl)
DATE W.L.: 12/2/15
TIME W.L.: 11:10

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLE NO.	TYPE	REC
0	585	0.00 - 3.00 CLAY; light brown/grey silty clay, trace organic material, soft	CL		582.23			
		3.00 - 7.00 SILTY CLAY; grey/orange/light brown silty clay, mottled, stiff to very stiff, some black streaking from 3'-4', moist	CL		3.00 578.23			
5	580	7.00 - 8.00 CLAY; light brown/orange/grey sandy, gravelly clay, mottled, moist	CL		7.00 577.23			
		8.00 - 12.00 SANDY GRAVEL; orange/light brown sandy gravel, coarse grained, sub-angular gravel,	GP		8.00 573.23			
10	575	12.00 - 17.00 light brown/orange sandy gravel, coarse grain, loosely compacted, moist			12.00 568.23			
		17.00 - 18.00 GRAVELLY CLAY; orange/light brown gravelly clay, sub-angular gravel, moist	CLG		17.00 567.23			
15	570	18.00 - 24.00 SANDY GRAVEL; orange/light brown sandy gravel, coarse grained, trace clay lenses, wet	GP		18.00 561.23			
		24.00 - 26.00 SILT; orange/light brown layered silt, soft, wet	ML		24.00 559.23			
20	565	26.00 - 27.00 grey silt with trace limestone shale and clay, foliated, soft, wet			26.00 558.23			
		Boring completed at 27.00 ft						
25	560							
30	555							
35	550							
40	545							
45								

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval: -3'-15'
Material: Schedule 40 PVC
Diameter: 6"
Joint Type: Screw/Flush

WELL SCREEN
Interval: 15'-25'
Material: Schedule 40 PVC
Diameter: 2'
Slot Size: 0.010"
End Cap: Schedule 40 PVC

FILTER PACK
Interval: 12.5'-25'
Type: #1 sand/ Prepack Filter

FILTER PACK SEAL
Interval: 3'-12.5'
Type: 3/8" Bentonite Pellets

ANNULUS SEAL
Interval: 0'-3'
Type: Portland Type I/Type II/Gel Mix

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

DRILLING METHODS
Soil Drill: 6-inch diameter Sonic
Rock Drill: 6-inch diameter Sonic

LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Cascade
DRILLER: Tom Ardito

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

Golder Associates

BOREHOLE RECORD HAMMOND BORING LOGS.GPJ PIEDMONT.GDT 9/29/17

RECORD OF BOREHOLE HGWA-3/ APA-3D

SHEET 1 of 1

PROJECT: SCS Hammond
PROJECT NUMBER: 1545812
DRILLED DEPTH: 42.00 ft
LOCATION: Rome, GA

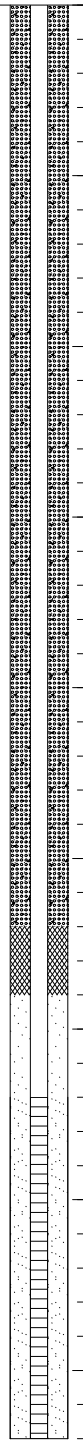
DRILL RIG: Pro Sonic 150
DATE STARTED: 12/1/15
DATE COMPLETED: 12/2/15

NORTHING: 1,549,793.93
EASTING: 1,939,833.46
GS ELEVATION: 585.19
TOC ELEVATION: 588.06 ft

DEPTH W.L.: 2.68 (bgs)
ELEVATION W.L.: (amsl)
DATE W.L.: 12/2/15
TIME W.L.: 07:30

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES SAMPLE NO.	SAMPLES TYPE	SAMPLES REC
0	585	0.00 - 5.00 SANDY CLAY; grey/brown/orange mottled sandy clay, fine grained, medium density, stiff, moist	CLS		580.19			
5	580	5.00 - 13.00 CLAYEY GRAVEL; orange/brown clayey gravel with some sand, poorly sorted and angular pieces, gravel becomes more rounded at 9 feet, medium density compaction	GC		5.00 572.19			
10	575	13.00 - 14.00 wet around 13.5 feet	GC		13.00 571.19			
15	570	14.00 - 17.00 SANDY GRAVEL; brown/grey poorly sorted, well rounded sandy gravel, wet	GP		14.00 568.19			
20	565	17.00 - 25.00 orange/brown sandy gravel, well rounded, poorly sorted, wet			17.00 560.19			
25	560	25.00 - 26.00 some larger rock fragments and coarse grained sand			25.00 559.19			
		26.00 - 31.00 CLAY; brown/grey sandy gravel, changes to grey weathered limestone and clay, medium density, firm, moist	CL		26.00 554.19			
30	555	31.00 - 37.00 TRANSITIONALLY WEATHERED ROCK; transitionally weathered limestone and trace clay, angular rock fragments, clay is mottled light and dark grey, wet	TWR		31.00 548.19			
35	550	37.00 - 42.00 transitionally weathered dark grey shaly limestone, poorly sorted and angular, some gravel, bottom 3 inches are solid limestone, wet (saturated)			37.00 543.19			
40	545	Boring completed at 42.00 ft						
45								

MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES



WELL CONSTRUCTION DETAILS

WELL CASING
Interval:
Material: Schedule 40 PVC
Diameter: 6"
Joint Type: Screw/Flush

WELL SCREEN
Interval: 32'-42'
Material: Schedule 40 PVC
Diameter: 2'
Slot Size: 0.010"
End Cap: Schedule 40 PVC

FILTER PACK
Interval: 29'-42'
Type: #1 sand/ Prepack Filter

FILTER PACK SEAL
Interval: 27'-29'
Type: 3/8" Bentonite Pellets

ANNULUS SEAL
Interval: 0'-27'
Type: Portland Type I/Type II/Gel Mix

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

DRILLING METHODS
Soil Drill: 6-inch diameter Sonic
Rock Drill: 6-inch diameter Sonic

LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Cascade
DRILLER: Tom Ardito

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

Golder Associates

BOREHOLE RECORD HAMMOND BORING LOGS.GPJ PIEDMONT.GDT 9/29/17

RECORD OF BOREHOLE HGWC-7/ AP1C-1

SHEET 1 of 1

PROJECT: SCS Hammond
PROJECT NUMBER: 1545812
DRILLED DEPTH: 27.20 ft
LOCATION: Rome, GA

DRILL RIG: Pro Sonic 150
DATE STARTED: 12/3/15
DATE COMPLETED: 12/3/15

NORTHING: 1,549,520.39
EASTING: 1,942,319.97
GS ELEVATION: 576.32
TOC ELEVATION: 579.49 ft

DEPTH W.L.: N/A (bgs)
ELEVATION W.L.: (amsl)
DATE W.L.: N/A
TIME W.L.: N/A

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	575	0.00 - 2.50 SILTY SAND; dark grey silty sand, fine to coarse with trace rounded gravel, non-plastic, loose, dry to wet, W<PL	SM		573.82					
		2.50 - 8.00 CLAY/RESIDUUM; yellow/brown clay, moderate to high plasticity, becomes mottled in the last 1 foot, firm to stiff, moist, W~PL	CH		2.50 568.32				Portland Type I/ Type II/ Gel mix	
5	570									
		8.00 - 17.00 CLAY/ALLUVIUM; yellowish brown clay, low to moderate plasticity, mottled, stiff, contains 5-15% sub-rounded to sub-angular gravel, moist, W<PL; wet, grayish brown sandy gravel at 8 feet	CL		8.00 559.32				3/8" Bentonite Pellets	
10	565									
15	560									
		17.00 - 27.20 TRANSITIONALLY WEATHERED ROCK and CLAY; light brown/tan clay, some rock, very soft, moist to wet, W>PL; rock is medium grey limestone, fine grained, wet	TWR		17.00 549.12				#1 sand 0.010" slot screen	
20	555									
25	550								3/8" Bentonite chips	
		Boring completed at 27.20 ft								
30	545									
35	540									
40	535									
45										

WELL CASING
Interval: -3'-15'
Material: Schedule 40 PVC
Diameter: 6"
Joint Type: Screw/Flush

WELL SCREEN
Interval: 15'-25'
Material: Schedule 40 PVC
Diameter: 2'
Slot Size: 0.010"
End Cap: Schedule 40 PVC

FILTER PACK
Interval: 13'-25'
Type: #1 sand/ Prepack Filter

FILTER PACK SEAL
Interval: 11'-13'
Type: 3/8" Bentonite Pellets

ANNULUS SEAL
Interval: 0'-11'
Type: Portland Type I/Type II/Gel Mix

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

DRILLING METHODS
Soil Drill: 6-inch diameter Sonic
Rock Drill: 6-inch diameter Sonic

LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Cascade
DRILLER: Tom Ardito

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

Golder Associates

BOREHOLE RECORD HAMMOND BORING LOGS.GPJ PIEDMONT.GDT 9/29/17

RECORD OF BOREHOLE HGWC-8/ AP1C-2

SHEET 1 of 1

PROJECT: SCS Hammond
PROJECT NUMBER: 1545812
DRILLED DEPTH: 23.50 ft
LOCATION: Rome, GA

DRILL RIG: Pro Sonic 150
DATE STARTED: 12/8/15
DATE COMPLETED: 12/8/15

NORTHING: 1,549,114.34
EASTING: 1,942,392.75
GS ELEVATION: 576.93
TOC ELEVATION: 580.08 ft

DEPTH W.L.: Ground Surface (bgs)
ELEVATION W.L.: (amsl)
DATE W.L.: 12/8/15
TIME W.L.: 11:20

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 - 1.50 CLAY/RESIDUUM; yellow/orange/brown clay with trace to some coarse sand and fine gravel, low plasticity, soft to firm, wet, W<PL	CL		575.43					
	575	1.50 - 3.00 dark brown clay, trace silt, low plasticity, dry, firm, W<PL			1.50 573.93					
		3.00 - 7.00 CLAY/SILTY CLAY/RESIDUUM; orange/brown clay to silty clay, low to moderate plasticity, firm to stiff, dry to moist, W<PL	CL-CH		3.00				Portland Type I/ Type II/ Gel mix	**WELL CASING** Interval: -3'-12.5' Material: Schedule 40 PVC Diameter: 6" Joint Type: Screw/Flush
5										**WELL SCREEN** Interval: 12.5'-22.5' Material: Schedule 40 PVC Diameter: 2' Slot Size: 0.010" End Cap: Schedule 40 PVC
	570				569.93					
		7.00 - 11.00 SILT/ALLUVIUM; light orange/grey clay with trace fine sand and silt, mottled, moderate to high plasticity, firm to stiff, moist, W=PL SHELBY TUBE: 7'-9'	MH		7.00		SH	2.00 2.00	3/8" Bentonite pellets3/8" Bentonite Pellets	**FILTER PACK** Interval: 9.5'-23.5' Type: #1 sand/ Prepack Filter
10					565.93					**FILTER PACK SEAL** Interval: 7.5'-9.5' Type: 3/8" Bentonite Pellets
	565	11.00 - 17.00 CLAYEY SAND and GRAVEL/ALLUVIUM; light blue-gray sand and gravel, sand is fine to coarse, sub-rounded to sub-angular, loose, moist to wet; gravel is 80% rounded to sub-rounded, fine to coarse, trace to some clay, appears to be a conglomerate type of soil	SC		11.00					**ANNULUS SEAL** Interval: 0'-7.5' Type: Portland Type I/Type II/Gel Mix
15										**WELL COMPLETION** Pad: 4'x4'x4" Protective Casing: Anodized Aluminum
	560				559.93				#1 sand	**DRILLING METHODS** Soil Drill: 6-inch diameter Sonic Rock Drill: 6-inch diameter Sonic
		17.00 - 23.50 SANDY GRAVEL/ALLUVIUM; tan brown to dark brown sand and gravel, fine to coarse, loose, non-plastic, rounded to sub-rounded, wet	SP-GP		17.00				0.010" slot screen	
20	555									
					553.43					
		Boring completed at 23.50 ft								
25	550									
30	545									
35	540									
40	535									
45										

LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Cascade
DRILLER: Tom Ardito

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

Golder Associates

BOREHOLE RECORD HAMMOND BORING LOGS.GPJ PIEDMONT.GDT 9/29/17

RECORD OF BOREHOLE HGWC-9/ AP1C-3

SHEET 1 of 2

PROJECT: SCS Hammond
PROJECT NUMBER: 1545812
DRILLED DEPTH: 47.00 ft
LOCATION: Rome, GA

DRILL RIG: Pro Sonic 150
DATE STARTED: 12/9/15
DATE COMPLETED: 12/9/15

NORTHING: 1,548,692.82
EASTING: 1,942,215.01
GS ELEVATION: 577.62
TOC ELEVATION: 580.60 ft

DEPTH W.L.: 7.2' (bgs)
ELEVATION W.L.: (amsl)
DATE W.L.: 12/9/15
TIME W.L.: 14:15

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	575	0.00 - 7.00 FILL/RESIDUUM; light to dark brown clay with trace fine sand and silt, low plasticity, soft to firm, moist, W<PL	FILL		570.62				Portland Type I/ Type II/ Gel mix	**WELL CASING** Interval: -3'-34' Material: Schedule 40 PVC Diameter: 6" Joint Type: Screw/Flush **WELL SCREEN** Interval: 34'-44' Material: Schedule 40 PVC Diameter: 2' Slot Size: 0.010" End Cap: Schedule 40 PVC **FILTER PACK** Interval: 32.1'-45' Type: #1 sand/ Prepack Filter **FILTER PACK SEAL** Interval: 29.5'-32.1' Type: 3/8" Bentonite Pellets **ANNULUS SEAL** Interval: 0'-29.5' Type: Portland Type I/Type II/Gel Mix **WELL COMPLETION** Pad: 4'x4'x4" Protective Casing: Anodized Aluminum **DRILLING METHODS** Soil Drill: 6-inch diameter Sonic Rock Drill: 6-inch diameter Sonic
5					7.00					
10	570	7.00 - 17.00 CLAY/RESIDUUM; orangish brown and blue grey mottled clay, moderate plasticity, very stiff, moist, W<PL	CL		560.62					
15	565				17.00		SH	2.00 2.00		
20	560	17.00 - 19.50 orangish brown and blue grey mottled clay, moderate plasticity, very stiff, moist, W<PL SHELBY TUBE: 17'-19'			558.12					
25	555	19.50 - 24.00 SAND/ALLUVIUM; light tan to blue-grey gravelly sand with trace clay and gravel, fine to coarse, rounded to sub-rounded, well graded, pooly sorted, non-plastic, compact, moist, W<PL	SW		19.50 553.62					
30	550	24.00 - 27.00 SAND/RESIDUUM; red/orange sand with trace clay, non-plastic, fine to coarse, wet, W>PL	SP		24.00 550.62					
35	545	27.00 - 37.00 GRAVELLY SAND/ALLUVIUM; tan/pink/brown sand with some gravel and trace clay, non-plastic, sand is fine to coarse, sub-rounded to sub-angular, gravel is medium to coarse with some cobbles containing rock fragments, wet	SP		27.00 540.62				3/8" Bentonite Pellets	
40	540	37.00 - 42.00 TRANSITIONALLY WEATHERED ROCK and CLAY/RESIDUUM; red/orange/brown sandy clay, low plasticity, trace rounded cobbles, sand is fine grain, very soft, wet, W>PL	TWR		37.00 535.62				#1 sand 0.010" slot screen	
45	535	42.00 - 47.00 BEDROCK; medium grey fine grained limestone, calcite veins, dry	ROCK		42.00					

Log continued on next page

LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Cascade
DRILLER: Tom Ardito

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

Golder Associates

BOREHOLE RECORD HAMMOND BORING LOGS.GPJ PIEDMONT.GDT 9/29/17

RECORD OF BOREHOLE HGWC-9/ AP1C-3

SHEET 2 of 2

PROJECT: SCS Hammond
PROJECT NUMBER: 1545812
DRILLED DEPTH: 47.00 ft
LOCATION: Rome, GA

DRILL RIG: Pro Sonic 150
DATE STARTED: 12/9/15
DATE COMPLETED: 12/9/15

NORTHING: 1,548,692.82
EASTING: 1,942,215.01
GS ELEVATION: 577.62
TOC ELEVATION: 580.60 ft

DEPTH W.L.: 7.2' (bgs)
ELEVATION W.L.: (amsl)
DATE W.L.: 12/9/15
TIME W.L.: 14:15

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 - 47.00 BEDROCK; medium grey fine grained limestone, calcite veins, dry *(Continued)*	ROCK		530.62				3/8" Bentonite – chips	**WELL CASING** Interval: -3'-34' Material: Schedule 40 PVC Diameter: 6" Joint Type: Screw/Flush **WELL SCREEN** Interval: 34'-44' Material: Schedule 40 PVC Diameter: 2' Slot Size: 0.010" End Cap: Schedule 40 PVC **FILTER PACK** Interval: 32.1'-45' Type: #1 sand/ Prepack Filter **FILTER PACK SEAL** Interval: 29.5'-32.1' Type: 3/8" Bentonite Pellets **ANNULUS SEAL** Interval: 0'-29.5' Type: Portland Type I/Type II/Gel Mix **WELL COMPLETION** Pad: 4'x4'x4" Protective Casing: Anodized Aluminum **DRILLING METHODS** Soil Drill: 6-inch diameter Sonic Rock Drill: 6-inch diameter Sonic
	530	Boring completed at 47.00 ft								
50	525									
55	520									
60	515									
65	510									
70	505									
75	500									
80	495									
85	490									
90										

LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Cascade
DRILLER: Tom Ardito

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

Golder Associates

BOREHOLE RECORD HAMMOND BORING LOGS.GPJ PIEDMONT.GDT 9/29/17

RECORD OF BOREHOLE HGWC-10/ AP1C-4

SHEET 1 of 1

PROJECT: SCS Hammond
PROJECT NUMBER: 1545812
DRILLED DEPTH: 26.50 ft
LOCATION: Rome, GA

DRILL RIG: Pro Sonic 150
DATE STARTED: 12/8/15
DATE COMPLETED: 12/8/15

NORTHING: 1,548,469.51
EASTING: 1,941,644.41
GS ELEVATION: 576.66
TOC ELEVATION: 579.66 ft

DEPTH W.L.: 4.29' (bgs)
ELEVATION W.L.: (amsl)
DATE W.L.: 12/8/15
TIME W.L.: 14:10

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	575	0.00 - 1.50 CLAY/RESIDUUM; dark grey/brown clay with trace to some fine sand, soft trace rounded pebbles and organic material, moist, W<PL	CL		575.16 / 1.50				Portland Type I/ Type II/ Gel mix	**WELL CASING** Interval: 0'-10' Material: Schedule 40 PVC Diameter: 6" Joint Type: Screw/Flush
5	570	1.50 - 7.00 yellowish medium brown clay with trace to some fine sand, low plasticity, stiff to firm, moist, W<PL			569.66 / 7.00				3/8" Bentonite Pellets	**WELL SCREEN** Interval: 10'-20' Material: Schedule 40 PVC Diameter: 2' Slot Size: 0.010" End Cap: Schedule 40 PVC
10	565	7.00 - 17.00 CLAY/RESIDUUM; yellow orangish clay, mottled with light grey sandy material, trace to some rounded to angular gravel and rock fragments, low to moderate plasticity, hard, dry to moist, W<PL								**FILTER PACK** Interval: 7'-20.5' Type: #1 sand/ Prepack Filter
15	560				559.66 / 17.00					**FILTER PACK SEAL** Interval: 3.5'-7' Type: 3/8" Bentonite Pellets
20	555	17.00 - 23.00 SANDY GRAVEL/ALLUVIUM; dark brown, fine to coarse sand and gravel, some clay, trace silt, wet	SC		553.66 / 23.00				#1 sand 0.010" slot screen	**ANNULUS SEAL** Interval: 0'-3.5' Type: Portland Type I/Type II/Gel Mix
25	550	23.00 - 26.50 BEDROCK; limestone rock fragments, grey, powdery, non-plastic, dry	BR		550.16				3/8" Bentonite Pellets	**WELL COMPLETION** Pad: 4'x4'x4" Protective Casing: Anodized Aluminum
30	545	Boring completed at 26.50 ft								**DRILLING METHODS** Soil Drill: 6-inch diameter Sonic Rock Drill: 6-inch diameter Sonic
35	540									
40	535									
45										

LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Cascade
DRILLER: Tom Ardito

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

Golder Associates

BOREHOLE RECORD HAMMOND BORING LOGS.GPJ PIEDMONT.GDT 9/29/17

DRILLING LOG
GEOLOGICAL SERVICES

Hole No. **AP1C-5S**

Sheet 1 of 1

SITE **Plant Hammond HGWC-11** HOLE DEPTH **40'** SURF.ELEV. 577.90

LOCATION Pond 1 South COORDINATES N 1548477.54 E 1941146.65

ANGLE _____ BEARING _____ CONTRACTOR SCS DRILL NO. _____

DRILLING METHOD Sonic NO. SAMPLES _____ NO. U.D. SAMPLES 0

CASING SIZE 2" LENGTH _____ CORE SIZE _____ TOTAL % REC. 93

WATER TABLE DEPTH 9.5' BLS ELEV. 732.1' NAVD88 TIME AFTER COMP. 10.5 DATE TAKEN 12/15/2015

TYPE GROUT _____ QUANTITY _____ MIX . DRILLING START DATE 12/152015

DRILLER Tommy (Casc RECORDER J. Abraham APPROVED _____ DRILLING COMP. DATE 12/15/2015

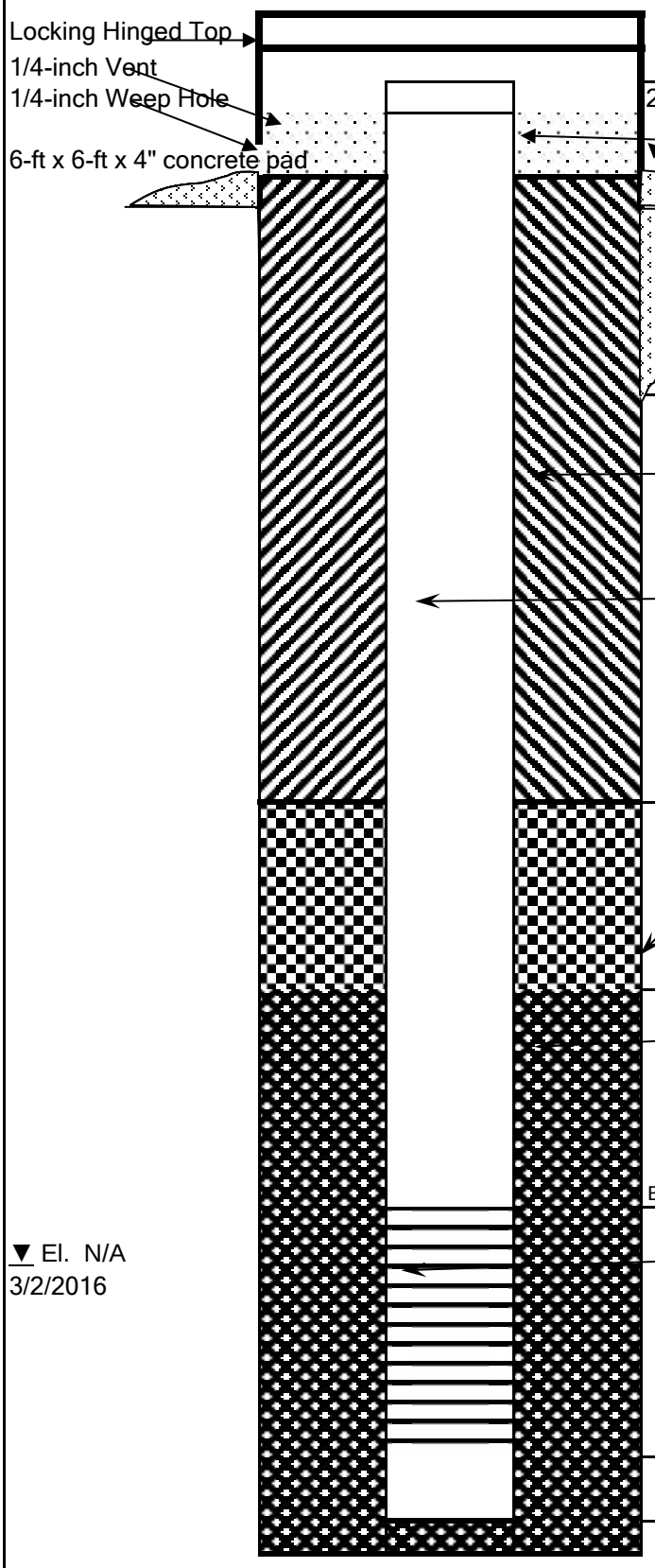
Depth	Elev.	Material Description, Classification and Remarks	Sample No.	Standard Penetration Test From To	Blows	N	Comments	% Rec	RQD
0	577.90	CLAY OVERBURDEN: Dark brown to black clay with minor silt, dry, non-plastic, organic material with roots.							
1	576.90								
2	575.90								
3	574.90								
4	573.90	CLAY OVERBURDEN: Dark brown to black fat clay, dry to moist, low plasticity, blocky texture.						90	
5	572.90								
6	571.90								
7	570.90	CLAYEY SAND OVERBURDEN: Reddish brown sand, fin dry to moist, low plasticity, blocky texture.							
8	569.90								
9	568.90	CLAYEY SAND OVERBURDEN: Reddish brown sand, fin minor gravel, dry to moist, low plasticity.						90	
10	567.90								
11	566.90								
12	565.90	CLAYEY SAND OVERBURDEN: Reddish brown sand, fin minor gravel, moist,non-plastic.							
13	564.90								
14	563.90	CLAY OVERBURDEN: Orange to brown clay, saturated						85	
15	562.90								
16	561.90								
17	560.90	CLAY OVERBURDEN: Orange to brown clay, saturated trace limestone fragments; shaly limestone.							
18	559.90								
19	558.90	SHALE-LIMESTONE						85	
20	557.90								
21	556.90	END DRILLING							
22	555.90								
23	554.90								
24	553.90								

Form GS9901 7-26-2004

WELL CONSTRUCTION LOG — Southern Company Generation

PROJECT: Plant Hammond	DRILLING CO.: Cascade	WELL NAME
CCB Storage Facility	DRILLER: Tommy	
LOCATION: AP-1	RIG TYPE: Sonic	
LOGGER: Abraham	DRILLING METHODS: Sonic	AP1C-5S
DATE CONSTRUCTED: 12/15/2015		

HGWC-11



	DEPTH FEET	ELEVATION FT, MSL
TOP OF RISER	-3.08	580.96
2" Threaded Riser Cap		
Pea Gravel in annular space		
GROUND SURFACE	0.00	577.88
PROTECTIVE CASING SIZE: 4x4-inch TYPE: Anodized Aluminum		
BOTTOM OF PROTECTIVE CASING	3.00	
BACKFILL MATERIAL TYPE: Bentomite Grout mix AMOUNT: 2 x 50lbs		
RISER CASING DIA: 2-inch TYPE: Schedule 40 PVC JOINT TYPE: Flush Threaded		
TOP OF SEAL	8.10	569.78
ANNULAR SEAL TYPE: 1/4-inch coated bentonite pellets 5-gal buckets AMOUNT: 0.5 bucket PLACEMENT: Tremie		
TOP OF FILTER PACK	10.10	567.78
FILTER PACK TYPE: DSI Sand - 1A (20/30) Drillers Services, Inc. AMOUNT: 6 bags PLACEMENT: Tremie; wash with water		
BOTTOM OF RISER / TOP OF SCREEN	12.40	565.48
SCREEN DIA: 2-inch TYPE: Schedule 40 PVC Prepack OPENING WIDTH: 0.01-inch OPENING TYPE: Slotted SLOT SPACING: 0.25-inch SLOT LENGTH: 1.5-inch		
BOTTOM OF SCREEN	22.40	555.48
BOTTOM OF CASING	22.70	555.18
Auger refusal at 20.3-ft		

RECORD OF BOREHOLE HGWC-12/ AP1C-5D

SHEET 1 of 1

PROJECT: SCS Hammond
PROJECT NUMBER: 1545812
DRILLED DEPTH: 37.00 ft
LOCATION: Rome, GA

DRILL RIG: Pro Sonic 150
DATE STARTED: 12/8/15
DATE COMPLETED: 12/9/15

NORTHING: 1,548,475.82
EASTING: 1,941,152.08
GS ELEVATION: 577.83
TOC ELEVATION: 581.01 ft

DEPTH W.L.: 10.55' (bgs)
ELEVATION W.L.: (amsl)
DATE W.L.: 12/9/15
TIME W.L.: 10:22

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 - 1.00 CLAY/RESIDUUM; dark brown clay with trace silt, non-plastic, trace gravel, trace to some organic material, topsoil, soft, dry, W<PL	CL		576.83 1.00					
		1.00 - 2.00 dark brown to black clay with trace fine to coarse sand, trace amounts of coal and rock fragments, soft, non-plastic, dry to moist, W<PL			575.83 2.00					
	575									
5		2.00 - 7.00 yellow orangish clay with trace fine sand, trace sub rounded gravel, low plasticity, stiff to very stiff, moist, W<PL								
					570.83					
		7.00 - 8.50 CLAYEY SAND/RESIDUUM; red orange and light gray mottled clay with some fine sand, moderate to high plasticity, firm, moist, W=PL	SC		7.00 569.33		SH	2.00 2.00		
	570	SHELBY TUBE: 7'-9'							Portland Type I/ Type II/ Gel mix	
		8.50 - 10.00 CLAYEY SAND/ALLUVIUM; red orange sand, sub rounded, fine to medium, well sorted, low to non-plastic, moist to wet, W<PL	SC		8.50 567.83					
10		10.00 - 13.00 CLAYEY SAND; blue grey sand with trace clay, trace rounded to sub rounded pebbles, fine to coarse grain, low plasticity, moist, W<PL	SC		10.00 564.83					
	565									
		13.00 - 17.00 SAND; yellowish brown fine to coarse sand with some pea gravel, rounded to sub-rounded, loose, moist to wet	SP		13.00 560.83					
15										
		17.00 - 21.00 CLAY/RESIDUUM; red orange and brown mottled clay, low to medium plasticity, soft, moist, W=PL	CL-CH		17.00 556.83				3/8" Bentonite Pellets	
	560									
20		21.00 - 24.00 CLAY; dark red/orange/brown clay with trace rock fragments, soft, wet, W>PL			21.00 553.83					
	555									
		24.00 - 27.00 BEDROCK; limestone, gravel and sand , fine to coarse, dry, non-plastic, W<PL	BR		24.00 550.83				#1 sand	
25										
		27.00 - 37.00 brownish grey limestone with calcite veins			27.00				0.010" slot screen	
	550									
30										
	545									
35									3/8" Bentonite Pellets	
					540.83					
		Boring completed at 37.00 ft								
	540									
40										
	535									
45										

WELL CASING
Interval: -3'-23'
Material: Schedule 40 PVC
Diameter: 6"
Joint Type: Screw/Flush

WELL SCREEN
Interval: 22.5'-32.5'
Material: Schedule 40 PVC
Diameter: 2'
Slot Size: 0.010"
End Cap: Schedule 40 PVC

FILTER PACK
Interval: 20.4'-33'
Type: #1 sand/ Prepack Filter

FILTER PACK SEAL
Interval: 18'-20.4'
Type: 3/8" Bentonite Pellets

ANNULUS SEAL
Interval: 0'-18'
Type: Portland Type I/Type II/Gel Mix

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

DRILLING METHODS
Soil Drill: 6-inch diameter Sonic
Rock Drill: 6-inch diameter Sonic

LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Cascade
DRILLER: Tom Ardito

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

Golder Associates

BOREHOLE RECORD HAMMOND BORING LOGS.GPJ PIEDMONT.GDT 9/29/17

RECORD OF BOREHOLE HGWC-13/ AP1C-6

SHEET 1 of 1

PROJECT: SCS Hammond
PROJECT NUMBER: 1545812
DRILLED DEPTH: 42.00 ft
LOCATION: Rome, GA

DRILL RIG: Pro Sonic 150
DATE STARTED: 12/9/15
DATE COMPLETED: 12/10/15

NORTHING: 1,548,628.52
EASTING: 1,940,900.41
GS ELEVATION: 591.76
TOC ELEVATION: 594.83 ft

DEPTH W.L.: 11.1' (bgs)
ELEVATION W.L.: (amsl)
DATE W.L.: 12/9/15
TIME W.L.: 09:45

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES SAMPLE NO.	SAMPLES TYPE	SAMPLES REC	MONITORING WELL/ PIEZOMETER DIAGRAM and NOTES
0	590	0.00 - 7.00 SILT/RESIDUUM; dark brown silt with some fine sand, loose, soft, dry, W<PL, appears to be fill	ML		584.76				
5	585								
10	580	7.00 - 16.00 CLAY/RESIDUUM; yellow orange and dark brown clay with trace silt, medium sand and organic material , low plasticity, soft to firm, moist, W<PL	CL		7.00 575.76				Portland Type I/ Type II/ Gel mix
15	575	16.00 - 17.00 SILT/RESIDUUM; dark grey silt, with trace sand and clay, low to moderate plasticity, soft, moist	ML		16.00 574.76				
20	570	17.00 - 25.00 CLAY/RESIDUUM; red/orange/tan clay with trace fine to coarse sand, mottled, low to moderate plasticity, very soft, dry to moist, W<PL	CL-CH		17.00 566.76				
25	565	25.00 - 27.00 CLAYEY SAND/RESIDUUM; mottled clay with 10-20% medium to coarse sand, moderate plasticity, moist, W<PL	SC		25.00 564.76				
30	560	27.00 - 31.00 CLAY/RESIDUUM; red orange/blue grey clay with trace sand, fine to medium, moderate plasticity, soft to stiff, moist, W=PL	CH		27.00 560.76				3/8" Bentonite Pellets
35	555	31.00 - 37.00 SAND/ALLUVIUM; reddish brown sand, fine to coarse, poorly sorted, some pebbles and cobble sized rock, rounded, non-plastic, loose, wet to moist	SP		31.00 554.76				#1 sand 0.010" slot screen
40	550	37.00 - 42.00 CLAY/RESIDUUM; red orange clay with some fine to coarse sand, non-plastic, soft to firm, W>PL	CL		37.00 549.76				
45		Boring completed at 42.00 ft							

WELL CASING
Interval: -3'-32.5'
Material: Schedule 40 PVC
Diameter: 6"
Joint Type: Screw/Flush

WELL SCREEN
Interval: 32'-42'
Material: Schedule 40 PVC
Diameter: 2'
Slot Size: 0.010"
End Cap: Schedule 40 PVC

FILTER PACK
Interval: 29.5'-42'
Type: #1 sand/ Prepack Filter

FILTER PACK SEAL
Interval: 27.1'-29.5'
Type: 3/8" Bentonite Pellets

ANNULUS SEAL
Interval: 0'-27.1'
Type: Portland Type I/Type II/Gel Mix

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

DRILLING METHODS
Soil Drill: 6-inch diameter Sonic
Rock Drill: 6-inch diameter Sonic

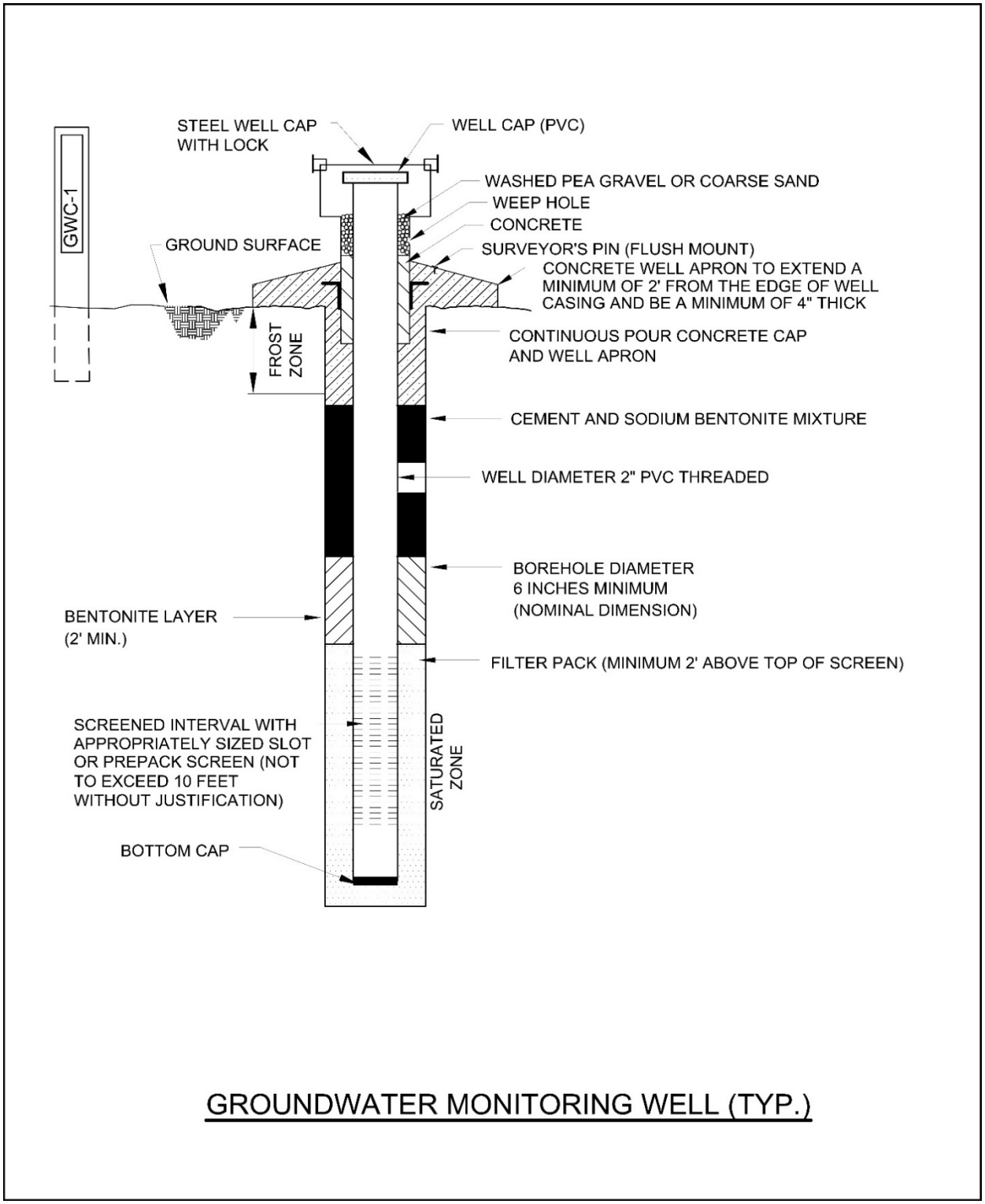
LOG SCALE: 1 in = 5.5 ft
DRILLING COMPANY: Cascade
DRILLER: Tom Ardito

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

Golder Associates

BOREHOLE RECORD HAMMOND BORING LOGS.GPJ PIEDMONT.GDT 9/29/17

B. GROUNDWATER MONITORING WELL DETAIL



GROUNDWATER MONITORING WELL (TYP.)

C. GROUNDWATER SAMPLING PROCEDURE

Groundwater sampling will be conducted using the most current applicable USEPA Region 4 SESD Field Branches Quality System and Technical Procedures as a guide (https://www.epa.gov/quality/quality-system-and-technical-procedures-sesd-field-branches). 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 using a water measuring device consisting of probe and measuring tape capable of measuring water levels with accuracy to 0.1 foot. 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 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. All non-dedicated equipment will be decontaminated before use and between well locations in general accordance with USEPA Region 4 SESD guidance document, *Operating Procedure - Field Equipment Cleaning and Decontamination* (EPA, SESDGUID-205-R3), or the latest version of the document.

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 feet 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, oxidation-reduction potential (ORP), and dissolved oxygen (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 for pH

   ±5% for specific conductance (conductivity)

±10% or ±0.2 mg/L (whichever is greater) for DO where DO>0.5mg/L. If DO<0.5mg/L no stabilization criteria apply

<5 NTU 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 100 and 200 mL/min according to the most current version of USEPA Region 4 SESD guidance document, *Operating Procedure – Groundwater Sampling* (EPA, SESDPROC-301-R#), 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. All 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 (i.e., >10 NTU), 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. A new filter must be used for each well and each sampling event. Filtered samples are not considered compliance samples and are only used to evaluate the effects of turbidity. Additional details related to managing for elevated turbidity is discussed below.

9. All 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 all non-dedicated equipment. Upon completion of all activity the well will be closed and locked.

13. Samples will be delivered to the laboratory following appropriate COC and temperature control requirements. The goal for sample delivery will be within 48 hours of collection; however, at no time will samples be analyzed after the method-prescribed hold time.

Throughout the sampling process new latex or 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 NTU; however, samples may be collected where turbidity is less than 10 NTU and the stabilization criteria described above are met.

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

- If turbidity remains above 5 NTU but is less than 10 NTU, and all other parameters are stabilized, the well can be sampled.
- Where turbidity remains above 10 NTU, 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 the COC form.