Allen Steam Station Ash Basin

Groundwater Monitoring Program Sampling, Analysis, and Reporting Plan

NPDES Permit NC0004979

October 10, 2014

Report Verification

PROJECT: **GROUNDWATER MONITORING PROGRAM**
ALLEN STEAM STATION
ASH BASIN
NPDES PERMIT NC0004979

TITLE: **GROUNDWATER MONITORING**
SAMPLING, ANALYSIS, AND REPORTING PLAN

This document has been reviewed for accuracy and quality commensurate with the intended application.

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Section 1 - Introduction

This Groundwater Monitoring Program Sampling, Analysis, and Reporting Plan (Plan) is developed to support the Duke Energy Carolinas, LLC (Duke Energy) requirement for groundwater monitoring around the Allen Steam Station (Allen) ash basin operated under National Pollutant Discharge Elimination System (NPDES) Permit NC0004979.

This Plan describes the groundwater monitoring network, methodologies of field sampling, record-keeping protocols, laboratory analytical methods, data quality objectives, data validation, and reporting that will be used for the Allen ash basin groundwater monitoring program.

Section 2 - Site Description

2.1 Plant Description

Allen is a five-unit, coal-fired electric generating plant with a capacity of 1,140 megawatts located in Gaston County, North Carolina, near the town of Belmont. Allen is located on the west bank of the Catawba River on Lake Wylie, as shown on Figure 1. Commercial operations at Allen began in 1957.

Lake Wylie is owned by Duke Energy and operated as part of the Catawba-Wateree Project Federal Energy Regulatory Commission (FERC) Project No. 2232. The reservoir is used for hydroelectric generation, municipal water supply, and recreation. Lake Wylie has a surface area of approximately 13,443 acres.

2.2 Ash Basin Description

The coal ash residue from the coal combustion process has historically been disposed of in the Allen ash basin. The ash basin currently receives waste streams from the ash sluice lines (mostly bottom ash), water treatment system wastewater, stormwater, Flue Gas Desulfurization (FGD) system blowdown, landfill leachate, and miscellaneous cleaning and maintenance wash waters. The discharge from the ash basin is permitted by the North Carolina Department of Environment and Natural Resources (NCDENR) Department of Water Resources (DWR) under NPDES Permit NC0004979.

Allen has an active ash basin and an inactive ash basin. The active ash basin was commissioned in 1973 (Duke Energy 2009) and is currently in operation. The inactive ash basin is located to the north of the active ash basin and is not in operation. A large portion of the inactive ash basin is permitted as an industrial landfill by the NCDENR Division of Waste Management (DWM) (Permit No. 3612). See Figure 2.

The active ash basin is located approximately 2,500 feet to the south of the power plant on the western side of Lake Wylie. There are two earthen dikes impounding the active ash basin; the East Dike, located along the west bank of Lake Wylie and the North Dike, separating the active and inactive ash basins. The surface area of the active ash basin is approximately 169 acres (Duke Energy 2009) with an approximate operating pond elevation of 633.5 feet. The full pond elevation of Lake Wylie is approximately 568.7 feet.

Due to the nature of Allen operations and weather, inflows to the ash basin are highly variable. The inflows from the ash removal system and other plant discharges are discharged through sluice lines into the ash basin. Prior to 2009, all of the fly ash produced was sluiced to the ash basin. Since 2009, fly ash has been dry-handled and is infrequently sluiced to the ash basin. All of the bottom ash produced by the station is sluiced to the ash basin. The water level (pond elevation) of the ash basin is maintained at approximately 633.5 feet by the use of concrete stop logs. A 42-inch-diameter reinforced concrete pipe serves as the outlet conduit for the discharge tower into Lake Wylie.

Section 3 - Site Geology and Hydrogeology

3.1 Geologic/Soil Framework

Allen and its associated ash basin system are located in the Charlotte Terrane of the Carolina Zone (Pippin et al. 2008), or as described in the older belt terminology, the Charlotte Belt of the Piedmont physiographic province (Piedmont) (North Carolina Geological Survey 1985). The Charlotte terrane is characterized by mostly felsic to mafic plutonic rocks which intrude a suite of mainly metaigneous rocks and minor metasedimentary rocks (Pippin et al. 2008).

The soils that overlie the bedrock in the area have generally formed from the in-place weathering of the parent bedrock. The fractured bedrock is overlain by a mantle of unconsolidated material known as regolith. The regolith, where present, includes the soil zone, a zone of weathered, decomposed bedrock known as saprolite, and alluvium. Saprolite, the product of chemical and mechanical weathering of the underlying bedrock, is typically composed of silt and coarser granular material up to boulder size and may reflect the texture of the rock from which it was formed. The weathering products of felsic rocks may be sandy-textured and rich in quartz content while mafic rocks form a more clayey saprolite (LeGrand 2004).

Based on a review of the monitoring well installation logs provided by Duke Energy, the soils comprising the saprolite layer on site were characterized as ranging from clayey silt to partially weathered rock containing quartz and potassium feldspar. Bedrock encountered on site consists of granite and quartz diorite. See Appendix A for Boring Logs and Monitoring Well Construction Logs.

3.2 Hydrogeologic Framework

The groundwater system in the Piedmont Province in most cases is comprised of two interconnected layers or mediums: 1) residuum/saprolite and weathered rock (regolith) overlying, and 2) fractured crystalline bedrock (Heath 1980; Harned and Daniel 1992). Within the regolith layer, a thoroughly weathered and structureless material (termed residuum) occurs near the ground surface with the degree of weathering decreasing with depth. The residuum grades into a coarser-grained material that retains the structure of the parent bedrock and is termed saprolite. Beneath the saprolite, partially weathered bedrock occurs with depth until sound bedrock is encountered. This mantle of residual soil, saprolite, and weathered rock is a hydrogeological unit that covers and crosses various types of rock (LeGrand 1988). It provides an intergranular medium through which the recharge and discharge of water from the underlying fractured rock occurs. The bedrock layer consists of fractured, nonporous crystalline bedrock. The fractures control both the hydraulic conductivity and storage capacity of the rock mass.

A transition zone at the base of the regolith has been interpreted to be present in many areas of the Piedmont. The zone consists of partially weathered/fractured bedrock and lesser amounts of saprolite that grades into bedrock and has been described as “being the most permeable part of the system, even slightly more permeable than the soil zone” (Harned and Daniel 1992). The zone thins and thickens within short distances and its boundaries may be difficult to distinguish.

It has been suggested that the zone may serve as a conduit of rapid flow and transmission of contaminated water (Harned and Daniel 1992).

Piedmont topography is characterized by gently rounded sloped hills and valleys. Recharge typically occurs on upland areas and slopes while groundwater discharge is concentrated in surface water bodies and lowland areas. LeGrand's (1988, 2004) conceptual model of the groundwater setting in the Piedmont incorporates the above two medium systems into an entity that is useful for the description of groundwater conditions. That entity is the surface drainage basin that contains a perennial stream or river (LeGrand 1988). Each basin is similar to adjacent basins and the conditions are generally repetitive from basin to basin. Within a basin, movement of groundwater is generally restricted to the area extending from the drainage divides to a perennial stream or river (Slope-Aquifer System; LeGrand 1988, 2004). Rarely does groundwater move beneath a perennial stream or river to another more distant stream (LeGrand 2004).

Therefore, in most cases in the Piedmont, the groundwater system is a two-medium system (LeGrand 1988) restricted to the local drainage basin. The groundwater occurs in a system composed of two interconnected layers: residuum/saprolite and weathered rock overlying fractured crystalline rock separated by the transition zone. Typically, the residuum/saprolite is partly saturated and the water table fluctuates within it. Water movement is generally through the fractured bedrock. The near-surface fractured crystalline rocks can form extensive aquifers. The character of such aquifers results from the combined effects of the rock type, fracture system, topography, and weathering. Topography exerts an influence on both weathering and the opening of fractures while the weathering of the crystalline rock modifies both transmissive and storage characteristics.

The aquifer system in the Piedmont typically exists in an unconfined or semi-confined condition in the bedrock zone. Under natural conditions, the general direction of groundwater flow can be approximated from the surface topography. Groundwater moves both vertically down through the regolith and parallel to the bedrock surface to areas where groundwater discharges as seepage into streams, lakes, or other surface water bodies.

The Allen ash basin is generally bounded to the north by the inactive ash basin (Figure 2). Lake Wylie is located to the east of the ash basin and lies along the toe of the East Dike. To the south, the ash basin is generally bounded by a surface water divide located north of Reese Wilson Road. This divide drops in elevation to the east toward Lake Wylie. The ash basin is generally bounded to the west by a surface water divide that runs approximately along the alignment of South Point Road (NC 273) and upland areas east of South Point Road. The geological/groundwater conditions at the site are expected to be generally consistent with the characteristics of the conceptual groundwater model developed by LeGrand for the Piedmont region. The surface water divide along South Point Road likely functions as a groundwater divide. The predominant direction of groundwater flow from the ash basin is likely in an easterly direction, generally from South Point Road towards Lake Wylie.

Section 4 - Monitoring Program

4.1 Regulatory Requirements for Groundwater Monitoring

The NPDES program regulates wastewater discharges to surface waters to ensure that surface water quality standards are maintained. Allen operates under NPDES Permit NC0004979, which authorizes discharge of cooling water (Outfall 001), operate a septic tank and ash pond with pH adjustment and discharge domestic wastewater, stormwater runoff, ash sluice, water treatment system wastewaters, FGD system blowdown, landfill leachate, and miscellaneous cleaning and maintenance wash waters (Outfall 002), coal yard sump overflow (Outfall 002A) and power house sump overflow (Outfall 002B), miscellaneous equipment for non-contact cooling and sealing water (Outfall 003), and miscellaneous non-contact cooling water, vehicle washwater, and intake screen backwash (Outfall 004) to the Catawba River in accordance with effluent limitations, monitoring requirements, and other conditions set forth in the permit. Finally, continued operation of the FGD wet scrubber wastewater treatment system discharging to the ash basin through internal Outfall 005. The NPDES permitting program requires that permits be renewed every five years.

The Allen NPDES permit requires groundwater monitoring. Permit condition A(11), Attachment XX, Version 1.1, dated June 15, 2011, lists the groundwater monitoring wells to be sampled, the parameters and constituents to be measured and analyzed, and the requirements for sampling frequency and results reporting. Attachment XX also provides requirements for well location and well construction. A copy of Attachment XX is included as Appendix B.

The compliance boundary for groundwater quality for the Allen ash basin is defined in accordance with NCAC Title 15A Chapter 02L .0107(a) as being established at either 500 feet from the waste boundary or at the property boundary, whichever is closer to the source.

Sampling at the compliance groundwater wells commenced March 2011. Analytical results have been submitted to the Department of Water Resources (DWR) before the last day of the month following the date of sampling for all monitoring wells except AB-9S, AB-9D, AB-10S, and AB-10D. In the future, analytical results will be submitted to the DWR within 60 days of the date of sampling for all monitoring wells except AB-9S, AB-9D, AB-10S, and AB-10D.

Monitoring wells AB-9S, AB-9D, AB-10S, and AB-10D are located inside of the compliance boundary. Compliance with 2L Standards (at the compliance boundary) for AB-9S, AB-9D, AB-10S, and AB-10D is determined by using predictive calculations or a groundwater model. For these four monitoring wells, Duke Energy uses a groundwater model to predict the concentrations at the compliance boundary. The predicted results from the groundwater model and the analytical results for samples collected during the sampling events are to be submitted to the DWR annually.

4.2 Description of Groundwater Monitoring System

The groundwater monitoring system for the Allen ash basin system consists of the following monitoring wells: AB-1R, AB-4S[1], AB-4D, AB-9S, AB-9D, AB-10S, AB-10D, AB-11D, AB-12S, AB-12D, AB-13S, AB-13D, and AB-14D. The compliance monitoring wells were installed in 2010 (MACTEC 2011). Well construction data is provided in Table 1 and Figure 3 provides an example of typical construction details.

The locations for the compliance boundary monitoring wells were selected in consultation with the DWR Aquifer Protection Section. The location of the monitoring wells, the waste boundary and the compliance boundary are shown on Figure 2. A summary of the monitoring well location data is included in Appendix C.

Monitoring wells AB-4S, AB-9S, AB-10S, AB-12S, and AB-13S were installed by rotary drilling methods using hollow stem augers, with the well screen installed above auger refusal to monitor the shallow aquifer within the saprolite layer. These wells were installed with 15-foot screens. The screen intervals for these wells range from 3 feet to 18 feet below ground surface (bgs) at AB-10S to 8 feet to 23 feet bgs at AB-12S.

Monitoring wells AB-4D, AB-9D, AB-10D, AB-11D, AB-12D, AB-13D, and AB-14D were installed by rotary drilling methods using hollow stem augers and by rock coring techniques (HQ-diameter barrel) with the well screen installed in the uppermost region of the fractured rock transition zone. These wells were installed with screens lengths of either 5 feet or 10 feet. The screen intervals for these wells range from 15 feet to 20 feet bgs at AB-11D to 110 feet to 115 feet bgs at AB-9D.

Monitoring well AB-1R is located to the northwest of the inactive ash basin and is considered by Duke Energy to represent background water quality at the site. AB-1R was installed by rotary drilling methods using hollow stem augers, with the well screen installed above auger refusal to monitor the shallow aquifer within the saprolite layer. AB-1R was installed with a 20-foot-long screen from 51 feet to 71 feet bgs.

Monitoring wells AB-9S, AB-9D, AB-10S, and AB-10D are located down gradient from the inactive and active ash basins. Monitoring wells AB-9S and AB-9D are located southeast of the Retired Ash Basin Ash Landfill. Monitoring wells AB-10S and AB-10D are located to the east of the active ash basin. AB-11D is located to the south of the active ash basin. Monitoring wells AB-12S, AB-12D, AB-4S, AB-4D, and AB-13S, AB-13D are generally located to the west of the active ash basin. Monitoring well AB-14D is located to the south of a portion of the inactive ash basin and near the western extent of the property.

With the exception of monitoring wells AB-9S, AB-9D, AB-10S, and AB-10D, the ash basin monitoring wells were installed at or near the compliance boundary. Monitoring wells AB-9S, AB-9D, AB-10S, and AB-10D are located where it was not possible to access the compliance

[1] Prior to 2011, monitoring well AB-4S was identified as AB-4. The NPDES permit condition A(11), Attachment XX, Version 1.1, dated June 15, 2011, and the well construction records and boring logs presented identify monitoring well AB-4S as AB-4.

boundary. Therefore, these monitoring wells were installed inside of the 500-foot compliance boundary.

Groundwater monitoring wells AB-1, AB-2, AB-2D, AB-5, AB-6A, AB-6R, and AB-8 were installed by Duke Energy in 2004 and 2005 as part of a voluntary monitoring system.[2] No samples are currently collected from these wells under the compliance monitoring program.

4.3 Monitoring Frequency

The monitoring wells will be sampled three times per year in March, July, and November.

4.4 Sample Parameters and Methods

The monitoring program consists of sampling and analysis for parameters and constituents identified in Attachment XX of the NPDES permit (Appendix B).

The parameters and constituents and the analytical methods are presented in Table 2. The analytical results will be compared to the 2L Standards.

4.5 Data Quality Objectives

The overall Quality Assurance (QA) objective is to ensure that reliable data of known and acceptable quality are provided. All measurements will be documented to yield results that are representative of the groundwater quality. Data will be calculated and reported in units as required by the NCDENR.

The analytical QA objectives for precision, accuracy, and completeness have been established by the laboratory(s) in accordance with the Environmental Protection Agency (EPA) or other accepted agencies for each measurement variable where possible. The objectives are outlined in the Duke Energy Analytical Laboratory Procedures Manual and are available upon request.

Appropriate methods have been selected to meet applicable standards for groundwater quality. Instances may occur, however, in which the condition of the sample will not allow detection of the desired limits for various parameters either because of matrix interference or high analyte concentrations requiring sample dilution. The laboratory(s) will provide sufficient documentation with each data package to notify reviewers about any analytical problems with the data, if needed.

[2] AB-1 and AB-8 were abandoned in 2010.

Section 5 - Sampling Procedures

5.1 Sampling Equipment

Development, purging, and sampling equipment shall be selected to ensure that materials are compatible with the sample parameters and comply with state and federal regulatory requirements for sampling. Positive-gas-displacement fluorocarbon resin bladder pumps are installed in each monitoring well as dedicated purging and sampling systems.

5.1.1 Equipment Cleaning Procedures

Dedicated sampling equipment has been installed in each monitoring well. In the event non-dedicated equipment is used between monitoring wells, equipment will be cleaned before use and between wells in accordance with standard EPA-approved cleaning procedures for field equipment. This standard is outlined in the Standard Operating Procedures and Quality Assurance Manual, Engineering Support Branch, EPA Region IV, February 1, 1991.

5.2 Groundwater Sampling

5.2.1 Development of Monitoring Wells

All 13 monitoring wells addressed in this sampling plan have been previously developed.

If new monitoring wells are installed, they will be developed prior to initial sampling. Development removes silt that has settled into the bottom of the well following installation and removes fine silt and clay particles from the well screen and sand pack surrounding the screen. Well development is necessary to eliminate potential clogging and enhance well performance. Development involves removing an estimated ten or more well volumes from the well using a positive-gas-displacement fluorocarbon resin bladder pump with up-and-down agitation to loosen particles from the well screen. After development of a well, a true well depth is recorded referencing the top of well casing (TOC).

5.2.2 Groundwater Level and Total Depth Measurements

Water level measurements shall be collected and recorded to determine the groundwater elevations and groundwater flow direction and to calculate the volume of standing water in the well. All monitoring wells have been surveyed to determine the elevation of the TOC. All depth and water level measurements shall be referencing the TOC and recorded to the nearest one - hundredth of a foot.

Water level measurements shall be made with an electronic measuring device consisting of a spool of dual-conductor wire and sensor. When the sensor comes in contact with water, the circuit is closed and a meter light and/or buzzer are attached to the spool to signal the contact. The sensor is lowered further until it rests on the bottom of the well to determine the total depth of the well referencing the TOC. The depth and water level measurements shall be used to verify that the well has not filled with silt and to calculate the volume of water in the well.

The volume of well water (in gallons) is calculated using the following equation:

$$V = h * \pi * r^2 * (7.48052\ gal/ft^3)$$

Where:

V = volume of water in the well screen and casing (gallons)

h = height of standing water (feet) = total well depth - water level

r = radius of well casing (feet)

For example, a 2-inch-diameter casing will have a volume of 0.1631 gallons per foot.

In dedicated sampling systems, an accurate well depth is determined as indicated above after development of the well and prior to installation of the dedicated bladder pump. The well depth will be re-measured anytime the dedicated sampling system is removed for repair or replacement. The well depth, water level measurement, and calculated well volume are recorded on the Groundwater Monitoring Data Sheet (Figure 4).

5.2.3 Well Purging and Sampling

The selection of purging technique is dependent on the hydrogeologic properties of the aquifer and hydraulic characteristics of each well. Hydraulic conductivity, water column, well volume, screen length, and other information are evaluated to select the purging technique to acquire groundwater representative of the aquifer conditions. The Groundwater Monitoring Data Sheet (Figure 4) is used to record purging methods and measurements.

A multi-parameter water quality monitoring instrument is used to measure field stabilization or indicator parameters for determining representative groundwater during purging. These instruments measure pH, specific conductance, temperature, dissolved oxygen (DO), and oxidation-reduction potential (ORP). Instrument calibration must be performed and documented before and after each sampling event. The pH subsystem will be calibrated with two pH standards (pH 7.0 and 4.0) bracketing the expected groundwater pH. The specific conductance subsystem will be calibrated using two standards bracketing the expected groundwater conductivity. Calibration results will be recorded on a Field Sampling Calibration Form (Figure 5).

Various well purging techniques are described below. The purging method utilized at any particular well will be selected after considering the characteristics of the well and the purging method(s) used during previous sampling events.

Conventional Purging

This technique entails removing one equivalent well volume and measuring the indicator parameters (temperature, pH, and specific conductance). When the parameters have stabilized to within ±0.2 pH units and ±10 percent for temperature and conductivity over three to five well volumes, representative groundwater has been achieved for sampling. It is acceptable to begin sampling after five complete well volumes have been removed, even when indicator parameters have not stabilized. Groundwater is pumped into a graduated container to measure the volume of water purged. Under normal rates of recovery, samples should be collected immediately after purging in accordance with EPA guidelines.

For low-yield wells incapable of yielding three to five well volumes in a reasonable amount of time (e.g., 2 hours or less), groundwater is purged to the elevation of the pump intake while measuring indicator parameters. Typically, low-yield wells are evacuated to dryness one time and sampled when sufficient water level recovery occurs. Turbidity is not a required stabilization parameter, but turbidity levels of 10 nephelometric turbidity units (NTU) or less should be targeted.

Low-Flow Purging

Low-flow purging and sampling are appropriate when the recharge rate of the well approximates or equals the discharge rate of the pump with minimal drawdown of the water column (≤1 foot).

During low-flow purging and sampling, groundwater is pumped into a flow-through chamber at flow rates that minimize or stabilize water level drawdown within the well. Indicator parameters are measured over time (usually at 5-minute intervals). When parameters have stabilized within ±0.2 pH units and ±10 percent for temperature, conductivity, and DO; and ±10 millivolts (mV) for ORP over three consecutive readings; representative groundwater has been achieved for sampling. Turbidity is not a required stabilization parameter, but turbidity levels of 10 NTU or less should be targeted.

Modified Low-Flow Purging

This technique is considered a viable option particularly in the Piedmont region due to the likely presence of fine-grained soils where water level drawdown cannot be stabilized while pumping. When the well recharge rate is less than the pump discharge rate, excessive drawdown (>1 foot) of the water column occurs and mixes with stagnant water located above the screened interval. One equivalent well volume is removed initially before measuring indicator parameters. Frequently, removal of the initial well volume reduces the hydraulic head and allows for matching of the recharge rate with the pumping rate providing stabilization of drawdown. Indicator parameters should be measured at 5-minute intervals using a flow-through chamber attached to a multi-parameter water quality instrument. When parameters have stabilized to within ±0.2 pH units and ±10 percent for temperature, conductivity, and DO; and ±10 mV for ORP over three consecutive readings; representative groundwater has been achieved for sampling. Turbidity is not a required stabilization parameter, but turbidity levels of 10 NTU or less should be targeted.

Very Low-Yield Well Purging

This technique provides the best option for monitoring wells that historically purge to dryness and do not sufficiently recharge to provide adequate volume for sample collection. Wells that yield less than 100 milliliters per minute (mL/min) frequently incur significant drawdown during well purging. Therefore, if the well yield is less than 100 mL/min, the volume of the pumping system (i.e., the pump bladder, tubing, and flow-through chamber) shall be calculated and two pumping system volumes shall be removed. Indicator parameters will be measured and recorded initially, and then sample collection will begin.

5.3 Sample Collection

Groundwater samples are collected after representative groundwater has been determined by purging and stabilizing the indicator parameters.

Sampling personnel wear clean, disposable, non-powdered nitrile gloves at each location. Samples are collected in the order of the volatilization sensitivity of the parameters:

- Metals, metalloids, and selenium
- Sulfate, nitrate, and chloride
- Total dissolved solids

After collection, samples will be preserved and stored according to parameter-specific methods and delivered to the laboratory under proper Chain-of-Custody (COC) procedures. All pertinent notations, water-level measurements, removed well volumes, and indicator parameters shall be documented on the Groundwater Monitoring Data Sheet (Figure 4).

5.4 Sample Containers, Volume, Preservation, and Holding Time

All sample containers supplied by the laboratory for the collection of groundwater samples shall be new and pre-cleaned as approved by EPA procedures appropriate for the parameters of interest. Table 3 summarizes the sample containers, sample volume, preservation procedures, and holding times required for each type of sample and parameter. Sample containers will be kept closed until used. All sample containers will be provided by Duke Energy or vendor laboratories.

5.5 Sample Tracking

The COC procedures allow for tracing the possession and handling of individual samples from the time of field collection through laboratory analysis and report preparation. Samples shall be pre-logged prior to sample collection. This process assigns a unique tracking number for each sample and generates corresponding labels. An example of the COC Record is provided as Figure 6.

5.6 Sample Labeling

Sample containers shall be pre-labeled and organized prior to field activities as part of the pre-sampling staging process. As samples are collected, the sampling personnel shall write the following information directly on the label: sampling date and time, and initials of sample collector. This information is also recorded on the Groundwater Monitoring Data Sheet (Figure 4) and the COC Record (Figure 6).

5.7 Field Documentation

Field documentation from each sampling event is recorded on the Groundwater Monitoring Data Sheets (Figure 4), the Field Sampling Calibration Form (Figure 5), and the COC Record (Figure 6). Additionally, a Groundwater Sampling Site Checklist (Figure 7) is completed indicating information about the monitoring well such as proper identification (ID) tag and condition of protective casing and pad. Field notations shall be made during the course of the field work to document the following information as applicable:

- Identification of well
- Well depth
- Static water level depth and measurement technique

- Presence of immiscible layers and detection method
- Well yield – high or low
- Purge volume or pumping rate
- Sample identification numbers
- Well evacuation procedure/equipment
- Sample withdrawal procedure/equipment
- Date and time of collection
- Types of sample containers used
- Identification of replicates or blind samples
- Preservative(s) used
- Parameters requested for analysis
- Field analysis data and methods
- Sample distribution and transporter
- Field observations during sampling event
- Name of sample collector(s)
- Climatic conditions including estimate of air temperature

The Groundwater Monitoring Data Sheets (Figure 4), the Field Sampling Calibration Form (Figure 5), and the COC Record and Analysis Request Form (Figure 6) will be filed by project and date. Recorded entries will be made on electronic forms or on paper forms with indelible ink. Errors on paper documents will be corrected by drawing a line through the error, initialing and dating the correction, and starting a new entry on the next line (if necessary).

5.8 Chain-of-Custody Record

The COC Record (Figure 6) accompanies the sample(s), traces sample possession from time of collection to delivery to the laboratory(s), and clearly identifies which sample containers have been designated for each requested analysis. The record includes the following types of information:

- Sample identification number
- Signature of collector
- Date and time of collection
- Sample type (e.g., groundwater, immiscible layer)
- Identification of well
- Number of containers
- Parameters requested for analysis
- Preservative(s) used
- Signature of persons involved in the chain of possession
- Inclusive dates of possession

5.9 Sample Custody, Shipment, and Laboratory Receipt

For the purpose of these procedures, a sample is considered in custody if it is:

- In actual possession of the responsible person
- In view, after being in physical possession
- Locked or sealed in a manner so that no one can tamper with it after having been in physical custody or in a secured area restricted to authorized personnel

All samples shall be maintained in the custody of the sampling crew during the sampling event. At the end of each sampling day and prior to the transfer of the samples off site, entries shall be completed on the COC form for all samples. Upon transfer of custody, the COC form is signed by a sampling crew member including the date and time. If outside vendor laboratories are utilized, samples shall be delivered to these facilities by Duke Energy personnel or courier.

All COC forms received by the laboratory(s) shall be signed and dated by the respective supervising scientist(s) or their designee (at the Duke Energy lab) or the laboratory sample custodian (at vendor labs) immediately following receipt by the laboratory.

The analysts at the laboratory(s) maintain a sample tracking record that will follow each sample through all stages of laboratory processing. The sample tracking records show the date of sample extraction or preparation and analysis. These records are used to determine compliance with holding time limits during lab audits and data validation.

Custody procedures followed by Duke Energy laboratory personnel are described in detail in the Duke Energy Laboratory Services Procedures Manual.

Section 6 - Analytical Methods

The main analytical laboratory used in this program is the Duke Energy Laboratory Services Laboratory: N.C. Drinking Water (NC37804) and Wastewater (#248) Certifications. The organizational structure and staff qualifications of the laboratory are discussed in its generic Quality Assurance Program (QAP). The QAP and the Analytical Laboratory Procedures Manual are available for review upon request.

Vendor laboratories that meet EPA and North Carolina certification requirements may be used for analyses with approval by Duke Energy.

The analytical methods used for the samples analyzed for this Groundwater Monitoring Program are listed in Table 2. Specific conductance, field pH, and temperature are measured in the field according to the Duke Energy Groundwater Monitoring and Sample Collection Procedure or the instrument manufacturer instructions.

Section 7 - Internal Quality Control Checks

Internal laboratory quality control (QC) checks used by the laboratories are described in each laboratory's generic QAP and procedures manual. Using the internal laboratory QC checks, the laboratories demonstrate the ability to produce acceptable results using the methods specified.

Internal quality control checks for sampling procedures and laboratory analyses will be conducted with each sampling event. These checks will consist of the preparation and submittal of field blanks, trip (travel) blanks, equipment blanks and/or field replicates for analysis of all parameters at frequencies described in the laboratory(s) procedures manuals.

The field QC blanks and replicates that may be included as internal QC checks are described below. The specific type and number of blanks used may vary depending on the sampling event and will be determined by the Duke Energy field sampling personnel:

- **Field Blanks**: A field blank consists of a sample container filled in the field with organic-free, deionized, or distilled water prepared and preserved in the same manner as the samples. The field blank is transported to the laboratory with the samples and analyzed along with the field samples for the constituents of interest to check for contamination imparted to the samples by the sample container, preservative, or other exogenous sources. Field blanks are typically utilized for each sampling event. The field blanks are typically analyzed for major anions, cations, and metals.
- **Trip Blanks**: A trip (travel) blank is a sample container filled with organic-free water in the laboratory that travels unopened with the sample bottles. Trip blanks are typically utilized when sampling for volatile organic compounds. The trip blank is returned to the laboratory with the field samples and analyzed along with the field samples for parameters of interest.
- **Equipment Blanks**: If non-dedicated equipment is used between wells, it is recommended that equipment blanks be collected. The field equipment is cleaned following documented cleaning protocols. An aliquot of the final control rinse water is passed over the cleaned equipment directly into a sample container and submitted for analyses.
- **Field Replicates**: A field replicate is a duplicate sample prepared at the sampling locations from equal portions of all sample aliquots combined to make the sample. Both the field replicate and the sample are collected at the same time, in the same container type, preserved in the same way, and analyzed by the same laboratory as a measure of sampling and analytical precision.

Section 8 - Validation of Field Data Package

The field data package includes all of the field records and measurements developed by the sampling team personnel. The field data package validation will be performed by Duke Energy personnel. The procedure for validation consists of the following:

- A review of field data contained on the Groundwater Monitoring Data Sheets for completeness.
- Verification that field replicates, equipment blanks, field blanks, and trip blanks were properly prepared, identified, and analyzed.
- A check of the Field Sampling Calibration Form for equipment calibration and instrument conditions.
- A review of the COC Record for proper completion, signatures of field personnel and the laboratory sample custodian, dates and times, and for verification that the correct analyses were specified.

Section 9 - Validation of Laboratory Data

The laboratory will perform a validation review of the submitted samples and analytical results to ensure that the laboratory QA/QC requirements are acceptable.

Section 10 - Report Submittal

A report of the monitoring results for all monitoring wells except AB-9S, AB-9D, AB-10S, and AB-10D will be submitted to the NCDENR DWR within 60 days of the date of sampling. The monitoring results will be submitted on NCDENR Form GW-59CCR.

The DWQ will be notified in the event that vendor lab analyses have not been completed within this time frame. All Groundwater Monitoring Data Sheets, Field Calibration Forms, COC Records, Laboratory QA data, and Data Validation Checklists shall be kept on file by Duke Energy and are available upon request.

A report of monitoring results and the predictive calculations at the compliance boundary for monitoring wells AB-9S, AB-9D, AB-10S and AB-10D will be submitted to the DWR within 120 days following the date of the October sampling event.

Section 11 - References

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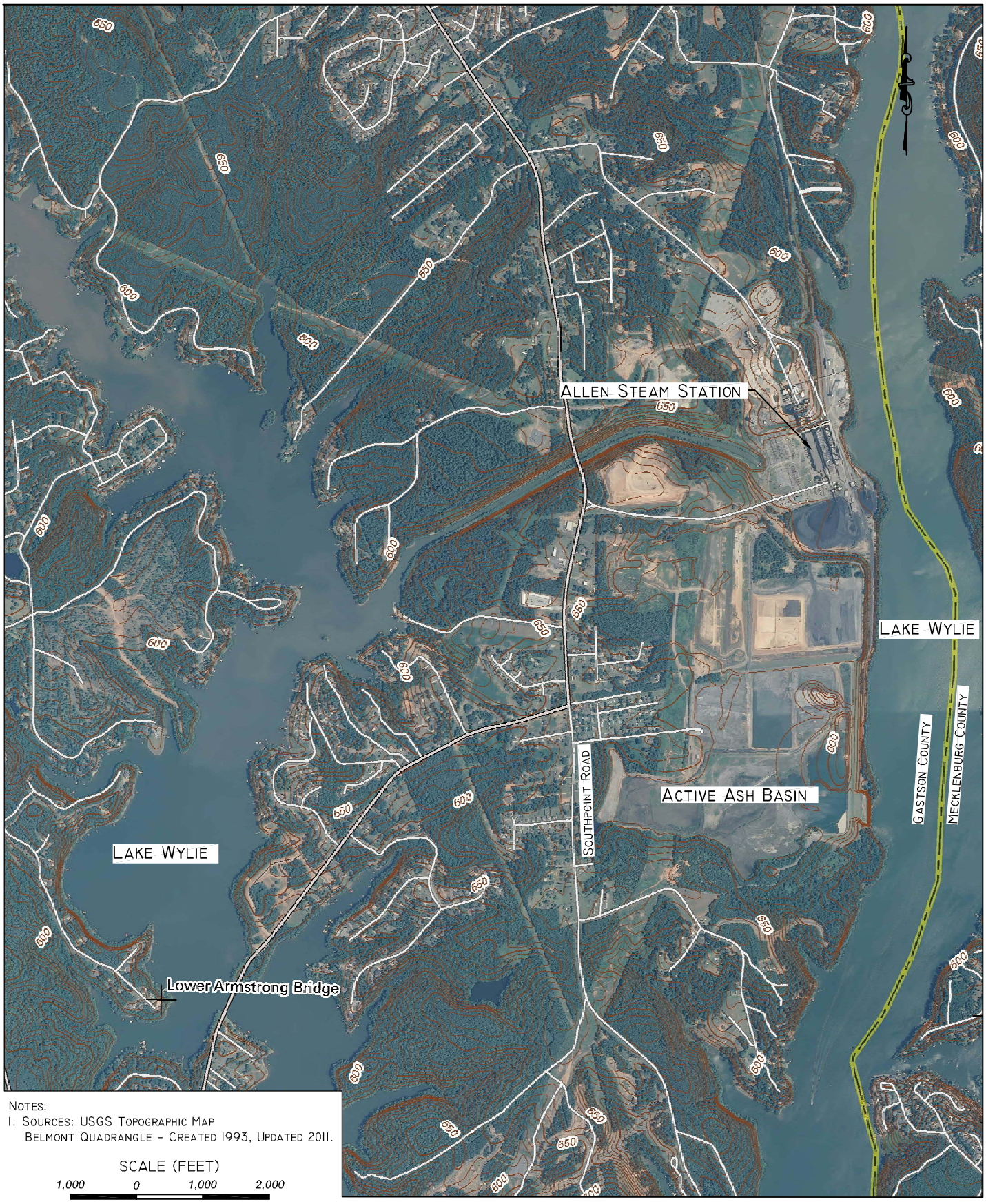
Figures



NOTES:
1. SOURCES: USGS TOPOGRAPHIC MAP
BELMONT QUADRANGLE - CREATED 1993, UPDATED 2011.

SCALE (FEET)
1,000 0 1,000 2,000

License Number: F-0116
440 South Church Street Charlotte, NC 28202

SITE LOCATION MAP
DUKE ENERGY CAROLINAS, LLC
ALLEN STEAM STATION ASH BASIN
NPDES PERMIT #NC0004979
GASTON COUNTY, NORTH CAROLINA

DATE
OCT. 10, 2014

FIGURE
1

NOTES:
1. PARCEL DATA FOR THE SITE WAS OBTAINED FROM DUKE ENERGY REAL ESTATE AND IS APPROXIMATE.
2. ASH BASIN WASTE BOUNDARY AND ASH STORAGE AREA BOUNDARIES ARE APPROXIMATE.
3. AS-BUILT MONITORING WELL LOCATIONS PROVIDED BY DUKE ENERGY.
4. SHALLOW MONITORING WELLS (S) - WELL SCREEN INSTALLED ACROSS THE SURFICIAL WATER TABLE.
5. DEEP MONITORING WELLS (D) - WELL SCREEN INSTALLED IN THE TRANSITION ZONE BETWEEN COMPETENT BEDROCK AND THE REGOLITH.
6. TOPOGRAPHY DATA FOR THE SITE WAS OBTAINED FROM NC DOT GEOGRAPHIC INFORMATION SYSTEM (GIS) WEB SITE.
7. ORTHOPHOTOGRAPHY WAS OBTAINED FROM NC ONEMAP GIS WEB SITE (DATED 2010).
8. THE ASH BASIN COMPLIANCE BOUNDARY IS ESTABLISHED ACCORDING TO THE DEFINITION FOUND IN 15A NCAC 02L .0107 (a).

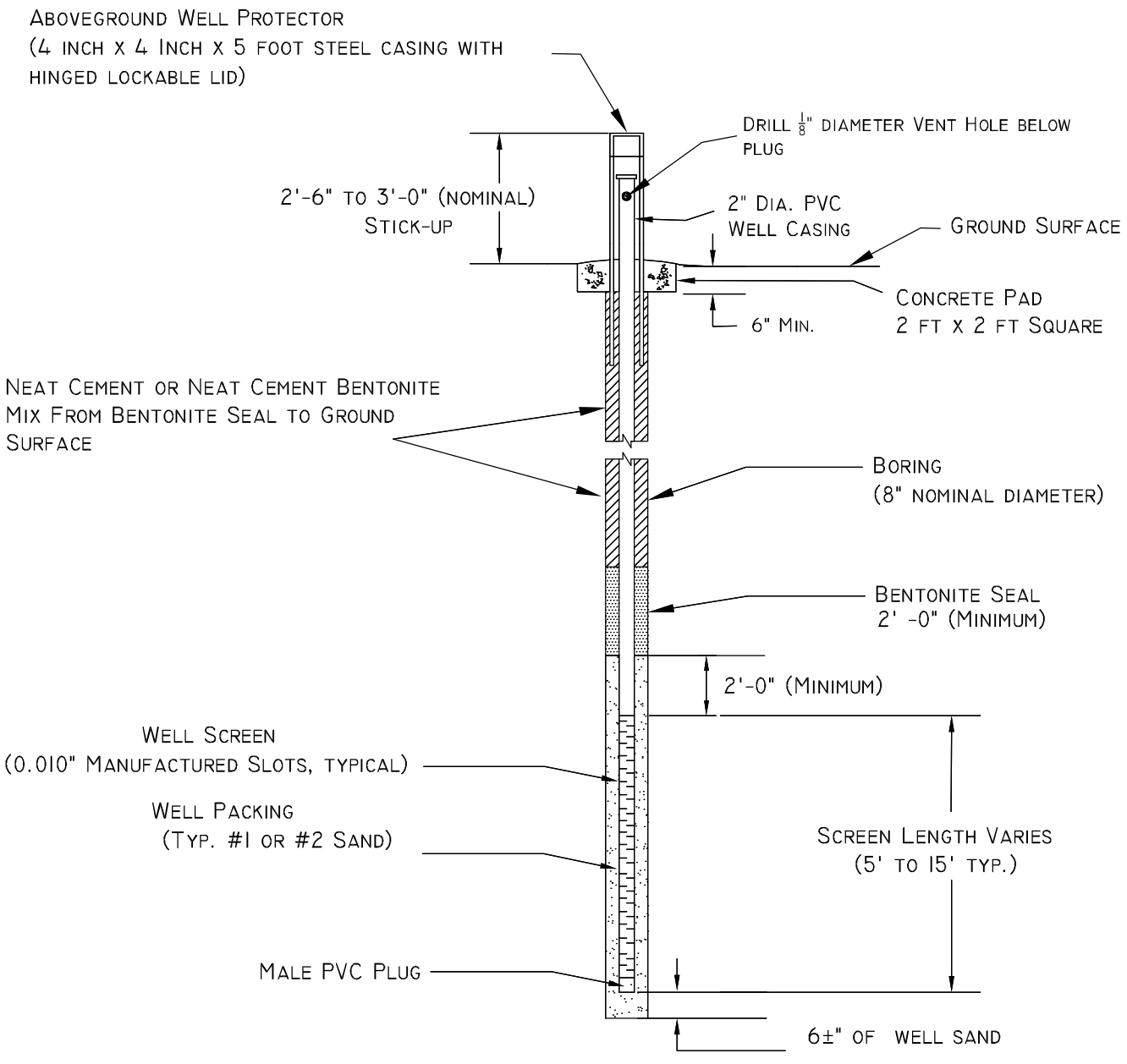
SCALE (FEET)
500′ 0 500′ 1000′
1" = 1000′

License Number: F-0116
440 South Church Street Charlotte, NC 28202

SITE LAYOUT MAP
DUKE ENERGY CAROLINAS, LLC
ALLEN STEAM STATION
NPDES PERMIT #NC0004979
GASTON COUNTY, NORTH CAROLINA

DATE
OCT. 10, 2014

FIGURE
2



Typical Well Construction Details
(no scale)

INFORMATION PROVIDED BY DUKE ENERGY CAROLINAS, LLC

License Number: F-0116
440 South Church Street Charlotte, NC 28202

TYPICAL MONITORING WELL CONSTRUCTION DETAILS

DATE
OCT. 10, 2014

FIGURE
3

DUKE ENERGY

GROUNDWATER MONITORING DATA SHEET FOR CONVENTIONAL SAMPLING

PROCEDURE NO	3175.1

SITE NAME	Allen Steam Station	PERMIT #	NC0004979	SITE ID	N/A
PROJECT NAME	Ash Basin Groundwater Monitoring	FIELD CREW			
SAMPLING DATE(s)	☐ ☐ ☐ ☐	WELL/LOCATION NAME			

MONITORING WELL INFORMATION

WELL DIAMETER (in)		TOC ELEV (ft msl)		MIDDLE OF WETTED SCREEN (ft toc)			
WELL DEPTH (ft TOC)		GS ELEV (ft msl)		PUMP INTAKE DEPTH (ft TOC)			
SCREEN LENGTH (ft)		ELEV REF		SCREEN INTERVAL (ft TOC)		TO	

EQUIPMENT INFORMATION

LEVEL METER SERIAL#		SAMPLING EQUIPMENT			PURGE METHOD		
		TUBING DIAMETER (in)					
PUMP CONTROLLER SETTINGS							
PRESSURE	(psi)	RECHARGE	(sec)	DISCHARGE	(sec)		

SAMPLING INFORMATION

INITIAL DEPTH TO WATER (ft TOC)		WATER COLUMN (ft)		*Well Volume = water column X conversion factor*
WATER ELEVATION (ft msl)		WELL VOLUME (gal)		(Conversion factor dependent on well diameter and selected well volume units)
DETECTED ODOR	None	CONVERSION FACTOR	0.1631	
APPEARANCE	Normal			

PURGE VOLUME (gal)	WATER LEVEL AFTER PURGE * (ft)	COMPLETE EVACUATION (YES/NO)	☑ TEMP (deg C)	☑ SPECIFIC COND. (umho/cm)	☑ pH (SU)	☑ TURBIDITY (NTU)	☐ ORP (mV -NEH)	☐ DISSOLVED OXYGEN (mg/L)	☐ (gal) WELL VOL (recalculates on current water level)

TOTAL PURGE VOLUME	* Optional measurement to recalculate well volume when purging results in substantial drawdown of water column	SAMPLE COLLECTED BY	DATE	TIME	CHLORINE (mg/l)
0.00			@		NA

QC By:	

WELL CONDITION

PROTECTIVE CASING		
WELL PAD		
WELL CASING		
WELL TAG		

ADDITIONAL WELL CONDITION NOTES

SAMPLING NOTES

FIGURE 4: EXAMPLE GROUNDWATER MONITORING DATA SHEET

FIELD SAMPLING CALIBRATION FORM

STUDY: Allen Steam Station Ash Basin Groundwater Monitoring

DATE (s): | **SURFACE UNIT READER:**

COLLECTORS: | **SURFACE UNIT SERIAL #:**

ANALYZER MODEL#: | **ANALYZER SERIAL #:**

OTHER EQUIPMENT: | **WEATHER CONDITIONS:**

PROCEDURE #: HYDROLAB 3210.3 **VALIDATED BY:**

Calibration Date / Time		DATE:		TIME:		DATE:		TIME:	
		BP (mmHg)				BP (mmHg)			
Parameter	**Calibation Standard**	**Instrument Value**		**Standard Value**	**Calibration Results**	**Instrument Value**		**Standard Value**	**Calibration Results**
SPEC. COND. (uS/cm)	SS	0.0	—/—►	0.0	Instrument Zeroed	0.0	—/—►	0.0	Zero Pass
	SS		—►	350			—/—►	350	
	SS		—/—►	150			—/—►	150	
pH (units)	B (7.00)		—►	7.00			—/—►		
	B (4.00)		—►	4.00			—/—►		
	B (10.00)		—/—►	10.00			—/—►		
		Buffer Temp.		25.00		Buffer Temp.			
Mid-Day Ck	B (7.00)		—►						
Time:		Buffer Temp.							
☑ ORP (mV)	SS (7.00)		—►	285			—/—►	285	
	SS (4.00)	N/A	—/—►	462		N/A	—/—►	462	
		ORP Temp.		25.00		ORP Temp.		25.00	
☐ DO (mg/L)	W								
	W								
	AW		—►				—/—►		
☐ TURB (ntu)	SS		—/—►				—/—►		
Temp Cert Device #									
TEMP (deg C)	NIST	N/A	—/—►	N/A	Adjustment Not Available	N/A	—/—►	N/A	Adjustment Not Available
AMMONIUM (mg/L)	SS	N/A	—/—►	N/A		N/A	—/—►	N/A	
	SS	N/A	—/—►	N/A		N/A	—/—►	N/A	

INSTRUMENT MAINTENANCE	DATE / TIME

Conductance Subsystem
- ☐ Cleaned Electrodes
- ☐ Tested - OK
- ☐ See Notes

pH Subsystem
- ☐ Cleaned Electrodes
- ☐ Replaced ref Electrode KCL
- ☐ Replaced Ref. Electrode Tip
- ☐ Tested - OK ☐ See Notes

Dissolved Oxygen Subsystem
- ☐ Replaced Teflon Membrane
- ☐ Replaced DO electrolyte
- ☐ Cleaned Electrode
- ☐ See Notes

Ammonium Subsystem
- ☐ Cleaned Electrode Tip
- ☐ Installed New Electrode
- ☐ Removed Electrode / Installed Plug
- ☐ Tested - OK ☐ See Notes

Oxidation Reduction Subsystem
- ☐ Cleaned Electrode
- ☐ Tested - OK ☐ See Notes

Turbidity Subsystem
- ☐ Cleaned Electrode & Wiper
- ☐ Tested - OK ☐ See Notes

Temperature Subsystem
- ☐ Cleaned Electrode
- ☐ Tested - OK ☐ See Notes

Depth Subsystem
- ☐ Reset / Calibrated
- ☐ Tested - OK ☐ See Notes

KEY: B = Buffer; SS = Standard solution; W = Winkler; AW = Average Winkler; —► = Adjusted To; —/—► = Not Adjusted To; N/A = Not Applicable

NOTES:

FIGURE 5: EXAMPLE FIELD SAMPLING CALIBRATION FORM

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST FORM

Duke Energy SM

For Detailed Instructions, see:
http://dewww/essenv/coc/

Duke Energy Analytical Lab Services
Mail Code MGO3A2 (Building 7405)
13339 Hagers Ferry Rd
Huntersville, N. C. 28078
(704) 875-5245
Fax: (704) 875-5038

Analytical Laboratory Use Only

LIMS #

Samples Originating From NC √ SC

Logged By | Date & Time

SAMPLE PROGRAM
Groundwater √
NPDES
Drinking Water
UST
RCRA Waste

Vendor | Cooler Temp (C)

PO #

[15]Preserv.: 1=HCL 2=H_2SO_4 3=HNO_3 4=Ice 5=None

MR #

[19]Page 1 of 1
DISTRIBUTION
ORIGINAL to LAB,
COPY to CLIENT

Customer must Complete

1)Project Name		2)Phone No:
3)Client		4)Fax No:
5)Business Unit: 20036	6)Process:	7)Resp. To:
8)Project ID:	9)Activity ID:	10)Mail Code:

Customer to complete all appropriate NON-SHADED areas.

[16]Analyses Required

LAB USE ONLY [11]Lab ID	[12]Chem Desktop No.	[13]Sample Description or ID	[14]Collection Information Date	Time	Signature	[17]Comp.	[18]Grab											[20]Total # of Containers
																		6

Customer to complete appropriate columns to right

Customer to sign & date below

21)Relinquished By	Date/Time	Accepted By	Date/Time
Relinquished By	Date/Time	Accepted By	Date/Time
Relinquished By	Date/Time	Accepted By	Date/Time
23)Seal/Locked By	Date/Time	Sealed/Lock Opened By	Date/Time
24)Comments			

Customer, important please indicate desired turnaround

[22]Requested Turnaround

14 Days √

*7 Days

* 48 Hr

*Other
* Add. Cost Will Apply

FIGURE 6 - CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST FORM

NORTH CAROLINA GROUNDWATER SAMPLING SITE CHECKLIST

LOCATION / SITE Allen Steam Station / Ash Basin Groundwater Monitoring PERMIT # NC0004979 **SAMPLE DATE**
SITE CONTACT **FIELD CREW**
WEATHER
PAGE 1 OF 1

		AB-1R	AB-4S	AB-4D	AB-9S	AB-9D	AB-10S	AB-10D	AB-11D	AB-12S	AB-12D	AB-13S	AB-13D	AB-14D		
ACCESS TO WELLS																
Access cleared into well																
Access cleared around well																
Tall grass or weeds - needs mowing																
Road washing out / muddy / needs grading																
Fallen tree blocking access																
WELL SECURITY																
Well found locked																
Well found unlocked																
WELL LOCK CONDITION																
Lock in good condition																
Lock rusted, difficult to open / needs replacing																
Replaced damaged lock																
WELL CASINGS																
Casing in good condition																
Damaged casing / still functional																
Damaged casing / repair required																
CONCRETE PADS																
Pad in good condition																
Minor cracks																
Major cracks / broken / repair required																
Undermined / washing out																
Fire ants around concrete pad																
WELL PROTECTIVE CASINGS																
Casing in good condition																
Damaged casing / still functional																
Damaged casing / repair required																
Broken hinge on protective lid																
Wasp nest inside protective casing																
Ants inside protective casing																
WELL CAPS																
Well cap in good conditon																
Damaged / needs replacement																
Replaced damaged well cap																
FLUSH MOUNT WELLS																
Vault in good condition																
Water inside vault																
Vault bolt holes broken or stripped																
Bolts stripped																
Vault lid cracked or broken																
WELL ID TAGS																
Well tag in good condition																
Well tag missing																
Well tag damaged / illegible																
Lacks required information - Driller Reg #																
Lacks required information - Completion date																
Lacks required information - Total well depth																
Lacks required information - Depth to screen																
Lacks required information - Non potable tag																

NOTE:

FIGURE 7: GROUNDWATER SAMPLING SITE CHECKLIST

Tables

Table 1
Monitoring Well Information
Allen Steam Station Ash Basin

	AB-1R	AB-4S	AB-4D	AB-9S	AB-9D	AB-10S	AB-10D	AB-11D	AB-12S	AB-12D	AB-13S	AB-13D	AB-14D
North (ft)	529,135.87	525,731.58	525,728.26	527,138.02	527,134.58	524,935.45	524,935.07	523,285.10	524,228.86	524,231.41	526,178.49	526,169.12	527,206.47
East (ft)	1,396,853.87	1,396,723.77	1,396,717.97	1,400,630.95	1,400,631.50	1,400,636.10	1,400,639.77	1,399,059.61	1,396,538.86	1,396,539.93	1,397,490.13	1,397,488.65	1,396,716.58
Top of PVC Casing Elevation (ft)	675.86	650.46	649.17	582.73	582.72	575.05	574.97	618.07	651.69	651.75	648.72	648.54	641.8
Well Diameter	2”	2”	2”	2”	2”	2”	2”	2”	2”	2”	2”	2”	2"
Well Stick-up (ft)	2.29	2.52	2.19	2.19	2.35	2.44	2.56	2.68	2.05	2.04	2.74	2.65	2.44
Type of Casing	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC
Total Depth below TOC (ft)	73.18	24.90	52.18	23.20	117.58	20.85	65.00	23.21	25.63	98.57	24.71	74.85	31.89
Screen Length (ft)	10	15	5	15	5	15	5	5	15	5	15	5	10
Screen Interval (ft below TOC)	63.18 - 73.18	9.9 - 24.9	47.18 - 52.18	8.20 - 23.20	112.58 - 117.58	5.85 - 20.85	60.00 - 65.00	18.21 - 23.21	10.63 - 25.63	93.57 - 98.57	9.71 - 24.71	69.85 - 74.85	21.89 - 31.89

Notes:

1. ft indicates feet.
2. TOC indicates top of casing.
3. As-built well coordinates (NAD 83) and top of PVC casing elevations (NAVD 88) provided by Duke Energy.
4. Well diameter, type of casing, and screen lengths were obtained from Well Construction Records provided by Duke Energy.
5. Well total depth below TOC and well stick-up measurements provided by Duke Energy.

Table 2
Sample Parameters and Analytical Methods
Allen Steam Station Ash Basin

PARAMETER	UNITS	ANALYTICAL METHOD
In Situ Parameters		
Field pH	pH Units	Hydrolab
Conductivity	µmhos/cm	Hydrolab
Temperature	°C	Hydrolab
Water Level	ft	Water Level Meter
Laboratory Analyses		
Antimony	µg/L	TRM / EPA 200.8
Arsenic	µg/L	TRM / EPA 200.8
Barium	mg/L	TRM / EPA 200.7
Boron	mg/L	TRM / EPA 200.7
Cadmium	µg/L	TRM / EPA 200.8
Chloride	mg/L	EPA 300.0
Chromium	mg/L	TRM / EPA 200.7
Copper	mg/L	TRM / EPA 200.7
Iron	mg/L	TRM / EPA 200.7
Lead	µg/L	TRM / EPA 200.8
Manganese	mg/L	TRM / EPA 200.7
Mercury	µg/L	EPA 245.1
Nickel	mg/L	TRM / EPA 200.7
Nitrate (as Nitrogen)	mg/L	EPA 300.0
Selenium	µg/L	TRM / EPA 200.8
Sulfate	mg/L	EPA 300.0
Thallium	µg/L	TRM / EPA 200.8
Total Dissolved Solids	µg/L	SM 2450C
Zinc	mg/L	TRM / EPA 200.7

Notes:

1. µmhos/cm indicates micro-mhos per centimeter.
2. ft indicates feet.
3. µg/L indicates micrograms per liter.
4. TRM indicates total recoverable metals.
5. EPA indicates Environmental Protection Agency.
6. SM indicates Standard Method.

Table 3
Sample Containers, Preservatives, and Holding Times
Allen Steam Station Ash Basin

PARAMETER	CONTAINERS	PRESERVATIVES	HOLDING TIMES
In Situ Parameters			
Field pH	In Situ	None	Analyze Immediately
Conductivity	In Situ	None	Analyze Immediately
Temperature	In Situ	None	Analyze Immediately
Laboratory Analyses			
Antimony	500 ml HDPE	pH<2 HNO_3	6 months
Arsenic	500 ml HDPE	pH<2 HNO_3	6 months
Barium	500 ml HDPE	pH<2 HNO_3	6 months
Boron	500 ml HDPE	pH<2 HNO_3	6 months
Cadmium	500 ml HDPE	pH<2 HNO_3	6 months
Chloride	500 ml HDPE	Cool 4^{o} C	28 days
Chromium	500 ml HDPE	pH<2 HNO_3	6 months
Copper	500 ml HDPE	pH<2 HNO_3	6 months
Iron	500 ml HDPE	pH<2 HNO_3	6 months
Lead	500 ml HDPE	pH<2 HNO_3	6 months
Manganese	500 ml HDPE	pH<2 HNO_3	6 months
Mercury	500 ml HDPE	pH<2 HNO_3	6 months
Nickel	500 ml HDPE	pH<2 HNO_3	6 months
Nitrate (as Nitrogen)	500 ml HDPE	Cool 4^{o} C	48 hours
Selenium	500 ml HDPE	pH<2 HNO_3	6 months
Sulfate	500 ml HDPE	Cool 4^{o} C	28 days
Thallium	500 ml HDPE	pH<2 HNO_3	6 months
Total Dissolved Solids	500 ml HDPE	Cool 4^{o} C	7 days
Zinc	500 ml HDPE	pH<2 HNO_3	6 months

Notes:

1. ml indicates milliliter.
2. HNO_3 indicates nitric acid.
3. HDPE indicates high density polyethylene.

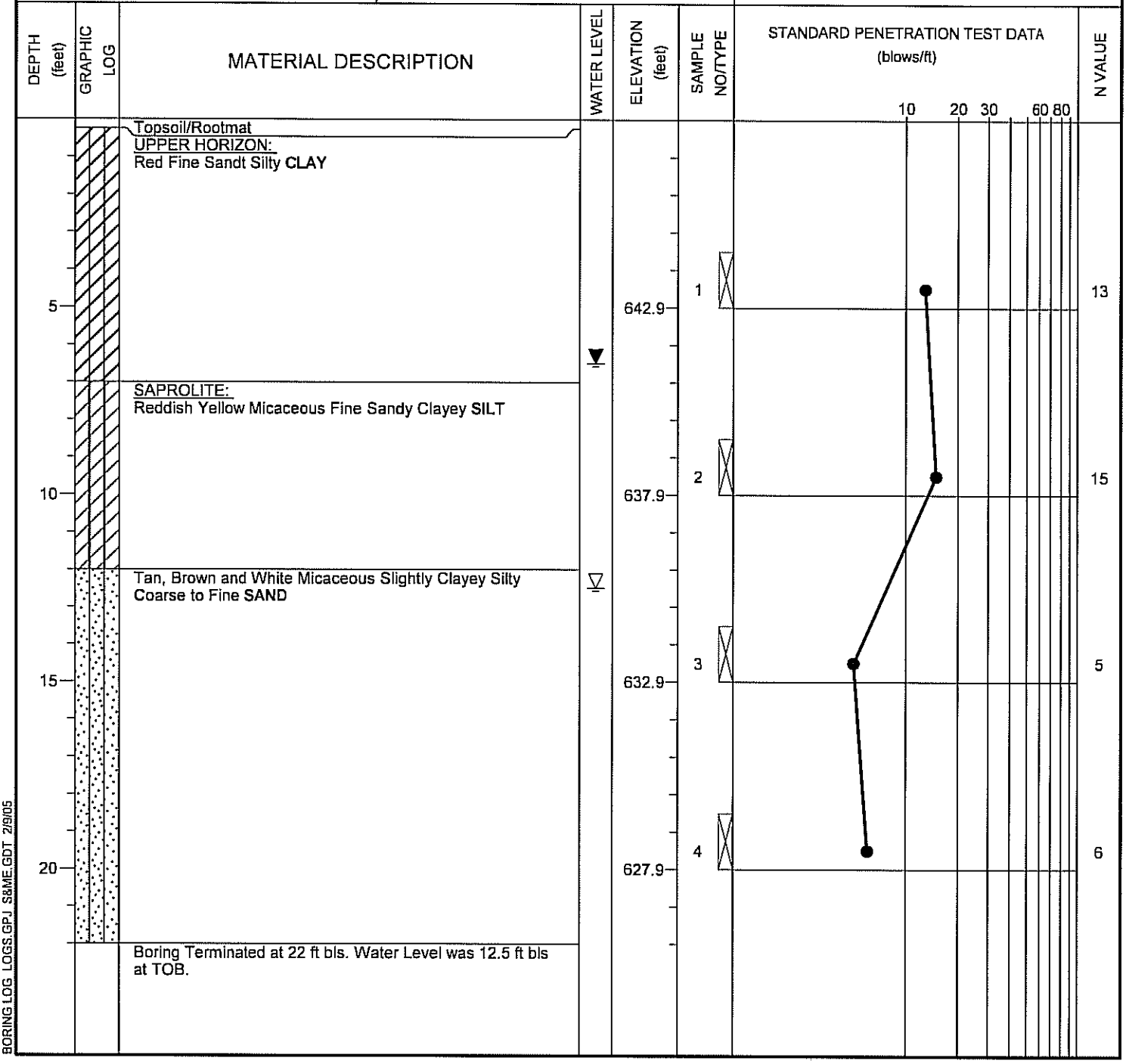
A

Appendix A – Boring Logs and Monitoring Well Construction Records

Allen Steam Station

Boring Logs and Well Construction Records

PROJECT:	Allen Steam Station Ash Basin Wells Belmont, North Carolina 1264-04-528	BORING LOG AB-4
DATE DRILLED: 10/1/04	ELEVATION: 647.9	NOTES:
DRILLING METHOD: 4¼" H.S.A.	BORING DEPTH: 22.0	
LOGGED BY: Julie Petersen	WATER LEVEL: 6.5 ft bls at 24 hrs	
DRILLER: Travis Costello	DRILL RIG: Diedrich D-50	



BORING LOG_LOGS.GPJ S&ME.GDT 2/9/05

1. *BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.*
2. *PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.*

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES
9751 Southern Pine Blvd.
Charlotte, NC 28273

PROJECT:	Allen Steam Station Ash Basin Wells Belmont, North Carolina 1264-04-528	BORING LOG AB-4D
DATE DRILLED: 10/5/04	ELEVATION: 646.9	NOTES:
DRILLING METHOD: Casing Advancer	BORING DEPTH: 50.0	
LOGGED BY: Julie Petersen	WATER LEVEL:	
DRILLER: Travis Costello	DRILL RIG: Diedrich D-50	

DEPTH (feet)	MATERIAL DESCRIPTION	ELEVATION (feet)	SAMPLE NO/TYPE	STANDARD PENETRATION TEST DATA (blows/ft)	N VALUE
0	Topsoil/Rootmat				
	UPPER HORIZON: Red Fine Sandy Silty CLAY	641.9	1		13
5					
	SAPROLITE: Reddish Yellow Micaceous Fine Sandy Clayey SILT	636.9	2		15
10					
	Tan, Brown and White Micaceous Slightly Clayey Silty Coarse to Fine SAND	631.9	3		5
15					
		626.9	4		6
20					
		621.9	5		10
25					
	Tannish Brown Slightly Clayey Silty Medium to Fine SAND	616.9	6		15
30					
	Tan, Brown and White Micaceous Slightly Clayey Silty Coarse to Fine SAND	611.9	7		12
35					
	PARTIALLY WEATHERED ROCK: When Sampled Becomes Grayish White Silty Coarse to Medium SAND with Rock Fragments	606.9	8		50/4
40	AUGER REFUSAL AT 40 FT BLS Quartz Diorite Core Run Information Provided on Attached Core Details Log.	601.9			
45					
50	Boring Terminated at 50 ft bls.	596.9			

STANDARD PENETRATION TEST DATA (blows/ft): 10, 20, 30, 60, 80

BORING LOG LOGS.GPJ S&ME.GDT 2/9/05

1. *BORING AND SAMPLING IS IN ACCORDANCE WITH ASTM D-1586.*
2. *PENETRATION (N-VALUE) IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.*

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES
9751 Southern Pine Blvd.
Charlotte, NC 28273

COMPLETION REPORT OF WELL No. AB-4

PROJECT: **Allen Steam Station Ash Basin Wells**
PROJECT NO: **1264-04-528**
PROJECT LOCATION: **Belmont, North Carolina**

WATER LEVEL: **6.5 ft bls at 24 hrs**

LATITUDE:
LONGITUDE:

DRILLING CONTRACTOR: **S&ME, Inc.**
DRILLING METHOD: **4¼" H.S.A.**
DATE DRILLED: **10/1/04**

TOP OF CASING ELEVATION: **651.02**
DATUM: **MSL**
LOGGED BY: **Julie Petersen**

STRATA DESCRIPTION	SYMBOL	DEPTH (ft.)	WELL DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)
		0		0.00	GS	647.90
Topsoil/Rootmat UPPER HORIZON: Red Fine Sandt Silty **CLAY**				3.00	CG	644.90
		5		5.00	BS	642.90
SAPROLITE: Reddish Yellow Micaceous Fine Sandy Clayey **SILT**		10				
Tan, Brown and White Micaceous Slightly Clayey Silty Coarse to Fine **SAND**		15				
		20		22.00	FP	625.90

WELL CONSTRUCTION DETAILS

PROTECTIVE CASING
Diameter: **4-inch**
Type: **Lockable Steel Stickup**
Interval:

RISER CASING
Diameter: **2-inch**
Type: **Sch. 40 PVC**
Interval: **0 to 7 ft bls**

GROUT
Type: **Neat Cement**
Interval: **0 to 3 ft bls**

SEAL
Type: **Bentonite**
Interval: **3 to 5 ft bls**

FILTERPACK
Type: **#1 Filter Sand**
Interval: **5 to 22 ft bls**

SCREEN
Diameter: **2-inch**
Type: **0.010 Slot Sch. 40 PVC**
Interval: **7 to 22 ft bls**

LEGEND

- FILTER PACK
- BENTONITE
- CEMENT GROUT
- CUTTINGS / BACKFILL
- STATIC WATER LEVEL

TOC	TOP OF CASING
GS	GROUND SURFACE
BS	BENTONITE SEAL
FP	FILTER PACK
TSC	TOP OF SCREEN
BSC	BOTTOM OF SCREEN
TD	TOTAL DEPTH
CG	CEMENT GROUT

MONITORING WELL LOGS.GPJ S&ME.GDT 2/9/05

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES
9751 Southern Pine Blvd.
Charlotte, NC 28273

COMPLETION REPORT OF
WELL No. AB-4

COMPLETION REPORT OF WELL No. AB-4D

PROJECT: **Allen Steam Station Ash Basin Wells**
PROJECT NO: **1264-04-528**
PROJECT LOCATION: **Belmont, North Carolina**

WATER LEVEL:

LATITUDE:
LONGITUDE:

DRILLING CONTRACTOR: **S&ME, Inc.**
DRILLING METHOD: **Casing Advancer**
DATE DRILLED: **10/5/04**

TOP OF CASING ELEVATION: **649.69**
DATUM: **MSL**
LOGGED BY: **Julie Petersen**

STRATA DESCRIPTION	SYMBOL	DEPTH (ft.)	WELL DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)
		0		0.00	GS	646.90
Topsoil/Rootmat UPPER HORIZON: Red Fine Sandy Silty **CLAY**		5				
SAPROLITE: Reddish Yellow Micaceous Fine Sandy Clayey SILT		10				
Tan, Brown and White Micaceous Slightly Clayey Silty Coarse to Fine **SAND**		15 20 25				
Tannish Brown Slightly Clayey Silty Medium to Fine **SAND**		30				
Tan, Brown and White Micaceous Slightly Clayey Silty Coarse to Fine **SAND**		35				
PARTIALLY WEATHERED ROCK: When Sampled Becomes Grayish White Silty Coarse to Medium SAND with Rock Fragments **AUGER REFUSAL AT 40 FT BLS** **Quartz Diorite** Core Run Information Provided on Attached Core Details Log.		40 45 50		41.00 43.00 50.00	CG BS FP	605.90 603.90 596.90

WELL CONSTRUCTION DETAILS

PROTECTIVE CASING
Diameter: **4-inch**
Type: **Lockable Steel Stickup**
Interval:

RISER CASING
Diameter: **2-inch**
Type: **Sch. 40 PVC**
Interval: **0 to 45 ft bls**

GROUT
Type: **Neat Cement**
Interval: **0 to 41 ft bls**

SEAL
Type: **Bentonite**
Interval: **41 to 43 ft bls**

FILTERPACK
Type: **#1 Filter Sand**
Interval: **43 to 50 ft bls**

SCREEN
Diameter: **2-inch**
Type: **0.010 Slot Sch. 40 PVC**
Interval: **45 to 50 ft bls**

LEGEND

- FILTER PACK
- BENTONITE
- CEMENT GROUT
- CUTTINGS / BACKFILL
- STATIC WATER LEVEL

TOC	TOP OF CASING
GS	GROUND SURFACE
BS	BENTONITE SEAL
FP	FILTER PACK
TSC	TOP OF SCREEN
BSC	BOTTOM OF SCREEN
TD	TOTAL DEPTH
CG	CEMENT GROUT

MONITORING WELL LOGS.GPJ S&ME.GDT 2/9/05

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Charlotte, NC 28273

COMPLETION REPORT OF
WELL No. AB-4D

MACTEC

engineering and constructing a better tomorrow

January 7, 2011

Mr. Kelley B. Allison, Project Manager
Duke Energy Corporation
573 Duke Power Road
Mooresboro, North Carolina 28114

Subject: **Ash Basin Monitoring Well Installation Report**
Allen Steam Station
253 Plant Allen Road
Belmont, Gaston County, North Carolina
MACTEC Project No.: 6288-10-5284

Dear Mr. Allison:

MACTEC is pleased to provide this report on behalf of our client, AE Drilling, LLC. The purpose of this report is to present the results of monitoring well installation and evaluation activities conducted in November and December 2010 at the above-referenced site (Figure 1). The well installation and testing was conducted in general accordance with the requirements outlined in the Ash Basin Groundwater Monitoring Well Installation Project Work Summary (Work Summary) provided by Duke Energy (Duke) and dated October 18, 2010. The following Figure, Tables and Appendices have been included:

Figure 1:	Monitoring Well Locations
Table 1:	Summary of Well Construction Details
Table 2:	Summary of Slug Test Results
Appendix A:	Rock Core Photographs
Appendix B:	Soil and Rock Boring Logs
Appendix C:	NCDENR Monitoring Well Construction Records
Appendix D:	Monitoring Well Development Records
Appendix E:	Photographs of Completed Well Pairs
Appendix F:	Slug Test Data

Four Type II groundwater monitoring well pairs and two Type II single groundwater monitoring wells (a total of 10 wells) were installed between November 15, 2010 and December 2, 2010 at the locations shown on Figure 1. The well locations were pre-determined by Duke and marked in the field with wooden stakes and survey flagging. Each well pair consisted of one shallow well (using the identifier "S") set into overburden soils and one deep well (using the identifier "D) set into

MACTEC Engineering and Consulting, Inc.
2801 Yorkmont Road, Suite 100 • Charlotte, NC 28208 • Phone: 704.357.8600 • Fax: 704.357.8638

bedrock. Please note that shallow wells were not installed at two locations (MW-11 and MW-14) because bedrock was encountered prior to groundwater, indicating a local absence of a surficial aquifer in these locations. In addition, MACTEC replaced one well (AB-1R), at the request of Duke, that had historically produced inadequate water for sampling. Standard Penetration Testing (SPT) and split-spoon sampling was performed at five-foot intervals from the surface to bedrock during installation of the deep well at each well pair. Soils observed in the split-spoon samples were logged in the field in accordance with the Unified Soil Classification System (ASTM D2487/D2488). Upon auger refusal, each deep boring was extended a minimum of 10 feet into competent bedrock using HQ-sized rock core techniques.

Rock core samples were logged in the field in accordance with the Field Guide for Rock Core Logging and Fracture Analysis established by Midwest Geosciences. As specified in the Work Summary, split-spoon sampling and rock coring were not performed during installation of the shallow wells. Photographs of rock cores obtained during installation of the five deep wells are included as Appendix A.

Shallow wells were installed using 4.25-inch ID hollow stem augers; deep wells were installed using 4.25-inch ID hollow stem augers to refusal, then HQ-sized rock core approximately 10 feet into competent bedrock. Total depths for shallow wells ranged from 18 feet below ground surface (bgs) in MW-10S to 23 feet bgs in MW-12S. Total depths for bedrock wells ranged from 20 feet bgs in MW-11D to 115 feet bgs in MW-9D. Shallow wells were constructed with 15 feet of 0.010-slot 2-inch diameter PVC well screen and riser with well screens set so that at least 10 feet of screen is below the static water table at the time of installation. Deep wells were constructed with 5-foot well screens (except well MW-14D, in which a 10-foot screen was installed) set across low-RQD bedrock core intervals to facilitate maximum water flow through each well. Filter sand was placed in the annular space between the augers and the casing from the total depth of the boring to at least one foot above the screen. A bentonite seal was placed on top of the filter pack and the well was grouted to the surface. Please note that shallow well depths were typically adjusted after installation, but prior to placement of bentonite, to account for rise in hydraulic head observed at each location. In these instances, additional filter sand was placed between the bottom of the borehole and the bottom of the well. Each well was completed with a stand-up well cover that extends approximately 30 inches above-grade and set into a 2-foot by 2-foot concrete pad.

Monitoring well ID tags were secured to the outside of the stand-up covers and well numbers were etched into the wet concrete pad. Soil boring logs and well construction records for the ten monitoring wells installed in during this work have been included as Appendix B and C, respectively.

Subsequent to installation, each well was developed using a submersible or bladder pump to remove fine-grained material. In general, each well was purged until the development water appeared visually clear, at which time, water quality parameters (temperature, pH, conductivity and turbidity) were recorded in 5-gallon increments until turbidity readings were less than or equal to 50 NTUs. Purge water generated during well development ranged from 10 gallons to more than 150 gallons and was discharged to the ground surface adjacent to each well. Please note that water quality parameters were not recorded for well MW-11D. However, 10 gallons of water were purged from the well during well development. Monitoring well development records are included as Appendix D. Photographs of the completed monitoring well pairs are included as Appendix E.

Rising head slug tests were performed on each well on December 2 and 3, 2010. Prior to the tests an In-situ Level Troll pressure transducer and 4-foot long stainless steel slug were placed into the well. The water level in the well was recorded as a "Background" test until the well recharged to within 90% of the original measurement. Subsequent to normalization, the rising head test was started, the slug was removed and the change in head versus time was measured using a Rugged-reader data logger. Slug test data was analyzed using Aqtesolv software to estimate hydraulic conductivity in each well. A summary of slug test data is presented in Table 2. Copies of raw data generated during completion of the rising head slug tests are included in Appendix F. Electronic slug test data is included on the attached compact disc.

Please contact the undersigned at (704) 357-8600, if you have questions or comments concerning this project.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

Mark P. Filardi, P.G.
Senior Geologist

Robert C. Foster, L.G.
Principal

NORTH CAROLINA LICENSED SEAL 1335 GEOLOGIST ROBERT C. FOSTER

Enclosures

cc: William M. Miller, PE, PLS, S&ME
Mark Lassiter, PG, AE Drilling, LLC

FIGURE

Source: USDA-FSA-APFO NAIP MrSID Mosaic for Gaston County, North Carolina, dated 2009.

Monitoring Well Location

N

0 300 600 1,200 1,800 2,400 Feet

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MONITORING WELL LOCATIONS
DUKE ENERGY
ALLEN STEAM STATION
GASTON COUNTY, NORTH CAROLINA

PREPARED BY	DATE	CHECKED BY	DATE	JOB NUMBER 6228-10-5284	FIGURE 2

TABLES

Table 1
Summary of Well Construction Details
Allen Steam Station, Belmont, North Carolina

Well Number	Coordinates		Drilling Method	Construction Details				Measured Details
	Latitude	Longitude		Well Diameter (I.D. in.)	Borehole Depth (ft bgs)	Well Depth (ft bgs)	Screen Interval (ft bgs)	Depth to Water (ft below TOC)
AB-9S	-81.00605605	35.18176931	Hollow-stem Auger	2	29.0	20.5	5.5-20.5	12.75
AB-9D	-81.00604749	35.18175083	HSA/Rock Core	2	121.0	115.0	110-115	14.52
AB-10S	-81.00594763	35.17570216	Hollow-stem Auger	2	25.0	18.0	3-18	9.11
AB-10D	-81.00590817	35.17572754	HSA/Rock Core	2	65.0	62.5	57.5-62.5	8.99
AB-11D	-81.01108074	35.17110334	HSA/Rock Core	2	25.5	20.4	15-20	10.26
AB-12S	-81.01957827	35.17367812	Hollow-stem Auger	2	29.0	23.0	8-23	15.63
AB-12D	-81.01955410	35.17352860	HSA/Rock Core	2	104.0	96.0	91-96	14.01
AB-13S	-81.01649472	35.17896038	Hollow-stem Auger	2	28.0	21.0	6-21	13.91
AB-13D	-81.01651614	35.17894216	HSA/Rock Core	2	86.0	72.0	67-72	13.54
AB-14D	-81.01915799	35.18173666	HSA/Rock Core	2	33.5	29.6	19.3-29.3	17.01

ft bgs = feet below ground surface

Prepared by/Date:
Checked by/Date: RCF 1-5-11

Table 2
Summary of Slug Test Data
Allen Steam Station, Belmont, North Carolina

Well Number	Test Date	Rising Head Test		Borehole Depth (ft)	Well Depth (ft)	Screen Interval (ft bgs)	Well Diameter (I.D. in.)
		Solution Method	K-value (cm/sec)				
AB-9S	12/2/2010	Bouwer-Rice	3.16E-06	29.0	20.5	5.5-20.5	2
AB-9D	12/2/2010	Bouwer-Rice	1.30E-03	121.0	115.0	110-115	2
AB-10S	12/2/2010	Bouwer-Rice	8.39E-04	25.0	18.0	3-18	2
AB-10D	12/2/2010	Bouwer-Rice	7.52E-04	65.0	62.5	57.5-62.5	2
AB-11D	12/3/2010	Bouwer-Rice	1.53E-05	25.5	20.4	15-20	2
AB-12S	12/3/2010	Bouwer-Rice	7.58E-04	29.0	23.0	8-23	2
AB-12D	12/3/2010	Bouwer-Rice	8.61E-04	104.0	96.0	91-96	2
AB-13S	12/3/2010	Bouwer-Rice	1.91E-04	28.0	21.0	6-21	2
AB-13D	12/3/2010	Bouwer-Rice	7.20E-04	86.0	72.0	67-72	2
AB-14D	12/3/2010	Bouwer-Rice	7.26E-04	33.5	29.6	19.3-29.3	2

Prepared by/Date: _____

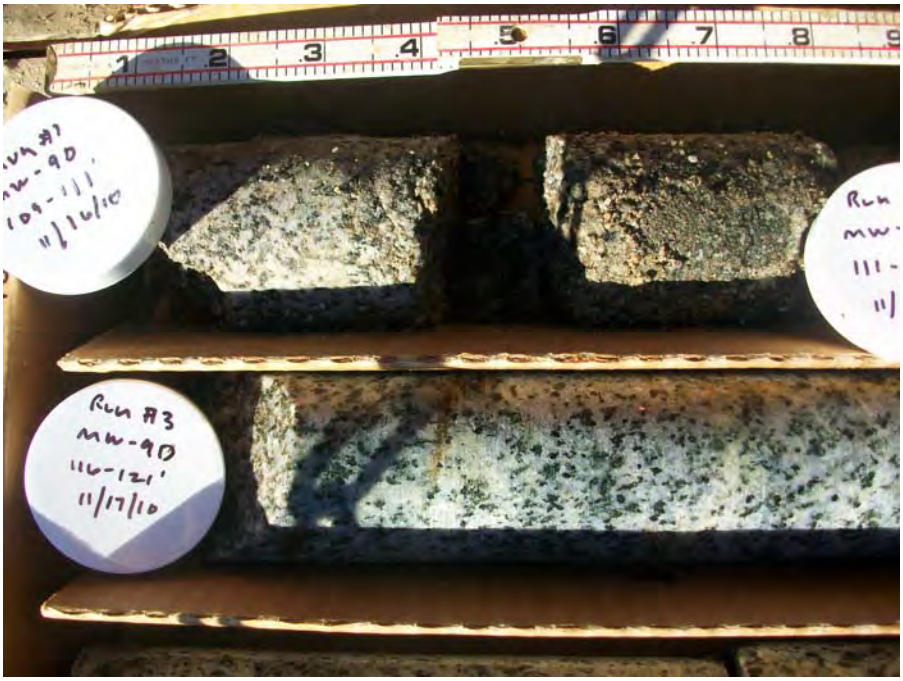
Checked by/Date: RWF 1-5-11

ft bgs = feet below ground surface
ft/d = feet per day

APPENDICES

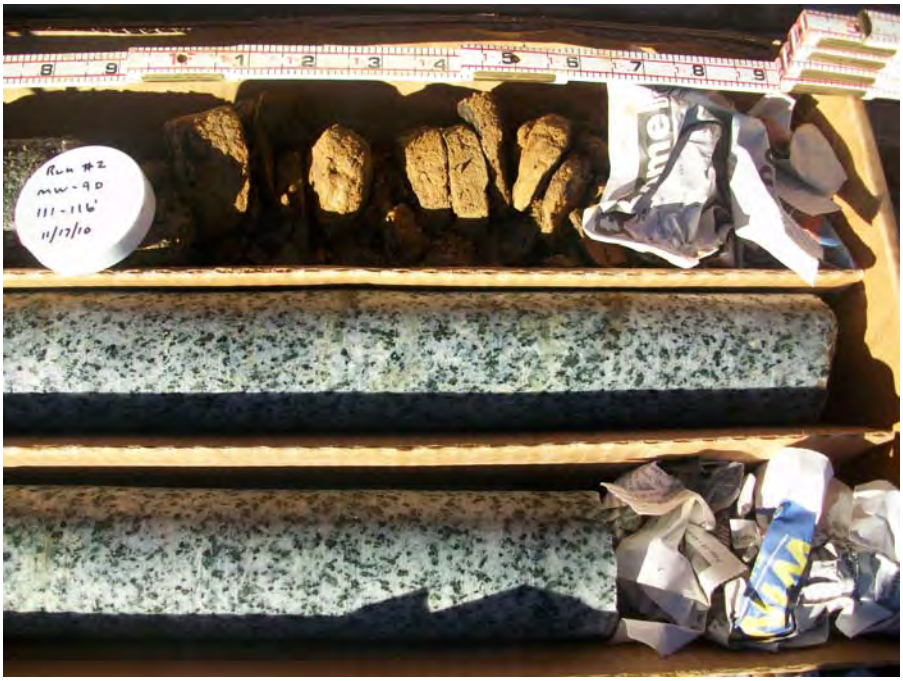
APPENDIX A
ROCK CORE PHOTOGRAPHS

Photograph 1: Well AB-9D (Runs 1-3).



Photograph 2: Well AB-9D (Runs 1 and 3 (top)).

Photograph 3: Well AB-9D (Run 3 (top)).



Photograph 4: Well AB-9 D (Runs 2 and 3 (bottom)).

Photograph 5: Well AB-10D (Runs 2, 3, and 4).

Photograph 6: Well AB-10D (Runs 3 and 4).

Photograph 7: Well AB-11D (Runs 1 and 2).

Photograph 8: Well AB-11D (Run 1 (top)).

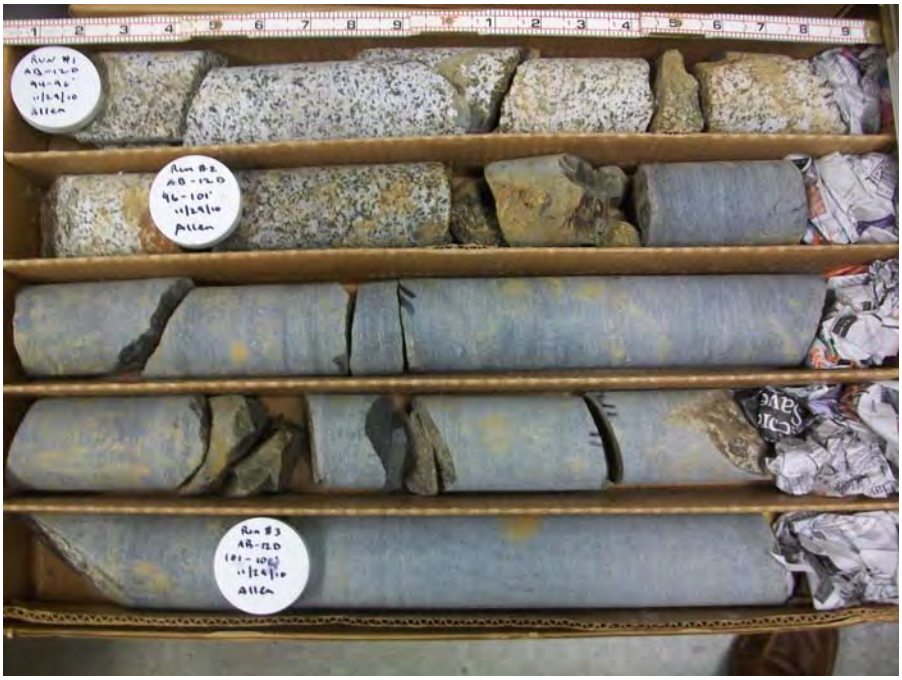
Photograph 9: Well AB-11D (Run 1 (bottom)).

Photograph 10: Well AB-11D (Run 2).

Photograph 11: Well AB-11D (Run 2 cont'd).

Photograph 12: Well AB-11D (Run 3 (top)).

Photograph 13: Well AB-11D (Run 3 (bottom)).



Photograph 14: Well AB-12D (Runs 1 thru 3).

Photograph 15: Well AB-12 (Runs 1 thru 3 (top)).

Photograph 16: Well AB-12D (Runs 1 thru 3 (bottom)).

Photograph 17: Well AB-12D (Run 3).

Photograph 18: Well AB-13D (Runs 1 thru 5).

Photograph 19: Well AB-13D (Runs 1 and 2 (top)).

Photograph 20: Well AB-13D (Run 2 (top) and Run 5 (bottom)). No recovery on Runs 3 and 4 (see logs).

Photograph 21: Well AB-13D (Runs 3, 4 and 5).

Photograph 22: Well AB-14D (Runs 1 thru 4).

APPENDIX B

SOIL AND ROCK BORING LOGS

MAJOR DIVISIONS			GROUP SYMBOLS		TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)		GW	Well graded gravels, gravel - sand mixtures, little or no fines.
				GP	Poorly graded gravels or gravel - sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)		GM	Silty gravels, gravel - sand - silt mixtures.
				GC	Clayey gravels, gravel - sand - clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 Sieve Size)	CLEAN SANDS (Little or no fines)		SW	Well graded sands, well graded sands with gravel.
				SP	Poorly graded sands, poorly graded sands with gravel.
		SANDS WITH FINES (Appreciable amount of fines)		SM	Silty sands.
				SC	Clayey sands.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)			ML	Inorganic silts, sandy or clayey silts with low plasticity.
				CL	Inorganic clays of low plasticity.
				OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)			MH	Inorganic silts, elastic silts.
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic clays of high plasticity, organic silts.
CORED ROCK				RK	Rock

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

Reference: "Classification of Soils for Engineering Purposes" (Unified Soil Classification System) ASTM D 2487, and/or "Description and Identification of Soils" (Visual-Manual Procedure), ASTM D 2488.

Undisturbed Sample	Auger Cuttings
Split Spoon Sample	Bulk Sample
Rock Core	Crandall Sampler
Dilatometer	Pressure Meter
Packer	No Recovery
Water Table at time of drilling	Water Table after 24 hours
Caved Depth	WOH = Weight of Hammer

Monitoring Well Explanation

Cement Bentonite Sand Filter Screen

Correlation of Penetration Resistance with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 1	Very Soft
5 - 10	Loose	2 - 4	Soft
11 - 20	Firm	5 - 8	Firm
21 - 30	Very Firm	9 - 15	Stiff
31 - 50	Dense	16 - 30	Very Stiff
Over 50	Very Dense	Over 31	Hard

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KEY TO SYMBOLS AND DESCRIPTIONS

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DEPTH (ft)	SOIL CLASSIFICATION SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	SAMPLES TYPE	SAMPLES N-COUNT 1st 6" 2nd 6" 3rd 6"	REMARKS
0	Organic Surface Layer						
	Dark red (2.5 YR 3/6) stiff micaceous sandy silt (ML)			SS-1		8-9-10	
5							
10	Dusky red (10R 3/4) stiff micaceous sandy silt (ML)			SS-2		7-7-8	
15	Brownish yellow (10 YR 6/6) firm silty micaceous fine sand (SM) with small roots			SS-3		5-5-6	
20	Pale yellow (2.5 Y 7/4) firm silty micaceous fine sand (SM)			SS-4		8-7-5	
25				SS-5		11-9-9	
30	Yellow (10 YR 7/6) firm very fine sandy silt (ML), micaceous			SS-6		3-3-4	
35	Light yellowish brown (2.5 Y 6/3) very firm sandy silt (ML), slightly micaceous			SS-7		5-6-7	
40	Pale yellow (2.5 Y 8/2) firm silty fine sand (SM)			SS-8		5-5-6	
45	Light yellowish brown (2.5 Y 6/3) stiff sandy silt (ML)			SS-9		4-4-5	

SOIL_ALLEN STEAM STATION.GPJ 1/7/11

DRILLER: Tommy Burnette/AE Drilling
EQUIPMENT: CME 750
METHOD: 4.25" (ID) HSA
HOLE DIA.: 8"
REMARKS:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

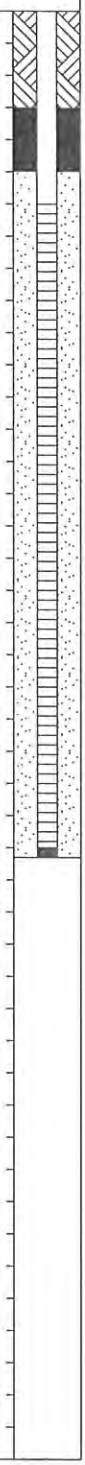
SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-1R

November 23, 2010
PROJ. NO.: 6228105284.03

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	SAMPLES TYPE	SAMPLES N-COUNT 1st 6" 2nd 6" 3rd 6"	REMARKS
45	Light yellowish brown (2.5 Y 6/3) stiff sandy silt (ML)						
50				SS-10		5-8-16	very stiff
55	Pale yellow (2.5 Y 8/2) very stiff silty fine sand (SM), micaceous			SS-11		7-7-10	
60	Olive (5Y 5/3) very dense silty fine sand (SM), dry			SS-12		50/5	
65	Pale yellow (5 Y 8/3) very dense silty fine sand (SM)			SS-13		13-50/6	
70	Pale olive (5Y 6/3) very dense silty fine sand (SM), wet			SS-14		30-50/5	spoon very wet
75	Boring Terminated at 75 feet below ground surface			SS-15		25-35-50/5	(2.5 Y 7/6)
80							
85							
90							



SOIL_ALLEN STEAM STATION.GPJ 1/7/11

DRILLER: Tommy Burnette/AE Drilling
EQUIPMENT: CME 750
METHOD: 4.25" (ID) HSA
HOLE DIA.: 8"
REMARKS:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

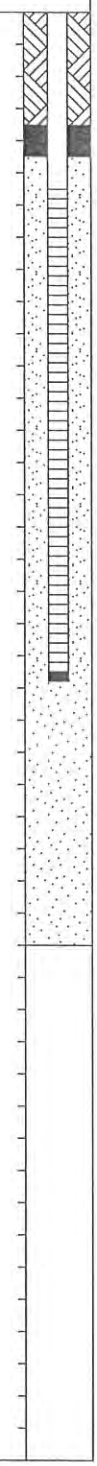
SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-1R

November 23, 2010
PROJ. NO.: 6228105284.03

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	SAMPLES TYPE	SAMPLES N-COUNT 1st 6" 2nd 6" 3rd 6"	REMARKS
0	Strong brown (7.5 YR 5/6) silt (ML), dry						with gravel (0-3')
5							
10							
15							
17	Yellow (10 YR 7/6) clayey silt (ML), moist						
20							
25							
29	Boring Terminated at 29 feet below ground surface						
30							
35							
40							
45							



SOIL ALLEN STEAM STATION.GPJ 1/7/11

DRILLER: Tommy Burnette/AE Drilling
EQUIPMENT: CME 750
METHOD: 4.25" (ID) HSA
HOLE DIA.: 8"
REMARKS:

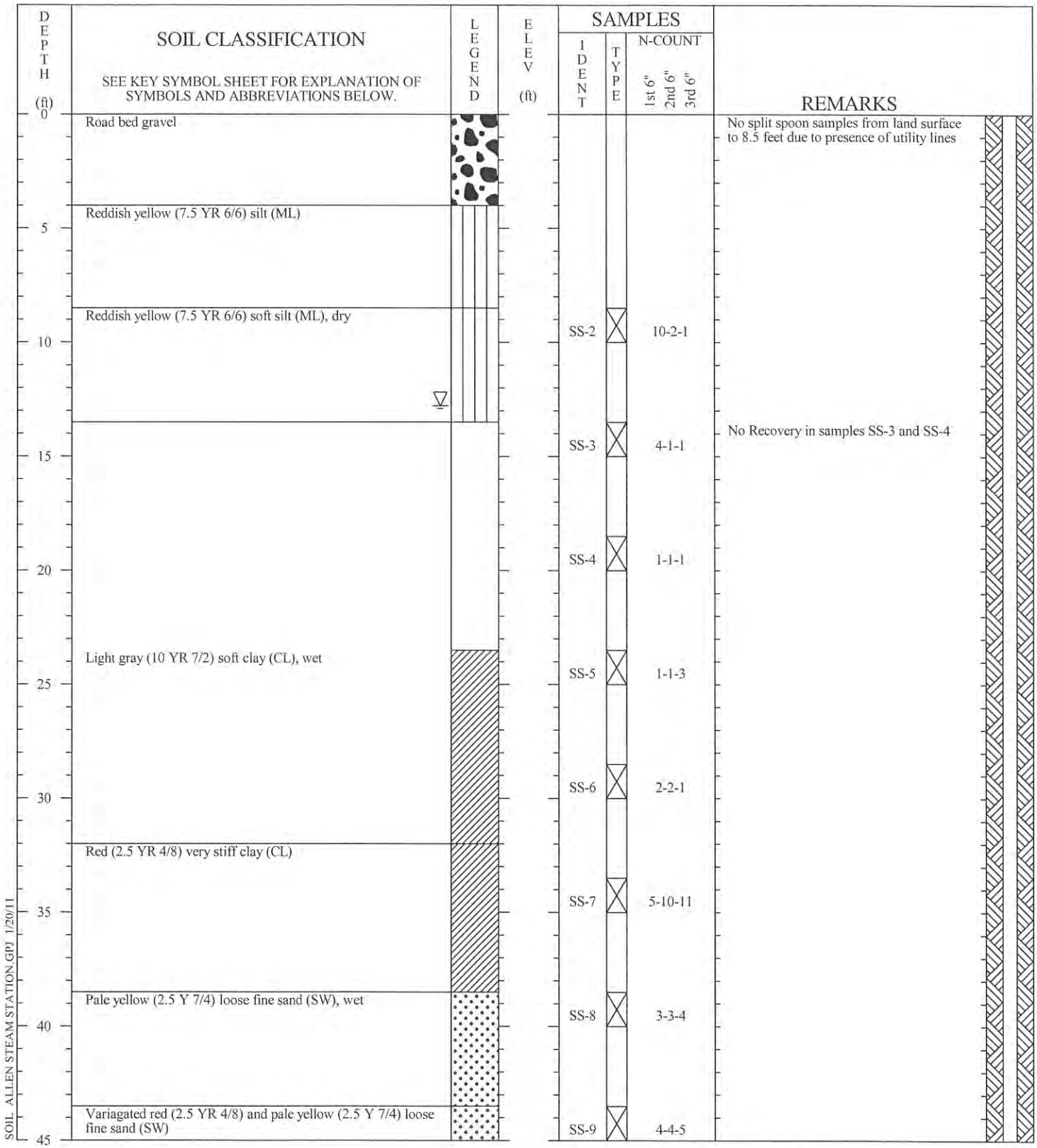
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-9S

November 17, 2010
PROJ. NO.: 6228105284.03 **PAGE 1 OF 1**

MACTEC



SOIL ALLEN STEAM STATION.GPJ 1/20/11

DRILLER: Tommy Burnette/AE Drilling
EQUIPMENT: CME 750
METHOD: 4.25" (ID) HSA, HQ Rock Core
HOLE DIA.: 8" HSA; HQ Rock Core
REMARKS: Auger refusal encountered at 109 feet below land surface

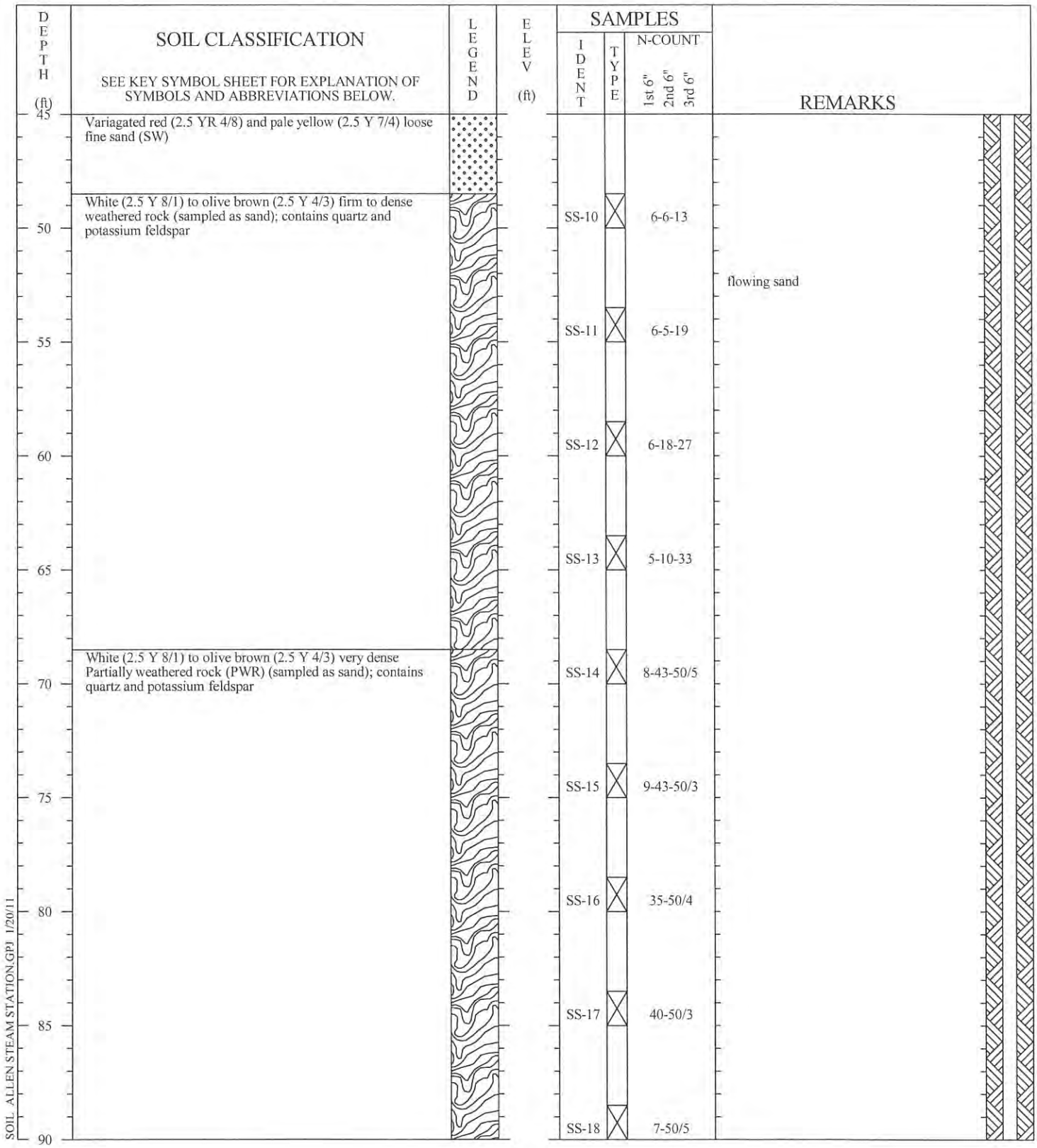
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-9D

November 15, 2010
PROJ. NO.: 6228105284.03

MACTEC



SOIL_ALLEN STEAM STATION.GPJ 1/20/11

DRILLER: Tommy Burnette/AE Drilling
EQUIPMENT: CME 750
METHOD: 4.25" (ID) HSA, HQ Rock Core
HOLE DIA.: 8" HSA; HQ Rock Core
REMARKS: Auger refusal encountered at 109 feet below land surface

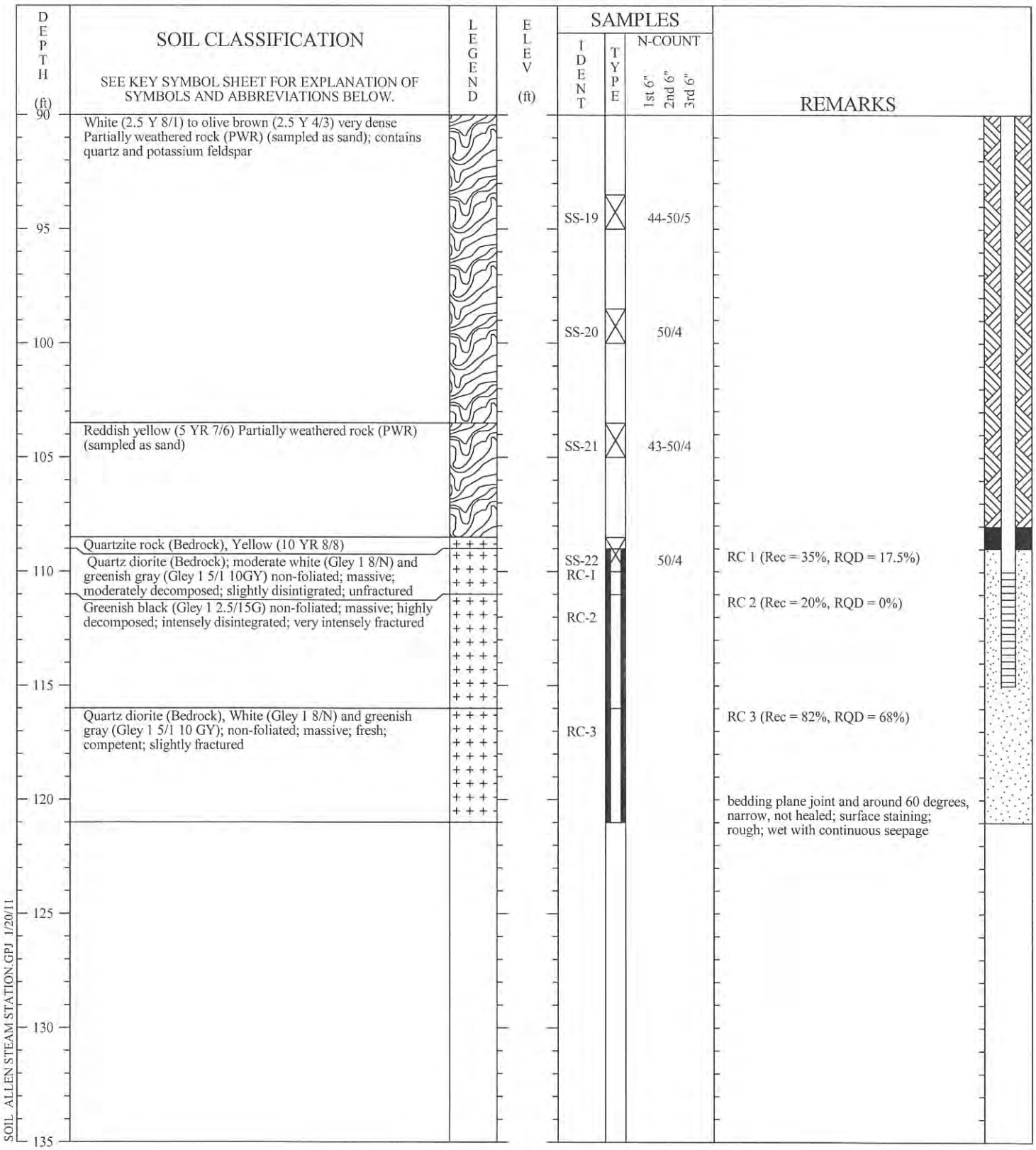
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-9D

November 15, 2010
PROJ. NO.: 6228105284.03

MACTEC



SOIL ALLEN STEAM STATION.GPJ 1/20/11

DRILLER:	Tommy Burnette/AE Drilling
EQUIPMENT:	CME 750
METHOD:	4.25" (ID) HSA, HQ Rock Core
HOLE DIA.:	8" HSA; HQ Rock Core
REMARKS:	Auger refusal encountered at 109 feet below land surface

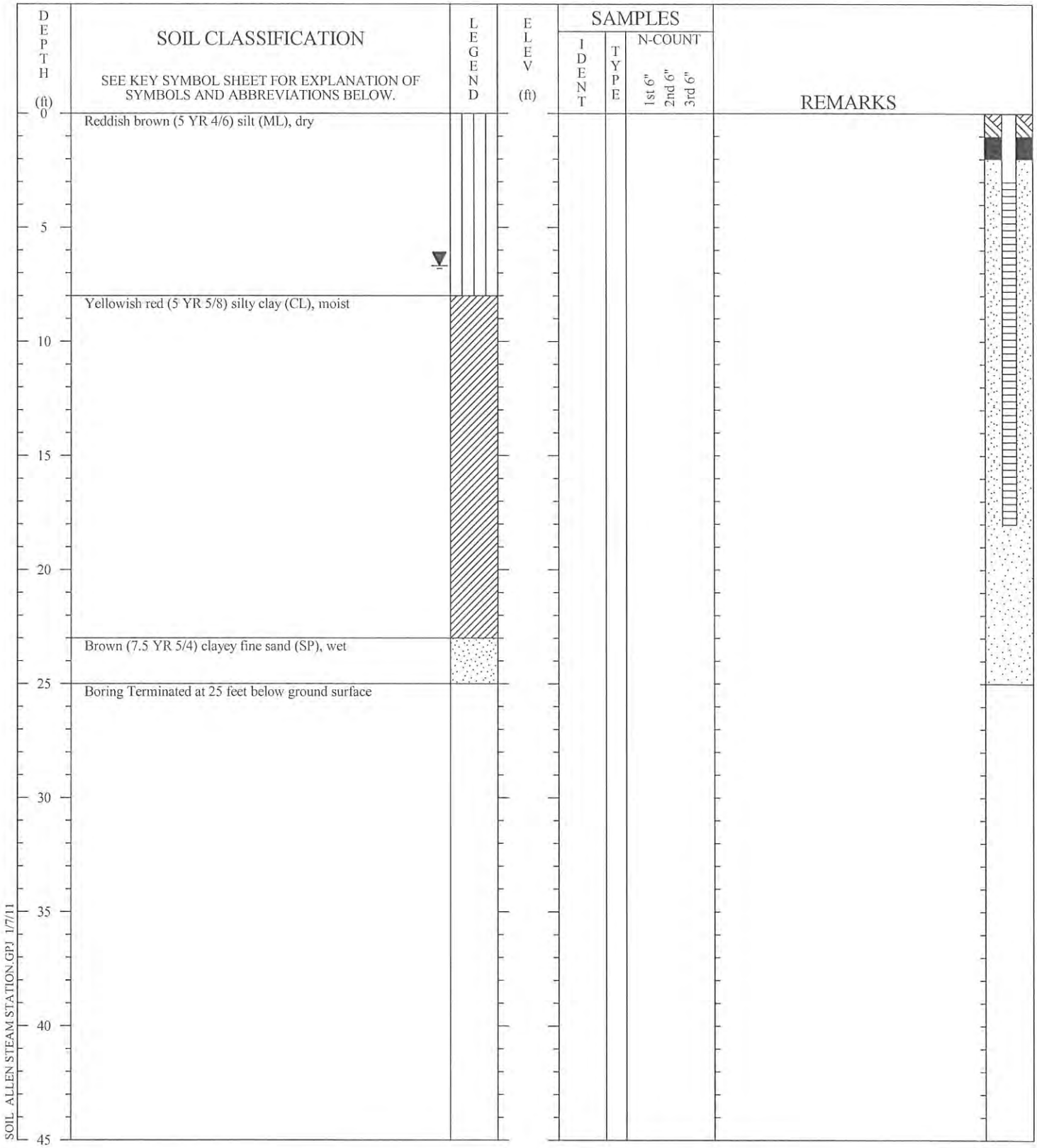
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-9D

November 15, 2010
PROJ. NO.: 6228105284.03

MACTEC



SOIL ALLEN STEAM STATION.GPJ 1/7/11

DRILLER: Tommy Burnette/AE Drilling
EQUIPMENT: CME 750
METHOD: 4.25" (ID) HSA
HOLE DIA.: 8"
REMARKS:

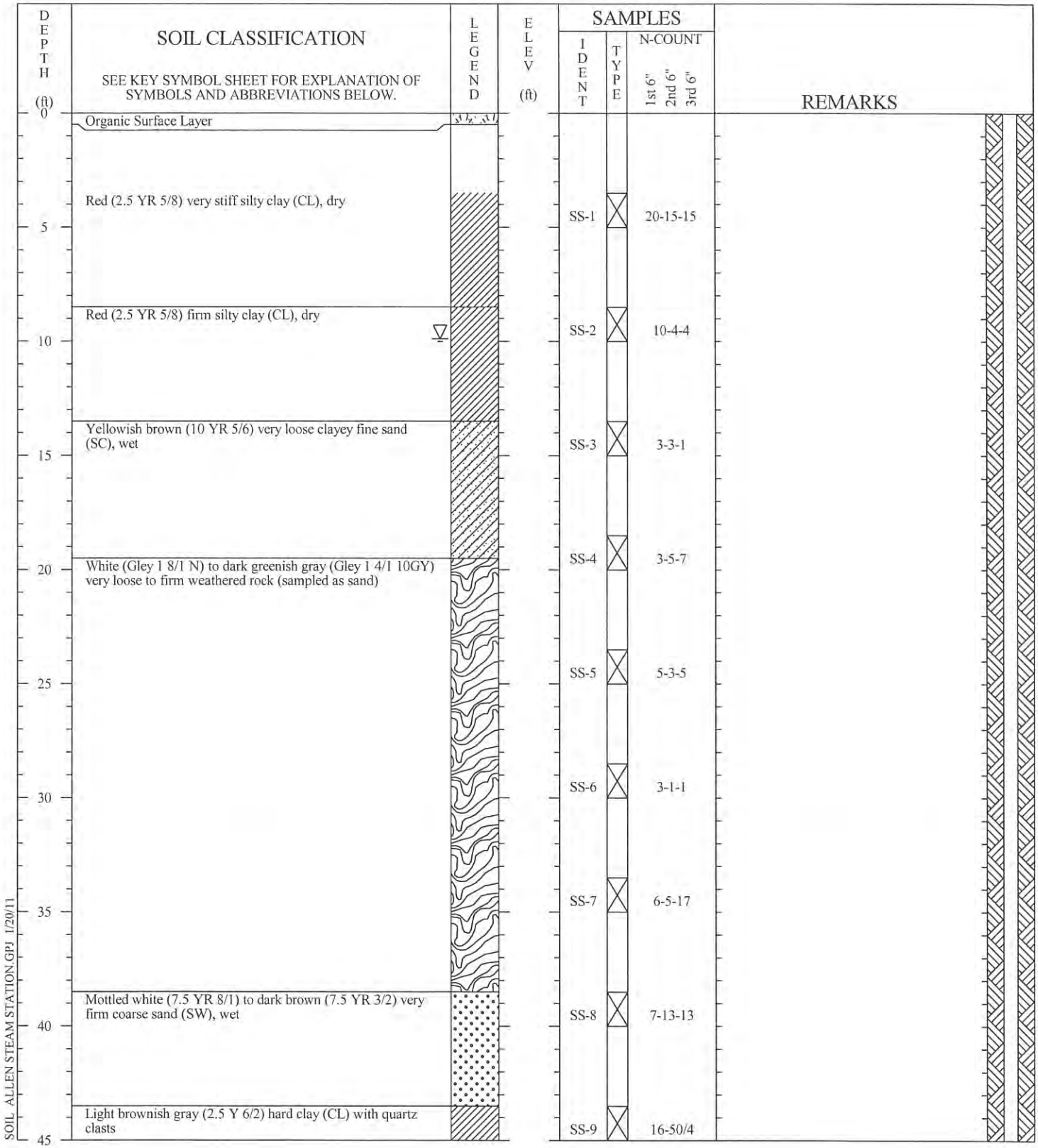
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-10S

November 18, 2010
PROJ. NO.: 6228105284.03 **PAGE 1 OF 1**

MACTEC



DRILLER: Tommy Burnette/AE Drilling
EQUIPMENT: CME 750
METHOD: 4.25" (ID) HSA, HQ Rock Core
HOLE DIA.: 8" HSA; HQ Rock Core
REMARKS: Auger refusal encountered at 45 feet below land surface

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-10D

November 18, 2010
PROJ. NO.: 6228105284.03

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	SAMPLES TYPE	SAMPLES N-COUNT 1st 6" 2nd 6" 3rd 6"	REMARKS
45				RC-1			RC 1 (Rec = 0%, RQD = 0%) mud in core barrel, no rock sample
50	Granite (Bedrock); strong; white (Gley 1 8/1 N) fine-grained; massive; slightly decomposed and disintigrated; very intensely fractured			RC-2			RC 2 (Rec = 12%, RQD = 0%)
55				RC-3			RC 3 (Rec = 24%, RQD = 0%)
60	Granite (Bedrock); moderate strength; light bluish gray (Gley 8/1 10B) fine-grained; massive; slightly decomposed and disintigrated; moderately fractured			RC-4			RC 4 (Rec = 74%, RQD = 34%)
65							
70							
75							
80							
85							
90							

SOIL_ALLEN STEAM STATION.GPJ 1/20/11

DRILLER: Tommy Burnette/AE Drilling
EQUIPMENT: CME 750
METHOD: 4.25" (ID) HSA, HQ Rock Core
HOLE DIA.: 8" HSA; HQ Rock Core
REMARKS: Auger refusal encountered at 45 feet below land surface

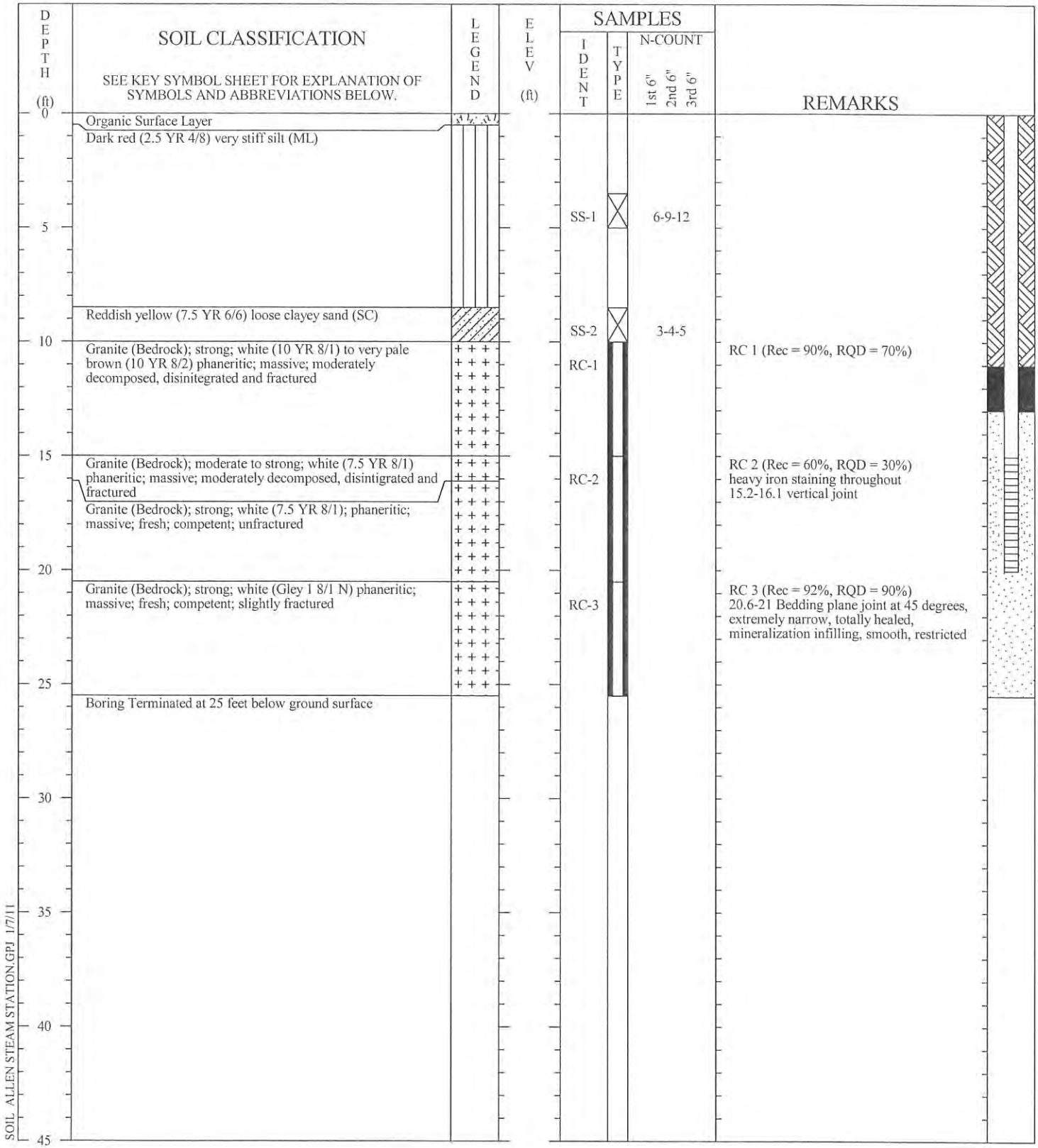
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-10D

November 18, 2010
PROJ. NO.: 6228105284.03

MACTEC



SOIL ALLEN STEAM STATION.GPJ 1/7/11

DRILLER:	Tommy Burnette/AE Drilling
EQUIPMENT:	CME 750
METHOD:	4.25" (ID) HSA, HQ Rock Core
HOLE DIA.:	8" HSA; HQ Rock Core
REMARKS:	Auger refusal encountered at 10 feet below land surface

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

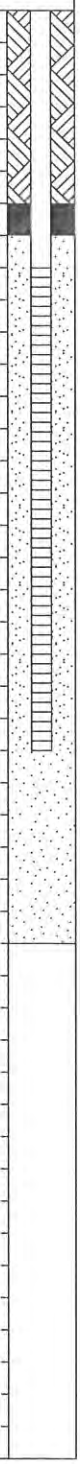
SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-11D

November 19, 2010
PROJ. NO.: 6228105284.03 **PAGE 1 OF 1**

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	SAMPLES TYPE	SAMPLES N-COUNT 1st 6" 2nd 6" 3rd 6"	REMARKS
0	Red (10 R 4/8) silt (ML)						
5	Strong brown (7.5 YR 5/6) silt (ML), micaceous						
10							
15							
20							
25							
30	Boring terminated at 29 feet below ground surface						
35							
40							
45							



SOIL_ALLEN STEAM STATION.GPJ 1/7/11

DRILLER: Tommy Burnette/AE Drilling
EQUIPMENT: CME 750
METHOD: 4.25" (ID) HSA
HOLE DIA.: 8"
REMARKS:

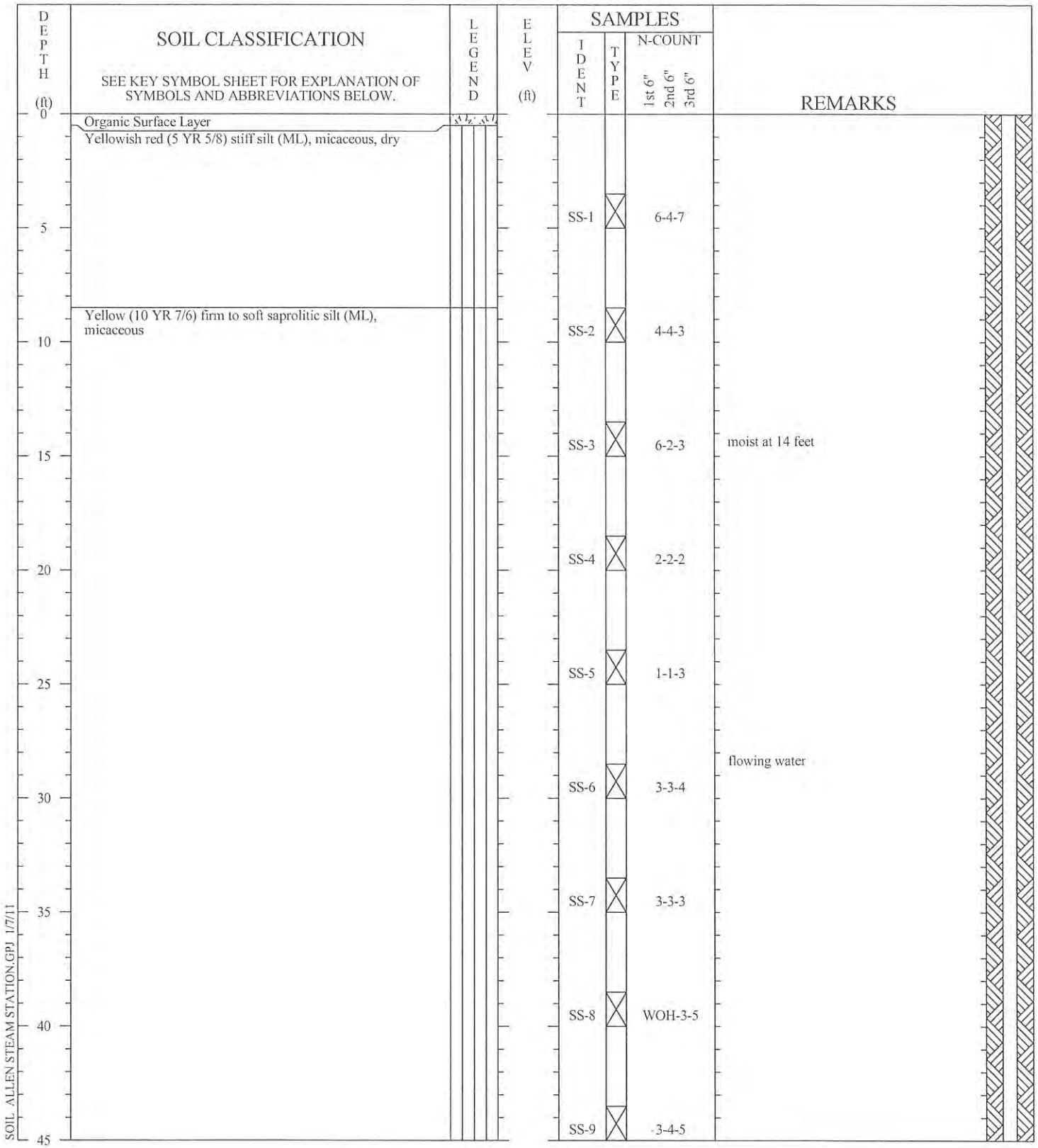
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-12S

November 30, 2010
PROJ. NO.: 6228105284.03 **PAGE 1 OF 1**

MACTEC



SOIL_ALLEN STEAM STATION.GPJ 1/7/11

DRILLER:	Tommy Burnette/AE Drilling
EQUIPMENT:	CME 750
METHOD:	4.25" (ID) HSA, HQ Rock Core
HOLE DIA.:	8" HSA; HQ Rock Core
REMARKS:	Auger refusal encountered at 94 feet below land surface

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-12D

November 29, 2010
PROJ. NO.: 6228105284.03

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	SAMPLES TYPE	SAMPLES N-COUNT 1st 6" 2nd 6" 3rd 6"	REMARKS
45	Yellow (10 YR 7/6) stiff to very stiff saprolitic silt (ML), micaceous						
				SS-10	X	WOH-6-6	
50							
				SS-11	X	6-9-13	
55							
	White (10 YR 8/1) to dark yellowish brown (10 YR 4/6) hard weathered rock (sampled as silt)						
				SS-12	X	9-14-20	
60							
				SS-13	X	19-19-27	
65							
				SS-14	X	13-14-15	
70							
				SS-15	X	19-28-50/6	
75							
				SS-16	X	13-23-29	
80							
	Olive (5Y 4/3) hard silt (ML)						
				SS-17	X	31-50/5	
85							
				SS-18	X	18-31-50/4	
90							

SOIL ALLEN STEAM STATION.GPJ 1/7/11

DRILLER: Tommy Burnette/AE Drilling
EQUIPMENT: CME 750
METHOD: 4.25" (ID) HSA, HQ Rock Core
HOLE DIA.: 8" HSA; HQ Rock Core
REMARKS: Auger refusal encountered at 94 feet below land surface

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-12D

November 29, 2010
PROJ. NO.: 6228105284.03 **PAGE 2 OF 3**

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	SAMPLES TYPE	SAMPLES N-COUNT 1st 6" 2nd 6" 3rd 6"	REMARKS
90	Olive (5Y 4/3) hard silt (ML)						
95	Quartz Diorite (Bedrock), strong white (Gley 1 8/N) to greenish black (Gley 1 2.5/1 5 GY), non-foliated, massive	+ + + +		SS-19 RC-1		50/2	RC 1 (Rec= 100%, RQD= 80%)
	Gabbro (Bedrock), strong, bluish black (Gley 2 2.5/1 5 PB)	+ + + +		RC-2			RC 2 (Rec= 100%, RQD= 85%) 96.75-97.25 Foliation joint infilled with fine grained matrix
100		+ + + +		RC-3			RC 3 (Rec= 100%, RQD= 100%)
105							
110							
115							
120							
125							
130							
135							

SOIL_ALLEN STEAM STATION.GPJ 1/7/11

DRILLER: Tommy Burnette/AE Drilling
EQUIPMENT: CME 750
METHOD: 4.25" (ID) HSA, HQ Rock Core
HOLE DIA.: 8" HSA; HQ Rock Core
REMARKS: Auger refusal encountered at 94 feet below land surface

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

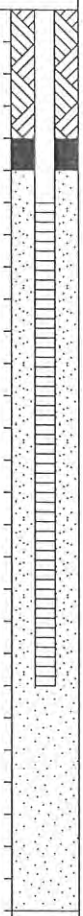
SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-12D

November 29, 2010
PROJ. NO.: 6228105284.03

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	SAMPLES TYPE	SAMPLES N-COUNT 1st 6" 2nd 6" 3rd 6"	REMARKS
0	Red (2.5 YR 5/8) to yellowish red (5 YR 5/6) clayey silt (ML)						
5							
10							
15							moist
20							
25							
28	Boring terminated at 28 feet below ground surface						
30							
35							
40							
45							



SOIL ALLEN STEAM STATION.GPJ 1/7/11

DRILLER: Tommy Burnette/AE Drilling
EQUIPMENT: CME 750
METHOD: 4.25" (ID) HSA
HOLE DIA.: 8"
REMARKS:

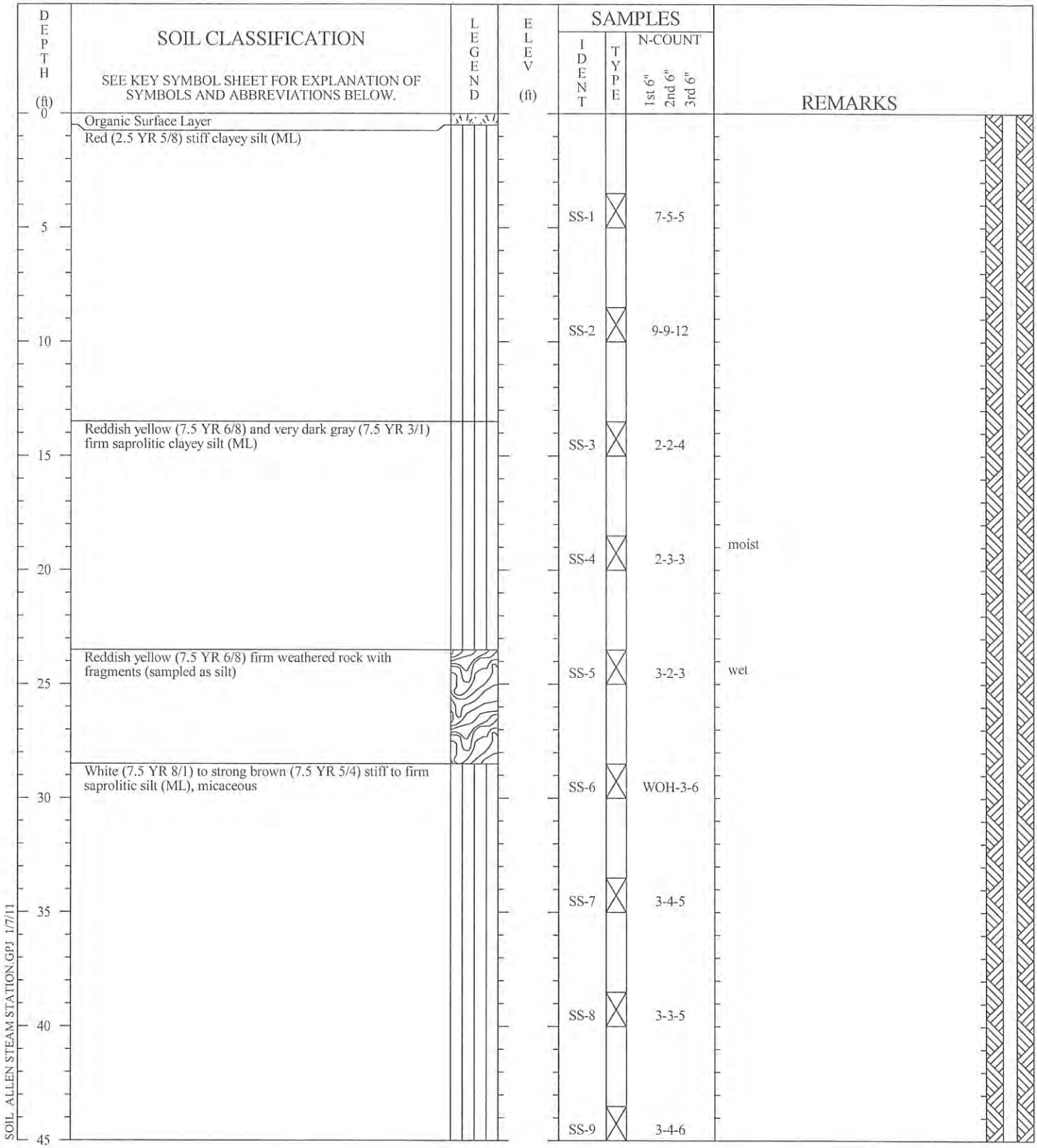
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-13S

December 1, 2010
PROJ. NO.: 6228105284.03 **PAGE 1 OF 1**

MACTEC



DRILLER: Tommy Burnette/AE Drilling
EQUIPMENT: CME 750
METHOD: 4.25" (ID) HSA, HQ Rock Core
HOLE DIA.: 8" HSA; HQ Rock Core
REMARKS: Auger refusal encountered at 65 feet below land surface

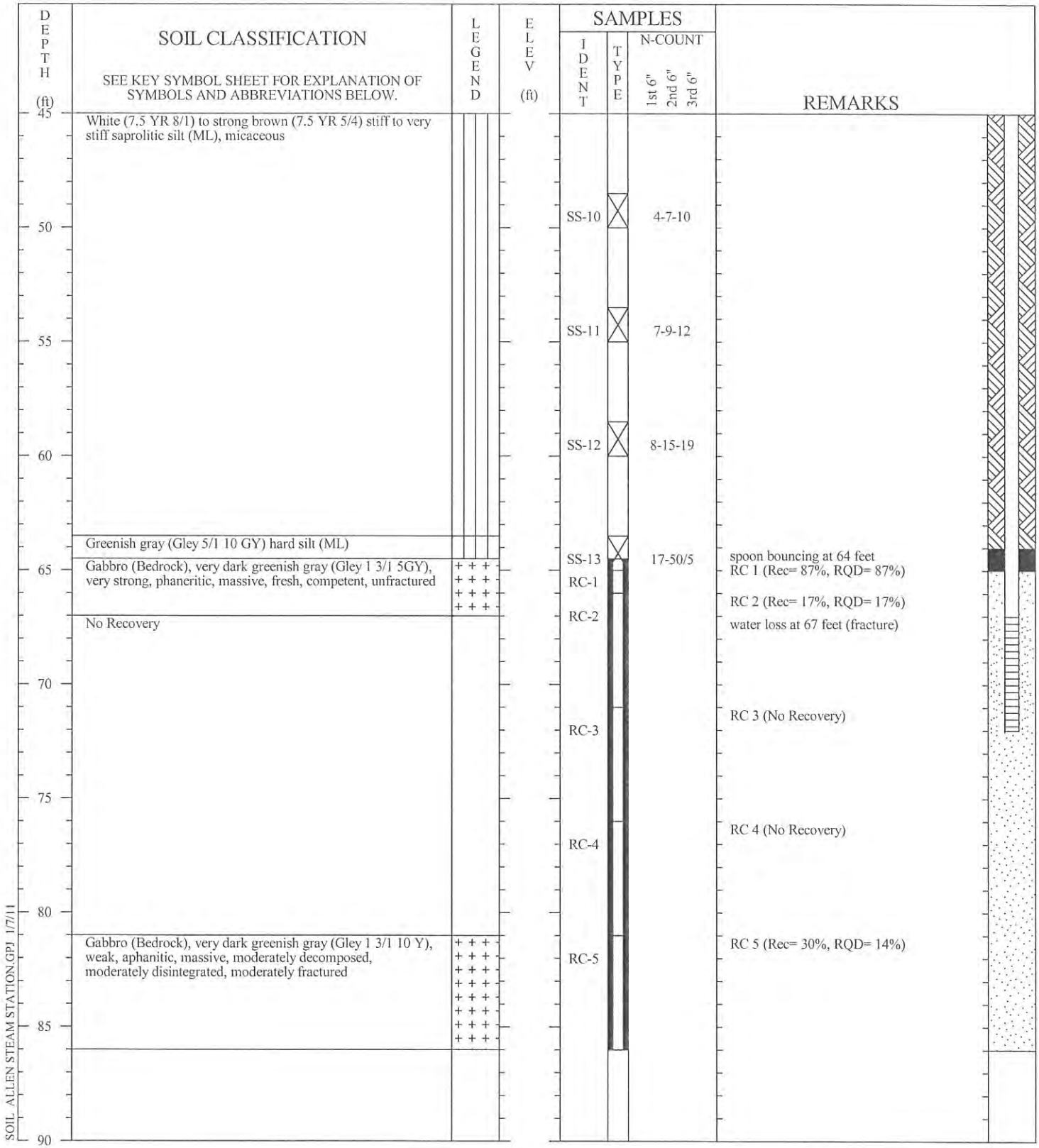
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-13D

December 1, 2010
PROJ. NO.: 6228105284.03

MACTEC



SOIL_ALLEN STEAM STATION.GPJ 1/7/11

DRILLER: Tommy Burnette/AE Drilling
EQUIPMENT: CME 750
METHOD: 4.25" (ID) HSA, HQ Rock Core
HOLE DIA.: 8" HSA; HQ Rock Core
REMARKS: Auger refusal encountered at 65 feet below land surface

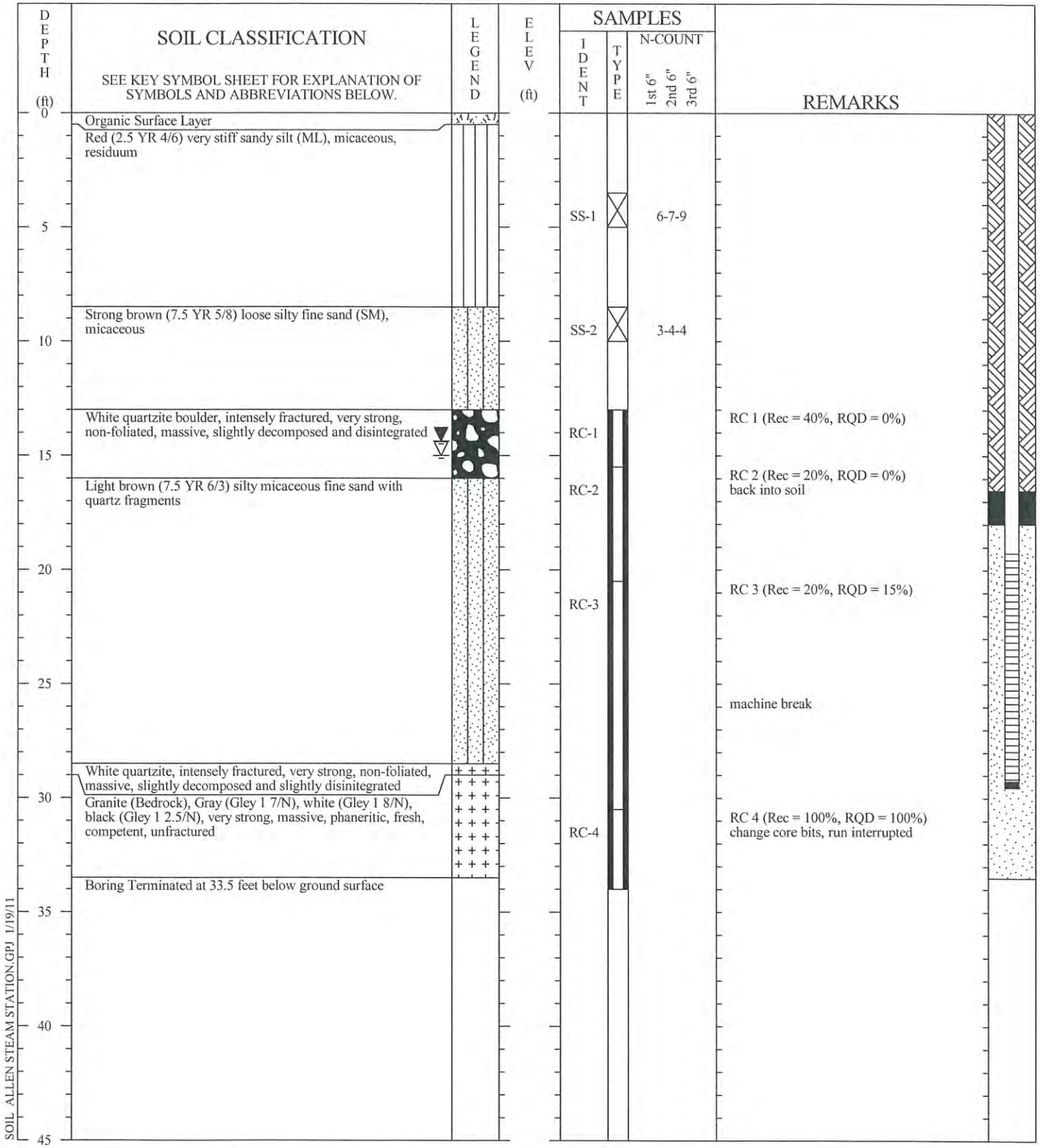
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-13D

December 1, 2010
PROJ. NO.: 6228105284.03

MACTEC



DRILLER:	Tommy Burnette/AE Drilling
EQUIPMENT:	CME 750
METHOD:	4.25" (ID) HSA, HQ Rock Core
HOLE DIA.:	8" HSA; HQ Rock Core
REMARKS:	Auger refusal encountered at 13.5 feet below land surface

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: Allen Steam Station
WELL ID: AB-14D

November 22, 2010
PROJ. NO.: 6228105284.03 **PAGE 1 OF 1**

MACTEC

APPENDIX C

NCDENR MONITORING WELL CONSTRUCTION RECORDS

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2277

1. WELL CONTRACTOR:
Thomas Burnette
Well Contractor (Individual) Name
A.E. Drilling Services, Inc.
Well Contractor Company Name
Two United Way
Street Address
Greenville SC 29607
City or Town State Zip Code
(864) 288-1986
Area code Phone number

2. WELL INFORMATION:
WELL CONSTRUCTION PERMIT#
OTHER ASSOCIATED PERMIT#(if applicable)
SITE WELL ID #(if applicable) AB-1R

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☑ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 11-23-10

4. WELL LOCATION:
253 Plant Allen Road, Belmont, NC 28012
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
CITY: Belmont COUNTY Gaston
TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
~ ~ ~ ~ ~ 35 ~ 0 ~ 0.0000 ~ ~ ~ **OR** 35.18704718 ~
~ ~ ~ ~ ~ 81 ~ 0 ~ 0.0000 ~ ~ ~ **OR** -81.0188339 ~
Latitude/longitude source: ☑ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)
Duke Energy Allen Steam St
Facility Name Facility ID# (if applicable)
253 Plant Allen Road
Street Address
Belmont NC 28012
City or Town State Zip Code
Ed Sullivan
Contact Name
P.O. Box 37929
Mailing Address
Charlotte NC 28237
City or Town State Zip Code
(980) 373-3719
Area code Phone number

6. WELL DETAILS:
a. **TOTAL DEPTH:** 71
b. **DOES WELL REPLACE EXISTING WELL?** YES ☑ NO ☐
c. **WATER LEVEL** Below Top of Casing: 65.1 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 2.3 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. **YIELD (gpm):** N/M **METHOD OF TEST**
f. **DISINFECTION: Type** N/A **Amount**
g. **WATER ZONES** (depth):
Top Bottom Top Bottom
Top Bottom Top Bottom
Top Bottom Top Bottom

7. CASING:	Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 51	Ft.	2"	sch40	PVC
Top	Bottom	Ft.			
Top	Bottom	Ft.			

8. GROUT:	Depth		Material	Method
Top 0	Bottom 48	Ft.	Cement/	Tremie
Top 48	Bottom 50	Ft.	Bentonite	
Top	Bottom	Ft.		

9. SCREEN:	Depth		Diameter	Slot Size	Material
Top 51	Bottom 71	Ft.	2 in.	.010 in.	PVC
Top	Bottom	Ft.	in.	in.	
Top	Bottom	Ft.	in.	in.	

10. SAND/GRAVEL PACK:

	Depth		Size	Material
Top 50	Bottom 75	Ft.	#1	Sand
Top	Bottom	Ft.		
Top	Bottom	Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description
0	75	Sandy Silt & Silty Sand

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Thomas L Burnette
SIGNATURE OF CERTIFIED WELL CONTRACTOR 1/7/11 DATE

Thomas Burnette
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit within 30 days of completion to: Division of Water Quality - Information Processing, 1617 Mail Service Center, Raleigh, NC 27699-161, Phone : (919) 807-6300

Form GW-1b
Rev. 2/09

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2277

1. WELL CONTRACTOR:
Thomas Burnette
Well Contractor (Individual) Name
A.E. Drilling Services, Inc.
Well Contractor Company Name
Two United Way
Street Address
Greenville SC 29607
City or Town State Zip Code
(864) 288-1986
Area code Phone number

2. WELL INFORMATION:
WELL CONSTRUCTION PERMIT#
OTHER ASSOCIATED PERMIT#(if applicable)
SITE WELL ID #(if applicable) AB-9D

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 11-17-10

4. WELL LOCATION:
253 Plant Allen Road, Belmont, NC 28012
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
CITY: Belmont COUNTY Gaston
TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
~ ~ ~ ~ ~ 35 ~ 0 ~ 0.0000 ~ ~ ~ **OR** ~ 35.1817508 ~
~ ~ ~ ~ ~ 81 ~ 0 ~ 0.0000 ~ ~ ~ **OR** ~ 81.0060474 ~
Latitude/longitude source: ☑ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)
Duke Energy Allen Steam St
Facility Name Facility ID# (if applicable)
253 Plant Allen Road
Street Address
Belmont NC 28012
City or Town State Zip Code
Ed Sullivan
Contact Name
P.O. Box 37929
Mailing Address
Charlotte NC 28237
City or Town State Zip Code
(980) 373-3719
Area code Phone number

6. WELL DETAILS:
a. **TOTAL DEPTH:** 115
b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☑
c. **WATER LEVEL** Below Top of Casing: 14.52 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 2.4 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. **YIELD (gpm):** N/M **METHOD OF TEST**
f. **DISINFECTION: Type** N/A **Amount**
g. **WATER ZONES** (depth):
Top Bottom Top Bottom
Top Bottom Top Bottom
Top Bottom Top Bottom

7. CASING:	Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 110	Ft.	2"	sch40	PVC
Top	Bottom	Ft.			
Top	Bottom	Ft.			

8. GROUT:	Depth		Material	Method
Top 0	Bottom 108	Ft.	Cement/	Tremie
Top 108	Bottom 109	Ft.	Bentonite	
Top	Bottom	Ft.		

9. SCREEN:	Depth		Diameter	Slot Size	Material
Top 110	Bottom 115	Ft.	2 in.	.010 in.	PVC
Top	Bottom	Ft.	in.	in.	
Top	Bottom	Ft.	in.	in.	

10. SAND/GRAVEL PACK:	Depth		Size	Material
Top 109	Bottom 121	Ft.	#1	Sand
Top	Bottom	Ft.		
Top	Bottom	Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description
0	4	Gravel Fill
4	13.5	Silt
13.5	20	No recovery
20	33	Clay
33	48	Sand
48	108	Weathered Rock
108	121	Quartz Diorite

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Thomas L Burnett
SIGNATURE OF CERTIFIED WELL CONTRACTOR 1/7/11 DATE

Thomas Burnette
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit within 30 days of completion to: Division of Water Quality - Information Processing, 1617 Mail Service Center, Raleigh, NC 27699-161, Phone : (919) 807-6300

Form GW-1b
Rev. 2/09

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2277

1. WELL CONTRACTOR:
Thomas Burnette
Well Contractor (Individual) Name
A.E. Drilling Services, Inc.
Well Contractor Company Name
Two United Way
Street Address
Greenville SC 29607
City or Town State Zip Code
(864) 288-1986
Area code Phone number

2. WELL INFORMATION:
WELL CONSTRUCTION PERMIT#
OTHER ASSOCIATED PERMIT#(if applicable)
SITE WELL ID #(if applicable) AB-9S

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 11/18/10

4. WELL LOCATION:
253 Plant Allen Road. Belmont. NC 28012
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
CITY: Belmont COUNTY Gaston
TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
~ ~ ~ ~ ~ 35 ~ 0 ~ 0.0000 ~ ~ ~ OR 35.18176931 ~
~ ~ ~ ~ ~ 81 ~ 0 ~ 0.0000 ~ ~ ~ OR -81.0060560 ~
Latitude/longitude source: ☑ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)
Duke Energy Allen Steam St
Facility Name Facility ID# (if applicable)
253 Plant Allen Road
Street Address
Belmont NC 28012
City or Town State Zip Code
Ed Sullivan
Contact Name
P.O. Box 37929
Mailing Address
Charlotte NC 28237
City or Town State Zip Code
(980) 373-3719
Area code Phone number

6. WELL DETAILS:
a. **TOTAL DEPTH:** 20.5
b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☑
c. **WATER LEVEL** Below Top of Casing: 12.75 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 2.2 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. **YIELD (gpm):** N/M **METHOD OF TEST**
f. **DISINFECTION: Type** N/A **Amount**
g. **WATER ZONES** (depth):
Top Bottom Top Bottom
Top Bottom Top Bottom
Top Bottom Top Bottom

7. CASING:	Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 5.5	Ft.	2"	sch40	PVC
Top	Bottom	Ft.			
Top	Bottom	Ft.			

8. GROUT:	Depth		Material	Method
Top 0	Bottom 4	Ft.	Cement/	Tremie
Top 4	Bottom 5	Ft.	Bentonite	
Top	Bottom	Ft.		

9. SCREEN:	Depth		Diameter		Slot Size		Material
Top 5.5	Bottom 20.5	Ft.	2	in.	.010	in.	PVC
Top	Bottom	Ft.		in.		in.	
Top	Bottom	Ft.		in.		in.	

10. SAND/GRAVEL PACK:

	Depth		Size	Material
Top 5	Bottom 21	Ft.	#1	Sand
Top	Bottom	Ft.		
Top	Bottom	Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description
0	29	Clayey Silt & Silt

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN GIVEN TO THE WELL OWNER.

Thomas L Burnette
SIGNATURE OF CERTIFIED WELL CONTRACTOR 1/7/11 DATE

Thomas Burnette
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit within 30 days of completion to: Division of Water Quality - Information Processing, 1617 Mail Service Center, Raleigh, NC 27699-161, Phone : (919) 807-6300

Form GW-1b
Rev. 2/09

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2277

1. WELL CONTRACTOR:
Thomas Burnette
Well Contractor (Individual) Name
A.E. Drilling Services, Inc.
Well Contractor Company Name
Two United Way
Street Address
Greenville SC 29607
City or Town State Zip Code
(864) 288-1986
Area code Phone number

2. WELL INFORMATION:
WELL CONSTRUCTION PERMIT#
OTHER ASSOCIATED PERMIT#(if applicable)
SITE WELL ID #(if applicable) AB-10D

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 11/18/10

4. WELL LOCATION:
253 Plant Allen Road, Belmont, NC 28012
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
CITY: Belmont COUNTY Gaston
TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
~ ~ ~ ~ ~ 35 ~ 0 ~ 0.0000 ~ ~ ~ OR 35.17572754 ~
~ ~ ~ ~ ~ 81 ~ 0 ~ 0.0000 ~ ~ ~ OR -81.0059081 ~
Latitude/longitude source: ☑ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)
Duke Energy Allen Steam St
Facility Name Facility ID# (if applicable)
253 Plant Allen Road
Street Address
Belmont NC 28012
City or Town State Zip Code
Ed Sullivan
Contact Name
P.O. Box 37929
Mailing Address
Charlotte NC 28237
City or Town State Zip Code
(980) 373-3719
Area code Phone number

6. WELL DETAILS:
a. **TOTAL DEPTH:** 62.5
b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☑
c. **WATER LEVEL** Below Top of Casing: 8.99 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 2.6 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. **YIELD (gpm):** N/M **METHOD OF TEST**
f. **DISINFECTION: Type** N/A **Amount**
g. **WATER ZONES** (depth):
Top Bottom Top Bottom
Top Bottom Top Bottom
Top Bottom Top Bottom

7. CASING:	Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 57.5	Ft.	2"	sch40	PVC
Top	Bottom	Ft.			
Top	Bottom	Ft.			

8. GROUT:	Depth		Material	Method
Top 0	Bottom 52	Ft.	Cement/	Tremie
Top 52	Bottom 56	Ft.	Bentonite	
Top	Bottom	Ft.		

9. SCREEN:	Depth		Diameter	Slot Size	Material
Top 57.5	Bottom 62.5	Ft.	2 in.	.010 in.	PVC
Top	Bottom	Ft.	in.	in.	
Top	Bottom	Ft.	in.	in.	

10. SAND/GRAVEL PACK:

	Depth		Size	Material
Top 56	Bottom 65	Ft.	#1	Sand
Top	Bottom	Ft.		
Top	Bottom	Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description
0	13	Clay
13	43	Sand
43	50	Clay
50	65	Granite

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Thomas L Burnett
SIGNATURE OF CERTIFIED WELL CONTRACTOR 1/7/11 DATE

Thomas Burnette
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit within 30 days of completion to: Division of Water Quality - Information Processing, 1617 Mail Service Center, Raleigh, NC 27699-161, Phone : (919) 807-6300

Form GW-1b
Rev. 2/09

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2277

1. WELL CONTRACTOR:
Thomas Burnette
Well Contractor (Individual) Name
A.E. Drilling Services, Inc.
Well Contractor Company Name
Two United Way
Street Address
Greenville SC 29607
City or Town State Zip Code
(864) 288-1986
Area code Phone number

2. WELL INFORMATION:
WELL CONSTRUCTION PERMIT#
OTHER ASSOCIATED PERMIT#(if applicable)
SITE WELL ID #(if applicable) AB-10S

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 11/19/10

4. WELL LOCATION:
253 Plant Allen Road, Belmont, NC 28012
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
CITY: Belmont COUNTY Gaston
TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
~ ~ ~ ~ ~ 35 ~ 0 ~ 0.0000 ~ ~ ~ OR 35.17570216 ~
~ ~ ~ ~ ~ 81 ~ 0 ~ 0.0000 ~ ~ ~ OR -81.0059476 ~
Latitude/longitude source: ☑ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)
Duke Energy Allen Steam St
Facility Name Facility ID# (if applicable)
253 Plant Allen Road
Street Address
Belmont NC 28012
City or Town State Zip Code
Ed Sullivan
Contact Name
P.O. Box 37929
Mailing Address
Charlotte NC 28237
City or Town State Zip Code
(980) 373-3719
Area code Phone number

6. WELL DETAILS:
a. **TOTAL DEPTH:** 18
b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☑
c. **WATER LEVEL** Below Top of Casing: 9.11 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 2.4 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. **YIELD (gpm):** N/M **METHOD OF TEST**
f. **DISINFECTION: Type** N/A **Amount**
g. **WATER ZONES** (depth):
Top Bottom Top Bottom
Top Bottom Top Bottom
Top Bottom Top Bottom

7. CASING:	Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 3	Ft.	2"	sch40	PVC
Top	Bottom	Ft.			
Top	Bottom	Ft.			

8. GROUT:	Depth		Material	Method
Top 0	Bottom 1	Ft.	Cement/	Tremie
Top 1	Bottom 2	Ft.	Bentonite	
Top	Bottom	Ft.		

9. SCREEN:	Depth		Diameter		Slot Size		Material
Top 3	Bottom 18	Ft.	2	in.	.010	in.	PVC
Top	Bottom	Ft.		in.		in.	
Top	Bottom	Ft.		in.		in.	

10. SAND/GRAVEL PACK:

	Depth		Size	Material
Top 2	Bottom 18	Ft.	#1	Sand
Top	Bottom	Ft.		
Top	Bottom	Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description
0	8	Silt
8	23	Clay
23	25	Sand

12. REMARKS:
Bentonite seal set between 2-1 feet

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN [illegible] WNER.

Thomas L Burnett
SIGNATURE OF CERTIFIED WELL CONTRACTOR 1/7/11 DATE

Thomas Burnette
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit within 30 days of completion to: Division of Water Quality - Information Processing, 1617 Mail Service Center, Raleigh, NC 27699-161, Phone : (919) 807-6300

Form GW-1b
Rev. 2/09

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2277

1. WELL CONTRACTOR:
Thomas Burnette
Well Contractor (Individual) Name
A.E. Drilling Services, Inc.
Well Contractor Company Name
Two United Way
Street Address
Greenville SC 29607
City or Town State Zip Code
(864) 288-1986
Area code Phone number

2. WELL INFORMATION:
WELL CONSTRUCTION PERMIT#
OTHER ASSOCIATED PERMIT#(if applicable)
SITE WELL ID #(if applicable) AB-11D

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 11/19/10

4. WELL LOCATION:
253 Plant Allen Road, Belmont, NC 28012
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
CITY: Belmont COUNTY Gaston
TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
~ ~ ~ ~ ~ 35 ~ 0 ~ 0.0000 ~ ~ ~ OR 35.17110334 ~
~ ~ ~ ~ ~ 81 ~ 0 ~ 0.0000 ~ ~ ~ OR -81.0110807 ~
Latitude/longitude source: ☑ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)
Duke Energy Allen Steam St
Facility Name Facility ID# (if applicable)
253 Plant Allen Road
Street Address
Belmont NC 28012
City or Town State Zip Code
Ed Sullivan
Contact Name
P.O. Box 37929
Mailing Address
Charlotte NC 28237
City or Town State Zip Code
(980) 373-3719
Area code Phone number

6. WELL DETAILS:
a. **TOTAL DEPTH:** 20.4
b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☑
c. **WATER LEVEL** Below Top of Casing: 10.26 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 2.7 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. **YIELD (gpm):** N/M **METHOD OF TEST**
f. **DISINFECTION: Type** N/A **Amount**
g. **WATER ZONES** (depth):
Top Bottom Top Bottom
Top Bottom Top Bottom
Top Bottom Top Bottom

7. CASING:	Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 15	Ft.	2"	sch40	PVC
Top	Bottom	Ft.			
Top	Bottom	Ft.			

8. GROUT:	Depth		Material	Method
Top 0	Bottom 11	Ft.	Cement/	Tremie
Top 11	Bottom 13	Ft.	Bentonite	
Top	Bottom	Ft.		

9. SCREEN:	Depth		Diameter	Slot Size	Material
Top 15	Bottom 20	Ft.	2 in.	.010 in.	PVC
Top	Bottom	Ft.	in.	in.	
Top	Bottom	Ft.	in.	in.	

10. SAND/GRAVEL PACK:

	Depth		Size	Material
Top 13	Bottom 25	Ft.	#1	Sand
Top	Bottom	Ft.		
Top	Bottom	Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description
0	10	Silt and Sand
10	25	Granite

12. REMARKS:
Bentonite seal set between 13-11 feet

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Thomas L Burnette
SIGNATURE OF CERTIFIED WELL CONTRACTOR 1/7/11 DATE

Thomas Burnette
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit within 30 days of completion to: Division of Water Quality - Information Processing, 1617 Mail Service Center, Raleigh, NC 27699-161, Phone : (919) 807-6300

Form GW-1b
Rev. 2/09

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2277

1. WELL CONTRACTOR:
Thomas Burnette
Well Contractor (Individual) Name
A.E. Drilling Services, Inc.
Well Contractor Company Name
Two United Way
Street Address
Greenville SC 29607
City or Town State Zip Code
(864) 288-1986
Area code Phone number

2. WELL INFORMATION:
WELL CONSTRUCTION PERMIT#
OTHER ASSOCIATED PERMIT#(if applicable)
SITE WELL ID #(if applicable) AB-12D

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 11/30/10

4. WELL LOCATION:
253 Plant Allen Road, Belmont, NC 28012
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
CITY: Belmont COUNTY Gaston
TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
~ ~ ~ ~ ~ 35 ~ 0 ~ 0.0000 ~ ~ ~ OR 35.17352860 ~
~ ~ ~ ~ ~ 81 ~ 0 ~ 0.0000 ~ ~ ~ OR -81.0195541 ~
Latitude/longitude source: ☑ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)
Duke Energy Allen Steam St
Facility Name Facility ID# (if applicable)
253 Plant Allen Road
Street Address
Belmont NC 28012
City or Town State Zip Code
Ed Sullivan
Contact Name
P.O. Box 37929
Mailing Address
Charlotte NC 28237
City or Town State Zip Code
(980) 373-3719
Area code Phone number

6. WELL DETAILS:
a. **TOTAL DEPTH:** 96
b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☑
c. **WATER LEVEL** Below Top of Casing: 14.01 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 2.04 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. **YIELD (gpm):** N/M **METHOD OF TEST**
f. **DISINFECTION: Type** N/A **Amount**
g. **WATER ZONES** (depth):
Top Bottom Top Bottom
Top Bottom Top Bottom
Top Bottom Top Bottom

7. CASING:	Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 91	Ft.	2"	sch40	PVC
Top	Bottom	Ft.			
Top	Bottom	Ft.			

8. GROUT:	Depth		Material	Method
Top 0	Bottom 89	Ft.	Cement/	Tremie
Top 89	Bottom 90	Ft.	Bentonite	
Top	Bottom	Ft.		

9. SCREEN:	Depth		Diameter	Slot Size	Material
Top 91	Bottom 96	Ft.	2 in.	.010 in.	PVC
Top	Bottom	Ft.	in.	in.	
Top	Bottom	Ft.	in.	in.	

10. SAND/GRAVEL PACK:

	Depth		Size	Material
Top 90	Bottom 104	Ft.	#1	Sand
Top	Bottom	Ft.		
Top	Bottom	Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description
0	58	Silt
58	83	Weathered Rock
83	94	Silt
94	104	Quartz Diorite/Gabbro

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Thomas L Burnette
SIGNATURE OF CERTIFIED WELL CONTRACTOR 1/7/11 DATE

Thomas Burnette
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit within 30 days of completion to: Division of Water Quality - Information Processing, 1617 Mail Service Center, Raleigh, NC 27699-161, Phone : (919) 807-6300

Form GW-1b
Rev. 2/09

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2277

1. WELL CONTRACTOR:
Thomas Burnette
Well Contractor (Individual) Name
A.E. Drilling Services, Inc.
Well Contractor Company Name
Two United Way
Street Address
Greenville SC 29607
City or Town State Zip Code
(864) 288-1986
Area code Phone number

2. WELL INFORMATION:
WELL CONSTRUCTION PERMIT#
OTHER ASSOCIATED PERMIT#(if applicable)
SITE WELL ID #(if applicable) AB-12S

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 12/2/10

4. WELL LOCATION:
253 Plant Allen Road, Blemont, NC 28012
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
CITY: Belmont COUNTY Gaston
TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
~ ~ ~ ~ ~ 35 ~ 0 ~ 0.0000 ~ ~ ~ OR 35.17367812 ~
~ ~ ~ ~ ~ 81 ~ 0 ~ 0.0000 ~ ~ ~ OR -81.0195782 ~
Latitude/longitude source: ☑ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)
Duke Energy Allen Steam St
Facility Name Facility ID# (if applicable)
253 Plant Allen Road
Street Address
Belmont NC 28012
City or Town State Zip Code
Ed Sullivan
Contact Name
P.O. Box 37929
Mailing Address
Charlotte NC 28237
City or Town State Zip Code
(980 6 373-3719
Area code Phone number

6. WELL DETAILS:
a. **TOTAL DEPTH:** 23
b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☑
c. **WATER LEVEL** Below Top of Casing: 15.63 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 2.1 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. **YIELD (gpm):** N/M **METHOD OF TEST**
f. **DISINFECTION: Type** N/A **Amount**
g. **WATER ZONES** (depth):
Top Bottom Top Bottom
Top Bottom Top Bottom
Top Bottom Top Bottom

7. CASING:	Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 8	Ft.	2"	sch40	PVC
Top	Bottom	Ft.			
Top	Bottom	Ft.			

8. GROUT:	Depth		Material	Method
Top 0	Bottom 6	Ft.	Cement/	Tremie
Top 6	Bottom 7	Ft.	Bentonite	
Top	Bottom	Ft.		

9. SCREEN:	Depth		Diameter		Slot Size		Material
Top 8	Bottom 23	Ft.	2	in.	.010	in.	PVC
Top	Bottom	Ft.		in.		in.	
Top	Bottom	Ft.		in.		in.	

10. SAND/GRAVEL PACK:

	Depth		Size	Material
Top 7	Bottom 29	Ft.	#1	Sand
Top	Bottom	Ft.		
Top	Bottom	Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description
0	29	Silt

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Thomas L Burnette
SIGNATURE OF CERTIFIED WELL CONTRACTOR 1/7/11 DATE

Thomas Burnette
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit within 30 days of completion to: Division of Water Quality - Information Processing, 1617 Mail Service Center, Raleigh, NC 27699-161, Phone : (919) 807-6300

Form GW-1b
Rev. 2/09

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2277

1. WELL CONTRACTOR:
Thomas Burnette
Well Contractor (Individual) Name
A.E. Drilling Services, Inc.
Well Contractor Company Name
Two United Way
Street Address
Greenville SC 29607
City or Town State Zip Code
(864) 288-1986
Area code Phone number

2. WELL INFORMATION:
WELL CONSTRUCTION PERMIT#
OTHER ASSOCIATED PERMIT#(if applicable)
SITE WELL ID #(if applicable) AB-13D

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 12/1/10

4. WELL LOCATION:
253 Plant Allen Road, Belmont, NC 28012
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
CITY: Belmont COUNTY Gaston
TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
~ ~ ~ ~ ~ 35 ~ 0 ~ 0.0000 ~ ~ ~ OR 35.17894216 ~
~ ~ ~ ~ ~ 81 ~ 0 ~ 0.0000 ~ ~ ~ OR -81.0165161 ~
Latitude/longitude source: ☑ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)
Duke Energy Allen Steam St
Facility Name Facility ID# (if applicable)
253 Plant Allen Road
Street Address
Belmont NC 28012
City or Town State Zip Code
Ed Sullivan
Contact Name
P.O. Box 37929
Mailing Address
Charlotte NC 28237
City or Town State Zip Code
(980 6 373-3719
Area code Phone number

6. WELL DETAILS:
a. **TOTAL DEPTH:** 72
b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☑
c. **WATER LEVEL** Below Top of Casing: 13.54 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 2.7 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. **YIELD (gpm):** N/M **METHOD OF TEST**
f. **DISINFECTION: Type** N/A **Amount**
g. **WATER ZONES** (depth):
Top Bottom Top Bottom
Top Bottom Top Bottom
Top Bottom Top Bottom

7. CASING:	Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 67	Ft.	2"	sch40	PVC
Top	Bottom	Ft.			
Top	Bottom	Ft.			

8. GROUT:	Depth		Material	Method
Top 0	Bottom 64	Ft.	Cement/	Tremie
Top 64	Bottom 65	Ft.	Bentonite	
Top	Bottom	Ft.		

9. SCREEN:	Depth		Diameter	Slot Size	Material
Top 67	Bottom 72	Ft.	2 in.	.010 in.	PVC
Top	Bottom	Ft.	in.	in.	
Top	Bottom	Ft.	in.	in.	

10. SAND/GRAVEL PACK:

	Depth		Size	Material
Top 65	Bottom 86	Ft.	#1	Sand
Top	Bottom	Ft.		
Top	Bottom	Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description
0	23	Clayey Silt
23	28	Weathered Rock
28	63	Saprolite Silt
63	86	Gabbro

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Thomas L Burnett
SIGNATURE OF CERTIFIED WELL CONTRACTOR 1/7/11 DATE

Thomas Burnette
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit within 30 days of completion to: Division of Water Quality - Information Processing, 1617 Mail Service Center, Raleigh, NC 27699-161, Phone : (919) 807-6300

Form GW-1b
Rev. 2/09

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2277

1. WELL CONTRACTOR:
Thomas Burnette
Well Contractor (Individual) Name
A.E. Drilling Services, Inc.
Well Contractor Company Name
Two United Way
Street Address
Greenville SC 29607
City or Town State Zip Code
(864) 288-1986
Area code Phone number

2. WELL INFORMATION:
WELL CONSTRUCTION PERMIT#
OTHER ASSOCIATED PERMIT#(if applicable)
SITE WELL ID #(if applicable) AB-13S

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 12/2/10

4. WELL LOCATION:
253 Plant Allen Road, Belmont, NC 28012
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
CITY: Belmont COUNTY Gaston
TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
~ ~ ~ ~ ~ 35 ~ ~ 0.0000 ~ ~ ~ **OR** 35.17896038 ~
~ ~ ~ ~ ~ 81 ~ ~ ~ ~ ~ ~ **OR** -81.0164947 ~
Latitude/longitude source: ☑ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)
Duke Energy Allen Steam St
Facility Name Facility ID# (if applicable)
253 Plant Allen Road
Street Address
Belmont NC 28012
City or Town State Zip Code
Ed Sullivan
Contact Name
P.O. Box 37929
Mailing Address
Charlotte NC 28237
City or Town State Zip Code
(980) 373-3719
Area code Phone number

6. WELL DETAILS:
a. **TOTAL DEPTH:** 21
b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☑
c. **WATER LEVEL** Below Top of Casing: 13.91 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 2.7 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. **YIELD (gpm):** N/M **METHOD OF TEST**
f. **DISINFECTION: Type** N/A **Amount**
g. **WATER ZONES** (depth):
Top Bottom Top Bottom
Top Bottom Top Bottom
Top Bottom Top Bottom

7. CASING:	Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 6	Ft.	2"	sch40	PVC
Top	Bottom	Ft.			
Top	Bottom	Ft.			

8. GROUT:	Depth		Material	Method
Top 0	Bottom 4	Ft.	Cement/	Tremie
Top 4	Bottom 5	Ft.	Bentonite	
Top	Bottom	Ft.		

9. SCREEN:	Depth		Diameter	Slot Size	Material
Top 6	Bottom 21	Ft.	2 in.	.010 in.	PVC
Top	Bottom	Ft.	in.	in.	
Top	Bottom	Ft.	in.	in.	

10. SAND/GRAVEL PACK:	Depth		Size	Material
Top 5	Bottom 28	Ft.	#1	Sand
Top	Bottom	Ft.		
Top	Bottom	Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description
0	28	Clayey Silt

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Thomas L Burnette
SIGNATURE OF CERTIFIED WELL CONTRACTOR 1/7/11 DATE

Thomas Burnette
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit within 30 days of completion to: Division of Water Quality - Information Processing, 1617 Mail Service Center, Raleigh, NC 27699-161, Phone : (919) 807-6300

Form GW-1b
Rev. 2/09

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2277

1. WELL CONTRACTOR:
Thomas Burnette
Well Contractor (Individual) Name
A.E. Drilling Services, Inc.
Well Contractor Company Name
Two United Way
Street Address
Greenville SC 29607
City or Town State Zip Code
(864) 288-1986
Area code Phone number

2. WELL INFORMATION:
WELL CONSTRUCTION PERMIT#
OTHER ASSOCIATED PERMIT#(if applicable)
SITE WELL ID #(if applicable) AB-14D

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 11/22/10

4. WELL LOCATION:
253 Plant Allen Road, Belmont, NC 28012
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
CITY: Belmont COUNTY Gaston
TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☐ Flat ☐ Ridge ☐ Other
~ ~ ~ ~ ~ 35 ~ 0 ~ 0.0000 ~ ~ ~ OR 35.18173666 ~
~ ~ ~ ~ ~ 81 ~ 0 ~ 0.0000 ~ ~ ~ OR -81.0191579 ~
Latitude/longitude source: ☑ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map andattached to this form if not using GPS)

5. FACILITY (Name of the business where the well is located.)
Duke Energy Allen Steam St
Facility Name Facility ID# (if applicable)
253 Plant Allen Road
Street Address
Belmont NC 28012
City or Town State Zip Code
Ed Sullivan
Contact Name
P.O. Box 37929
Mailing Address
Charlotte NC 28237
City or Town State Zip Code
(980) 373-3719
Area code Phone number

6. WELL DETAILS:
a. **TOTAL DEPTH:** 29.6
b. **DOES WELL REPLACE EXISTING WELL?** YES ☐ NO ☑
c. **WATER LEVEL** Below Top of Casing: 17.01 FT.
(Use "+" if Above Top of Casing)

d. **TOP OF CASING IS** 2.4 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.
e. **YIELD (gpm):** N/M **METHOD OF TEST**
f. **DISINFECTION: Type** N/A **Amount**
g. **WATER ZONES** (depth):
Top Bottom Top Bottom
Top Bottom Top Bottom
Top Bottom Top Bottom

7. CASING:	Depth		Diameter	Thickness/ Weight	Material
Top 0	Bottom 19.3	Ft.	2"	sch40	PVC
Top	Bottom	Ft.			
Top	Bottom	Ft.			

8. GROUT:	Depth		Material	Method
Top 0	Bottom 16.5	Ft.	Cement/	Tremie
Top 16.5	Bottom 18	Ft.	Bentonite	
Top	Bottom	Ft.		

9. SCREEN:	Depth		Diameter		Slot Size		Material
Top 19.3	Bottom 29.3	Ft.	2	in.	.010	in.	PVC
Top	Bottom	Ft.		in.		in.	
Top	Bottom	Ft.		in.		in.	

10. SAND/GRAVEL PACK:

	Depth		Size	Material
Top 18	Bottom 33.5	Ft.	#1	Sand
Top	Bottom	Ft.		
Top	Bottom	Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description
0	8	Sandy Silt
8	13	Sand
13	16	Quartzite
16	28	Sand with Quartzite
28	33.5	Granite

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Thomas L Burnett
SIGNATURE OF CERTIFIED WELL CONTRACTOR 1/7/11 DATE

Thomas Burnette
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit within 30 days of completion to: Division of Water Quality - Information Processing, 1617 Mail Service Center, Raleigh, NC 27699-161, Phone : (919) 807-6300

Form GW-1b
Rev. 2/09

APPENDIX D

MONITORING WELL DEVELOPMENT RECORDS

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.

MONITORING WELL SAMPLING FIELD DATA WORKSHEET

MACTEC PROJECT NUMBER 6228-10-5284 MONITORING WELL NUMBER AB-9S

SITE NAME Duke Plant Allen DATE 11-18-10 TIME OF SAMPLE N/A

FIELD PERSONNEL Gary Winbourn WEATHER CONDITIONS _____

TOTAL WELL DEPTH (TWD) _____ FT. (measured / well tag / drillers log – **circle one**)

SCREENED INTERVAL 5.5 to 20.5' MEASURING POINT FOR DEPTH Top of casing

DEPTH TO GROUNDWATER (DGW) _____

LENGTH OF WATER COLUMN (LWC) = TWD – DGW = _____

CASING DIAMETER 2 IN.

ONE STANDING WELL VOLUME = _____ gal.

(NOTE ½" = 0.0102G/FT: ¾" = 0.023 G/FT: 1"= 0.041G/FT: 2" = 0.163 G/FT: 4" = 0.653 G/FT: 6" = 1.46 G/FT)

THREE STANDING WELL VOLUMES = _____ FIVE STANDING WELL VOLUMES = _____

METHOD OF WELL EVACUATION: BAILER / (PUMP) / OTHER: TYPE _____

TOTAL VOLUME OF WATER REMOVED: _____ GAL.

WELL TYPE: FLUSH MOUNT / (ABOVE GRADE)

LOCKING CAP YES _____ NO _____

PROTECTIVE POST/ABUTMENT YES _____ NO _____

NONPOTABLE LABEL YES _____ NO _____

ID PLATE YES _____ NO _____

WELL INTEGRITY SATISFACTORY YES ✓ NO _____

WELL YIELD LOW _____ MODERATE _____ HIGH _____

COMMENTS Began pumping 1:10 at 0.33 gpm went To lunch. Pumped dry 2:00 5+ gallons pumped

Time	Volume	pH	Temp (°C)	Cond. (µS/cm)	Dis. O_2 (mg/L)	Turbidity (NTU)	ORP (mV)	Notes
3:00	7+	6.04	18.2	.154		230		
3:30	9+	5.83	18.3	.119		57		

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.

MONITORING WELL SAMPLING FIELD DATA WORKSHEET

MACTEC PROJECT NUMBER 6228-10-5284 MONITORING WELL NUMBER AB-9D

SITE NAME Duke Plant Allen DATE 11/18/10 TIME OF SAMPLE _____

FIELD PERSONNEL Gary Winbourn WEATHER CONDITIONS _____

TOTAL WELL DEPTH (TWD) _____ FT. (measured / well tag / drillers log – **circle one**)

SCREENED INTERVAL _____ MEASURING POINT FOR DEPTH _____

DEPTH TO GROUNDWATER (DGW) _____

LENGTH OF WATER COLUMN (LWC) = TWD – DGW = _____

CASING DIAMETER _____ IN.

ONE STANDING WELL VOLUME = _____ gal.

(NOTE ½" = 0.0102G/FT: ¾" = 0.023 G/FT: 1"= 0.041G/FT: 2" = 0.163 G/FT: 4" = 0.653 G/FT: 6" = 1.46 G/FT)

THREE STANDING WELL VOLUMES = _____ FIVE STANDING WELL VOLUMES = _____

METHOD OF WELL EVACUATION: BAILER / PUMP / OTHER: TYPE _____

TOTAL VOLUME OF WATER REMOVED: _____ GAL.

WELL TYPE: FLUSH MOUNT / ABOVE GRADE

LOCKING CAP YES _____ NO _____

PROTECTIVE POST/ABUTMENT YES _____ NO _____

NONPOTABLE LABEL YES _____ NO _____

ID PLATE YES _____ NO _____

WELL INTEGRITY SATISFACTORY YES _____ NO _____

WELL YIELD LOW _____ MODERATE _____ HIGH _____

COMMENTS Began pumping 10:55 at 0.75 GPM

Time	Volume	pH	Temp (°C)	Cond. (µS/cm)	Dis. O_2 (mg/L)	Turbidity (NTU)	ORP (mV)	Notes
12:30	67	7.25	20.4	.234		53		
12:45	78	7.21	20.1	.233		132		
1:00	90	7.21	20.1	.232		28		

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.

MONITORING WELL SAMPLING FIELD DATA WORKSHEET

MACTEC PROJECT NUMBER 6228-10-5284 MONITORING WELL NUMBER AB-10S

SITE NAME Plant Allen DATE 11-19-10 TIME OF SAMPLE _____

FIELD PERSONNEL Gary Windown WEATHER CONDITIONS _____

TOTAL WELL DEPTH (TWD) _____ FT. (measured / well tag / drillers log – **circle one**)

SCREENED INTERVAL _____ MEASURING POINT FOR DEPTH _____

DEPTH TO GROUNDWATER (DGW) _____

LENGTH OF WATER COLUMN (LWC) = TWD – DGW = _____

CASING DIAMETER _____ IN.

ONE STANDING WELL VOLUME = _____ gal.

(NOTE ½" = 0.0102G/FT: ¾" = 0.023 G/FT: 1"= 0.041G/FT: 2" = 0.163 G/FT: 4" = 0.653 G/FT: 6" = 1.46 G/FT)

THREE STANDING WELL VOLUMES = _____ FIVE STANDING WELL VOLUMES = _____

METHOD OF WELL EVACUATION: BAILER / PUMP / OTHER: TYPE _____

TOTAL VOLUME OF WATER REMOVED: _____ GAL.

WELL TYPE: FLUSH MOUNT / ABOVE GRADE COMMENTS _____

LOCKING CAP YES _____ NO _____ _____

PROTECTIVE POST/ABUTMENT YES _____ NO _____ _____

NONPOTABLE LABEL YES _____ NO _____ _____

ID PLATE YES _____ NO _____ _____

WELL INTEGRITY SATISFACTORY YES _____ NO _____ _____

WELL YIELD LOW _____ MODERATE _____ HIGH _____

Time	Volume	pH	Temp (°C)	Cond. (µS/cm)	Dis. O_2 (mg/L)	Turbidity (NTU)	ORP (mV)	Notes
10:20	20	6.37	16.4	.141		480		
11:20	40	6.30	16.9	.153		88		
12:20	60	6.34	17.6	.154		84		
1:10	104	6.30	17.7	.155		1		

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.

MONITORING WELL SAMPLING FIELD DATA WORKSHEET

MACTEC PROJECT NUMBER 6228-10-5284 MONITORING WELL NUMBER AB-10D

SITE NAME Plant Allen DATE 11-19-10 TIME OF SAMPLE _____

FIELD PERSONNEL _____ WEATHER CONDITIONS _____

TOTAL WELL DEPTH (TWD) _____ FT. (measured / well tag / drillers log – **circle one**)

SCREENED INTERVAL _____ MEASURING POINT FOR DEPTH _____

DEPTH TO GROUNDWATER (DGW) _____

LENGTH OF WATER COLUMN (LWC) = TWD – DGW = _____

CASING DIAMETER _____ IN.

ONE STANDING WELL VOLUME = _____ gal.

(NOTE ½" = 0.0102G/FT: ¾" = 0.023 G/FT: 1"= 0.041G/FT: 2" = 0.163 G/FT: 4" = 0.653 G/FT: 6" = 1.46 G/FT)

THREE STANDING WELL VOLUMES = _____ FIVE STANDING WELL VOLUMES = _____

METHOD OF WELL EVACUATION: BAILER / PUMP / OTHER: TYPE _____

TOTAL VOLUME OF WATER REMOVED: _____ GAL.

WELL TYPE: FLUSH MOUNT / ABOVE GRADE COMMENTS _____

LOCKING CAP YES _____ NO _____ _____

PROTECTIVE POST/ABUTMENT YES _____ NO _____ _____

NONPOTABLE LABEL YES _____ NO _____ _____

ID PLATE YES _____ NO _____ _____

WELL INTEGRITY SATISFACTORY YES _____ NO _____ _____

WELL YIELD LOW _____ MODERATE _____ HIGH _____

Time	Volume	pH	Temp (°C)	Cond. (µS/cm)	Dis. O_2 (mg/L)	Turbidity (NTU)	ORP (mV)	Notes
9:00	70	6.40	15.9			584		
9:15	85	6.41	16.3			129		
10:00	107.5	6.42	16.3			51		
10:30	—	—	—			—		
11:00	152.5	6.42	16.3			44		

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.

MONITORING WELL SAMPLING FIELD DATA WORKSHEET

MACTEC PROJECT NUMBER 6228-10-5284 MONITORING WELL NUMBER AB-11D

SITE NAME Duke Plant Allen DATE 11-23-10 TIME OF SAMPLE _____

FIELD PERSONNEL Gary Winbourn WEATHER CONDITIONS _____

TOTAL WELL DEPTH (TWD) _____ FT. (measured / well tag / drillers log – **circle one**)

SCREENED INTERVAL _____ MEASURING POINT FOR DEPTH _____

DEPTH TO GROUNDWATER (DGW) _____

LENGTH OF WATER COLUMN (LWC) = TWD – DGW = _____

CASING DIAMETER _____ IN.

ONE STANDING WELL VOLUME = _____ gal.

(NOTE ½" = 0.0102G/FT: ¾" = 0.023 G/FT: 1"= 0.041G/FT: 2" = 0.163 G/FT: 4" = 0.653 G/FT: 6" = 1.46 G/FT)

THREE STANDING WELL VOLUMES = _____ FIVE STANDING WELL VOLUMES = _____

METHOD OF WELL EVACUATION: BAILER / PUMP / OTHER: TYPE _____

TOTAL VOLUME OF WATER REMOVED: _____ GAL.

WELL TYPE: FLUSH MOUNT / ABOVE GRADE

LOCKING CAP YES _____ NO _____

PROTECTIVE POST/ABUTMENT YES _____ NO _____

NONPOTABLE LABEL YES _____ NO _____

ID PLATE YES _____ NO _____

WELL INTEGRITY SATISFACTORY YES _____ NO _____

WELL YIELD LOW _____ MODERATE _____ HIGH _____

COMMENTS Began pumping 8:00 at 0.33 GPM went dry after 2 gallons Pumped dry after 2 gallons 5 more times

Time	Volume	pH	Temp (°C)	Cond. (µS/cm)	Dis. O_2 (mg/L)	Turbidity (NTU)	ORP (mV)	Notes

A E DRILLING SERVICES, LLC

Plant Allen Well Development Records

12/2/2010
Pumped 5 gallons out of each before taking readings

Well ID	Time	Gal.	Ph	Cond	Turb	Temp
AB- 13D	10:10	5	61.68	0.195	822	15.0°
	10:15	10	6.31	0.103	312	15.3°
	10:20	15	6.71	0.113	124	14.9°
	10:25	20	6.56	0.113	118	15.6°
	10:30	25	6.58	0.118	0.67	14.9°
	10:35	30	6.79	0.124	68	15.6°
	10:40	40	6.62	0.127	40	15.4°
	10:45	50	6.55	0.134	0.41	15.6°
AB- 13S	10:15	5	5.73	0.109	102	14.6°
	10:24	10	6.56	0.097	125	14.7°
	10:35	15	6.73	0.095	100	14.5°
	10:45	20	6.59	0.089	90	15.5°
	10:55	25	6.51	0.109	95	15.4°
	11:05	30	6.46	0.119	80	15.6°
	11:15	35	6.57	0.117	70	15.3°
	11:20	40	5.77	0.076	0.55	15.8°
	12:30	55	5.89	0.08	43	15.9°
	12:35	60	5.79	0.091	35	15.7°

12/3/2010
AB- 12D 40 gallons pumped
Meter stopped working
Pumped wells till they were clear

12/5/2010

AB- 12S	7:30	10	5.75	0.089	150	15.7°
	7:40	15	6.08	0.011	75	15.1°
	7:50	20	6.17	0.075	61	14.9°
	8:00	25	6.21	0.048	47	14.9°
	8:10	30				

Two United Way * Greenville, SC 29607 * Ph: 864-288-1986 * Fx: 864-288-2272 * www.aedrilling.com

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.

MONITORING WELL SAMPLING FIELD DATA WORKSHEET

MACTEC PROJECT NUMBER 6228-10-5284 MONITORING WELL NUMBER AB-14D

SITE NAME Duke Plant Allen DATE 1-23-10 TIME OF SAMPLE N/A

FIELD PERSONNEL Gary Winbourn WEATHER CONDITIONS _____

TOTAL WELL DEPTH (TWD) _____ FT. (measured / well tag / drillers log – **circle one**)

SCREENED INTERVAL _____ MEASURING POINT FOR DEPTH _____

DEPTH TO GROUNDWATER (DGW) _____

LENGTH OF WATER COLUMN (LWC) = TWD – DGW = _____

CASING DIAMETER _____ IN.

ONE STANDING WELL VOLUME = _____ gal.

(NOTE ½" = 0.0102G/FT: ¾" = 0.023 G/FT: 1"= 0.041G/FT: 2" = 0.163 G/FT: 4" = 0.653 G/FT: 6" = 1.46 G/FT)

THREE STANDING WELL VOLUMES = _____ FIVE STANDING WELL VOLUMES = _____

METHOD OF WELL EVACUATION: BAILER / PUMP / OTHER: TYPE _____

TOTAL VOLUME OF WATER REMOVED: _____ GAL.

WELL TYPE: FLUSH MOUNT / ABOVE GRADE

LOCKING CAP YES _____ NO _____

PROTECTIVE POST/ABUTMENT YES _____ NO _____

NONPOTABLE LABEL YES _____ NO _____

ID PLATE YES _____ NO _____

WELL INTEGRITY SATISFACTORY YES _____ NO _____

WELL YIELD LOW _____ MODERATE _____ HIGH _____

COMMENTS 1-23-10 Began pumping with Waterra 2:55 at 0.33 gpm
1-24-10 Began pumping with Whale pump 8:15 at 1.25 gpm

Time	Volume	pH	Temp (°C)	Cond. (µS/cm)	Dis. O_2 (mg/L)	Turbidity (NTU)	ORP (mV)	Notes
3:05	5	6.56	18.4	.152		—		
3:35	16	6.29	17.8	.160		—		
4:05	25	6.14	17.7	.140		85		
1/24 8:30	39	6.05	15.9	.136		2		
9:15	95	5.96	15.8	.134		0		

APPENDIX E
PHOTOGRAPHS OF COMPLETED WELL PAIRS

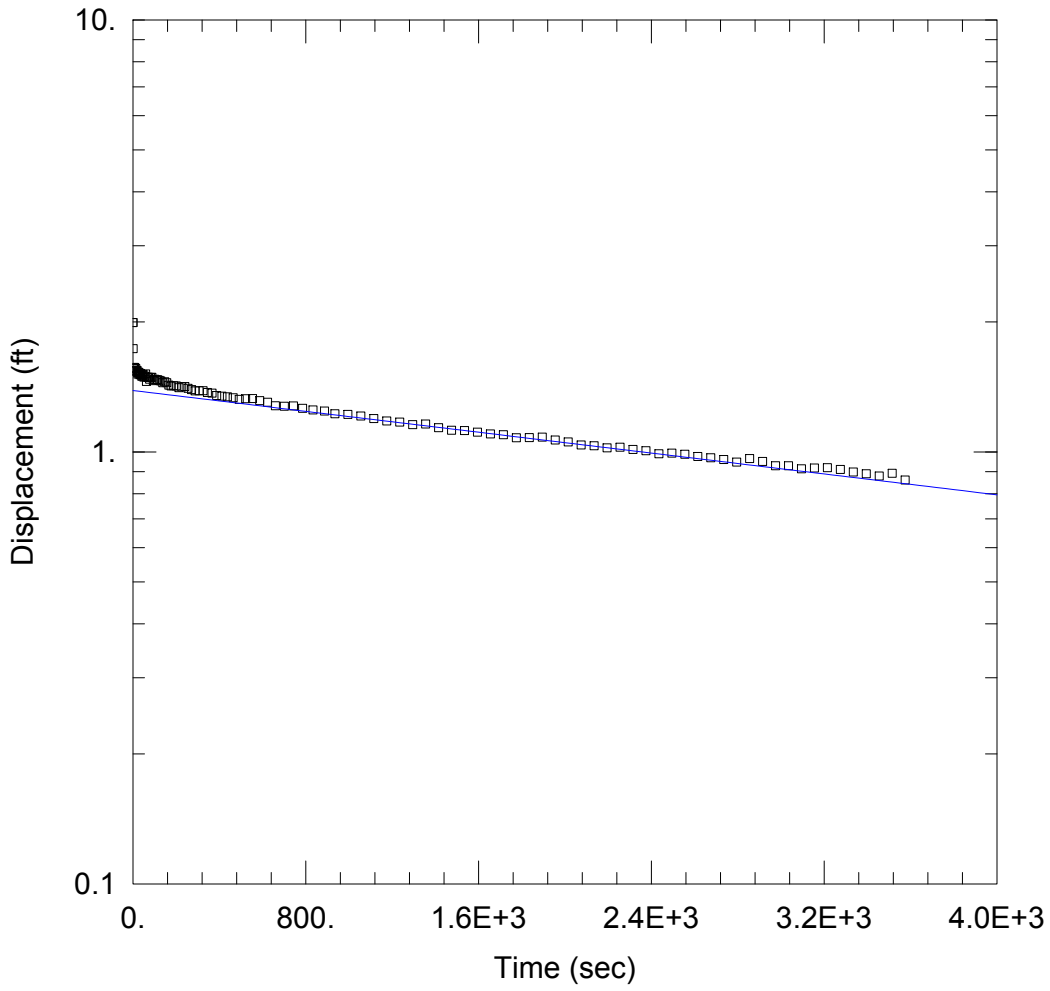
Photograph 1: Well pair MW-9S and MW9D.

Photograph 2: Well Pair MW-12S and MW-12D.

Photograph 3: Well pair MW-13S and MW-13D.

Photograph 4: Well MW-14D.

APPENDIX F
SLUG TEST DATA



AB-9S RISING HEAD TEST

PROJECT INFORMATION

Company: MACTEC
Client: Duke Energy
Project: 6228-10-5284
Location: Allen Steam Station
Test Well: AB-9S
Test Date: 12/2/10

AQUIFER DATA

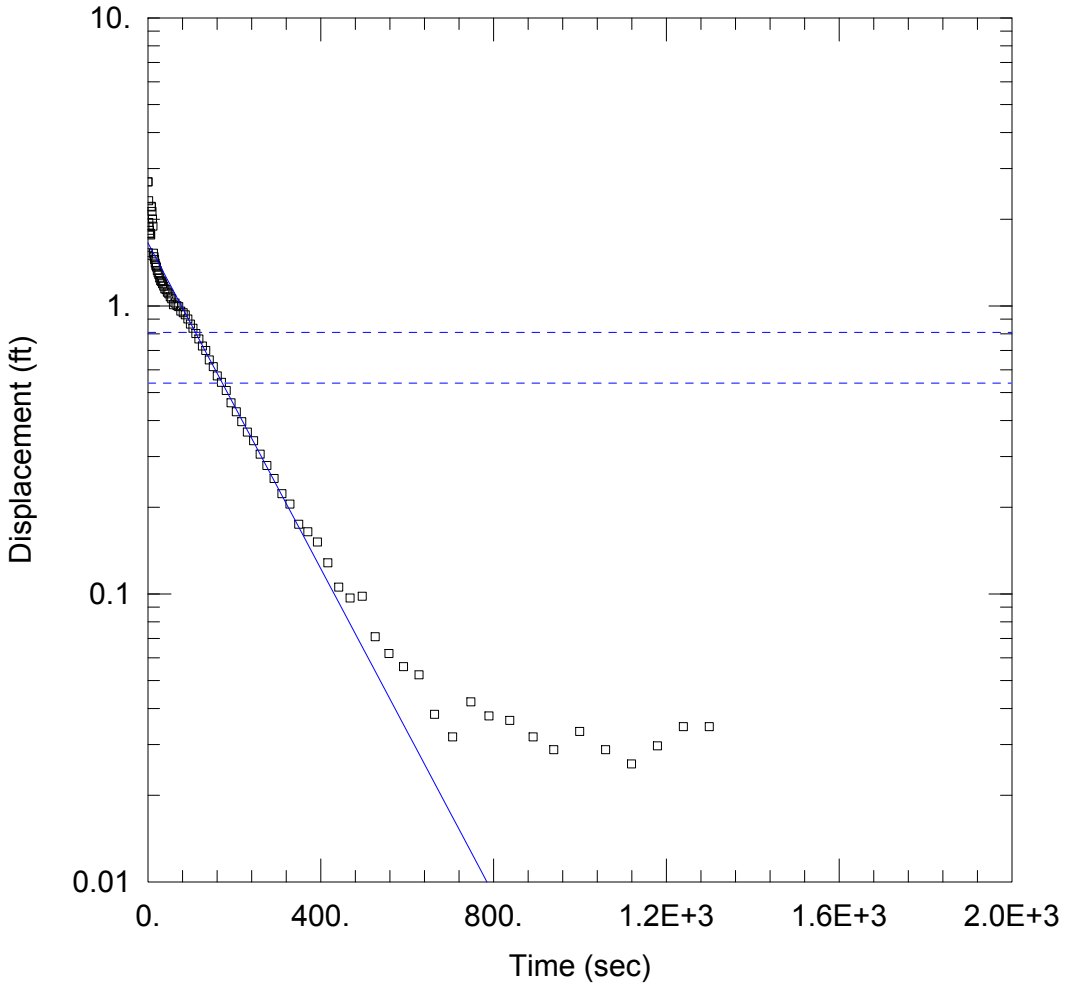
Saturated Thickness: 16.25 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AB-9S)

Initial Displacement: 1.993 ft
Total Well Penetration Depth: 8.25 ft
Casing Radius: 0.083 ft
Static Water Column Height: 8.25 ft
Screen Length: 8.25 ft
Well Radius: 0.34 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 3.164E-6 cm/sec
y0 = 1.387 ft



AB-13S RISING HEAD TEST

PROJECT INFORMATION

Company: MACTEC
Client: Duke Energy
Project: 6228-10-5284
Location: Allen Steam Station
Test Well: AB-13S
Test Date: 12/3/10

AQUIFER DATA

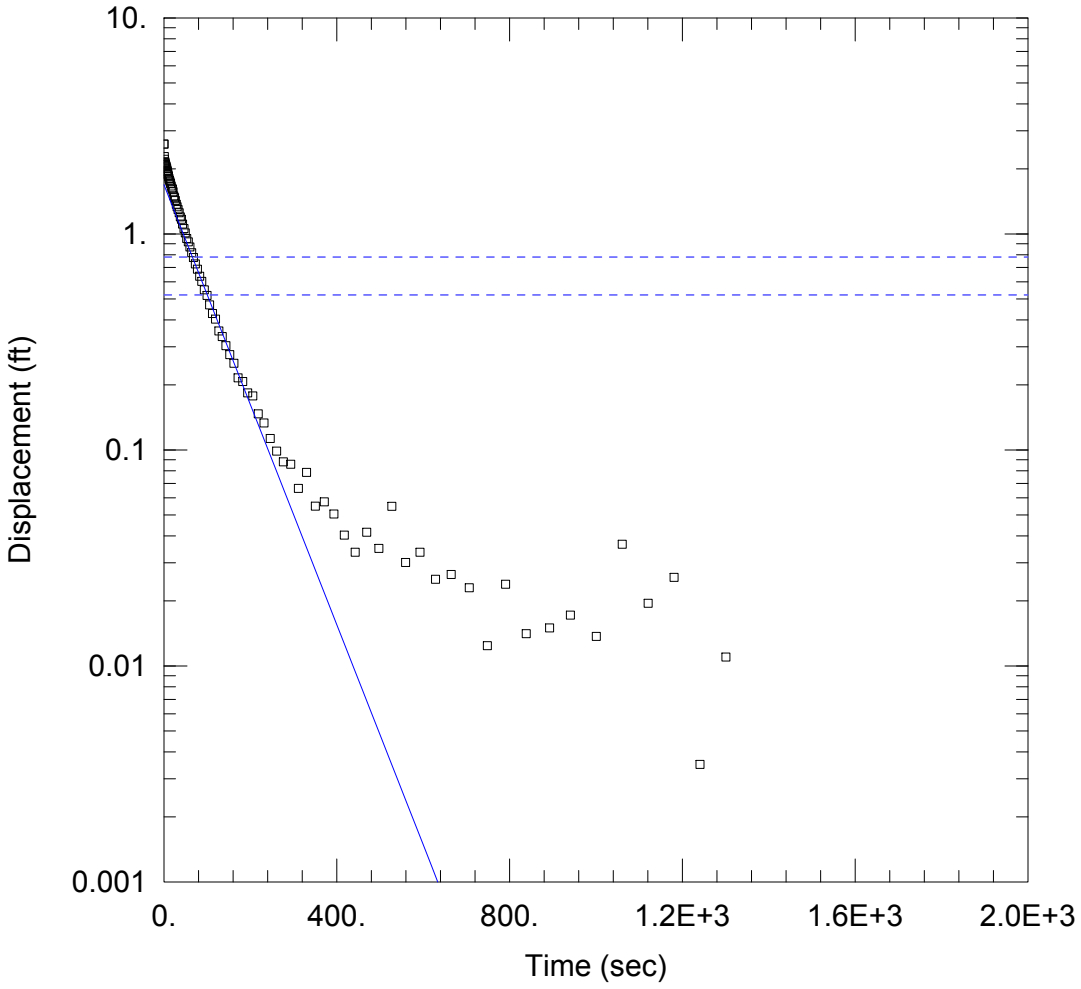
Saturated Thickness: 7.09 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AB-13S)

Initial Displacement: 2.697 ft
Total Well Penetration Depth: 7.09 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 7.09 ft
Screen Length: 7.09 ft
Well Radius: 0.34 ft

SOLUTION

Aquifer Model: Unconfined
K = 0.0001908 cm/sec
Solution Method: Bouwer-Rice
y0 = 1.654 ft



AB-13D RISING HEAD TEST

PROJECT INFORMATION

Company: MACTEC
Client: Duke Energy
Project: 6228-10-5284
Location: Allen Steam Station
Test Well: AB-13D
Test Date: 12/3/10

AQUIFER DATA

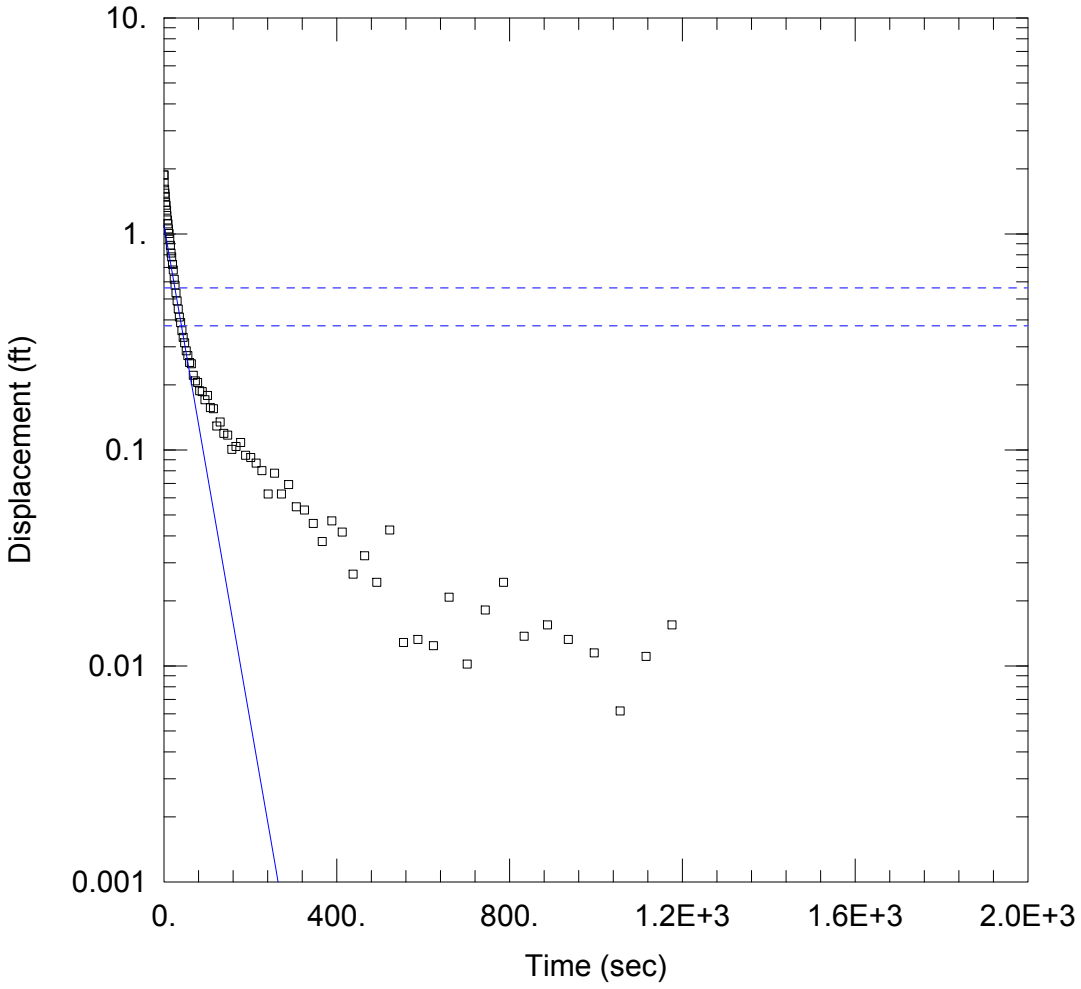
Saturated Thickness: 58.46 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AB-13D)

Initial Displacement: 2.606 ft
Total Well Penetration Depth: 56.46 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 58.46 ft
Screen Length: 5. ft
Well Radius: 0.16 ft

SOLUTION

Aquifer Model: Confined
K = 0.0007202 cm/sec
Solution Method: Bouwer-Rice
y0 = 1.689 ft



AB-12S RISING HEAD TEST

PROJECT INFORMATION

Company: MACTEC
Client: Duke Energy
Project: 6228-10-5284
Location: Allen Steam Station
Test Well: AB-12S
Test Date: 12/2/10

AQUIFER DATA

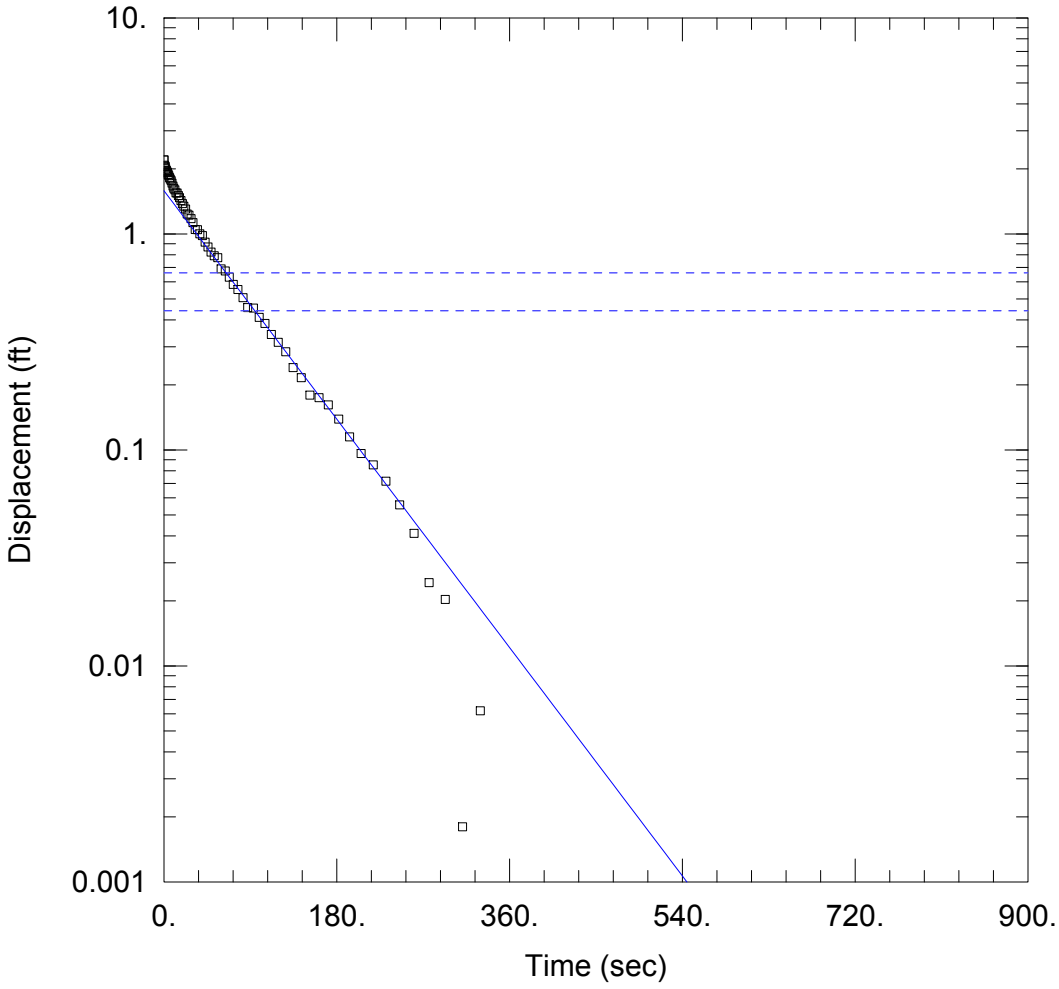
Saturated Thickness: 7.37 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AB-12S)

Initial Displacement: 1.875 ft
Total Well Penetration Depth: 7.37 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 7.37 ft
Screen Length: 7.37 ft
Well Radius: 0.34 ft

SOLUTION

Aquifer Model: Unconfined
K = 0.0007576 cm/sec
Solution Method: Bouwer-Rice
y0 = 1.094 ft



AB-12D RISING HEAD TEST

PROJECT INFORMATION

Company: MACTEC
Client: Duke Energy
Project: 6228-10-5284
Location: Allen Steam Station
Test Well: AB-12D
Test Date: 12/3/10

AQUIFER DATA

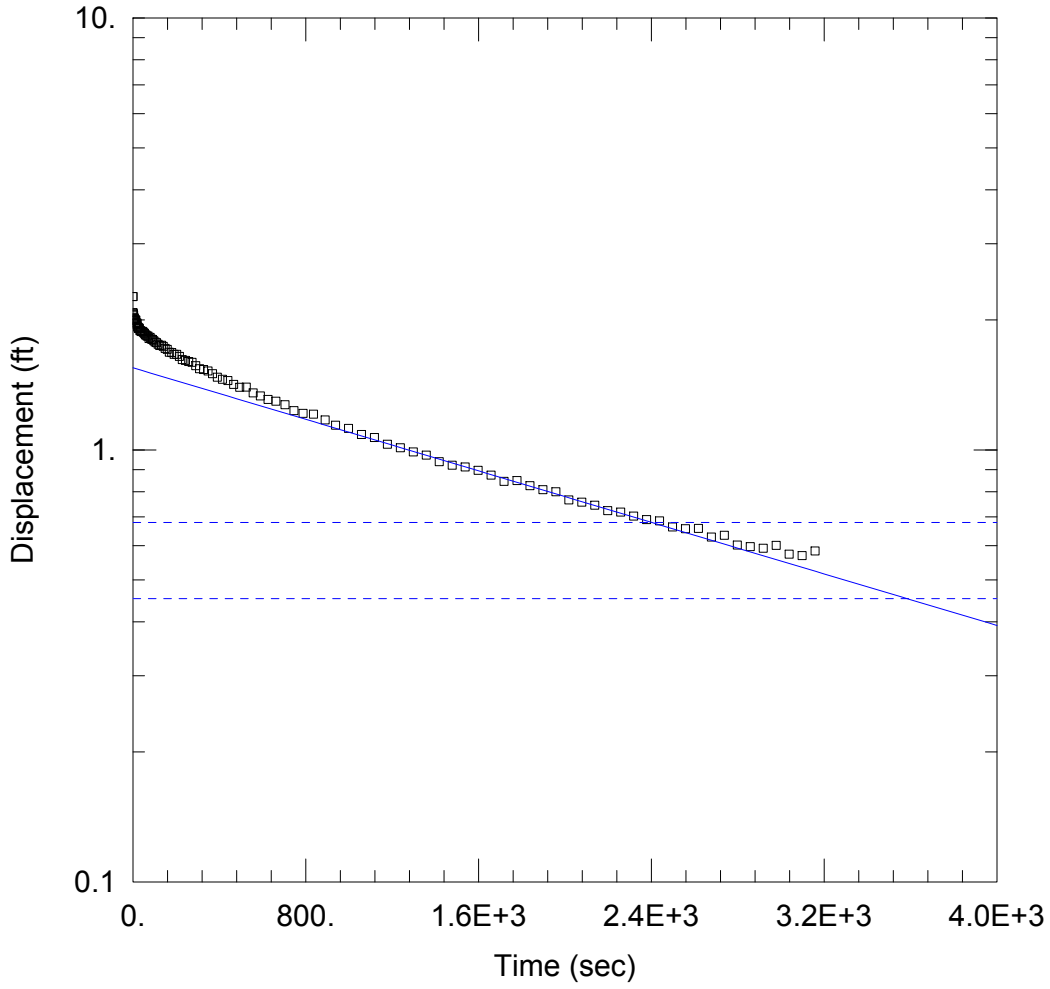
Saturated Thickness: 81.99 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AB-12D)

Initial Displacement: 2.201 ft
Total Well Penetration Depth: 79.99 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 81.99 ft
Screen Length: 5. ft
Well Radius: 0.16 ft

SOLUTION

Aquifer Model: Confined
K = 0.0008611 cm/sec
Solution Method: Bouwer-Rice
y0 = 1.584 ft



AB-11 RISING HEAD TEST

PROJECT INFORMATION

Company: MACTEC
Client: Duke Energy
Project: 6228-10-5284
Location: Allen Steam Station
Test Well: AB-11
Test Date: 12/2/10

AQUIFER DATA

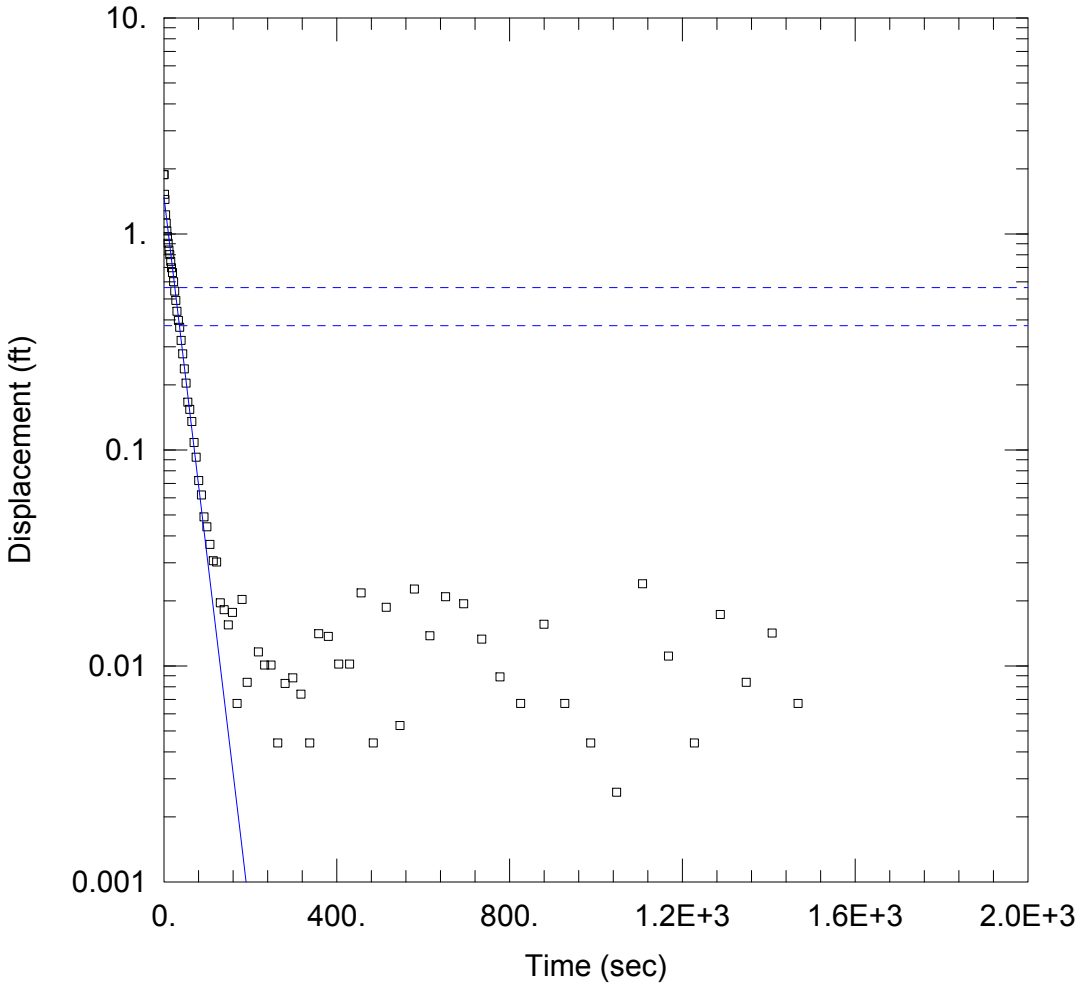
Saturated Thickness: 15.26 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AB-11)

Initial Displacement: 2.264 ft
Total Well Penetration Depth: 7.74 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 9.74 ft
Screen Length: 5. ft
Well Radius: 0.16 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 1.531E-5 cm/sec
y0 = 1.549 ft



AB-10S RISING HEAD TEST

PROJECT INFORMATION

Company: MACTEC
Client: Duke Energy
Project: 6228-10-5284
Location: Allen Steam Station
Test Well: AB-10S
Test Date: 12/2/10

AQUIFER DATA

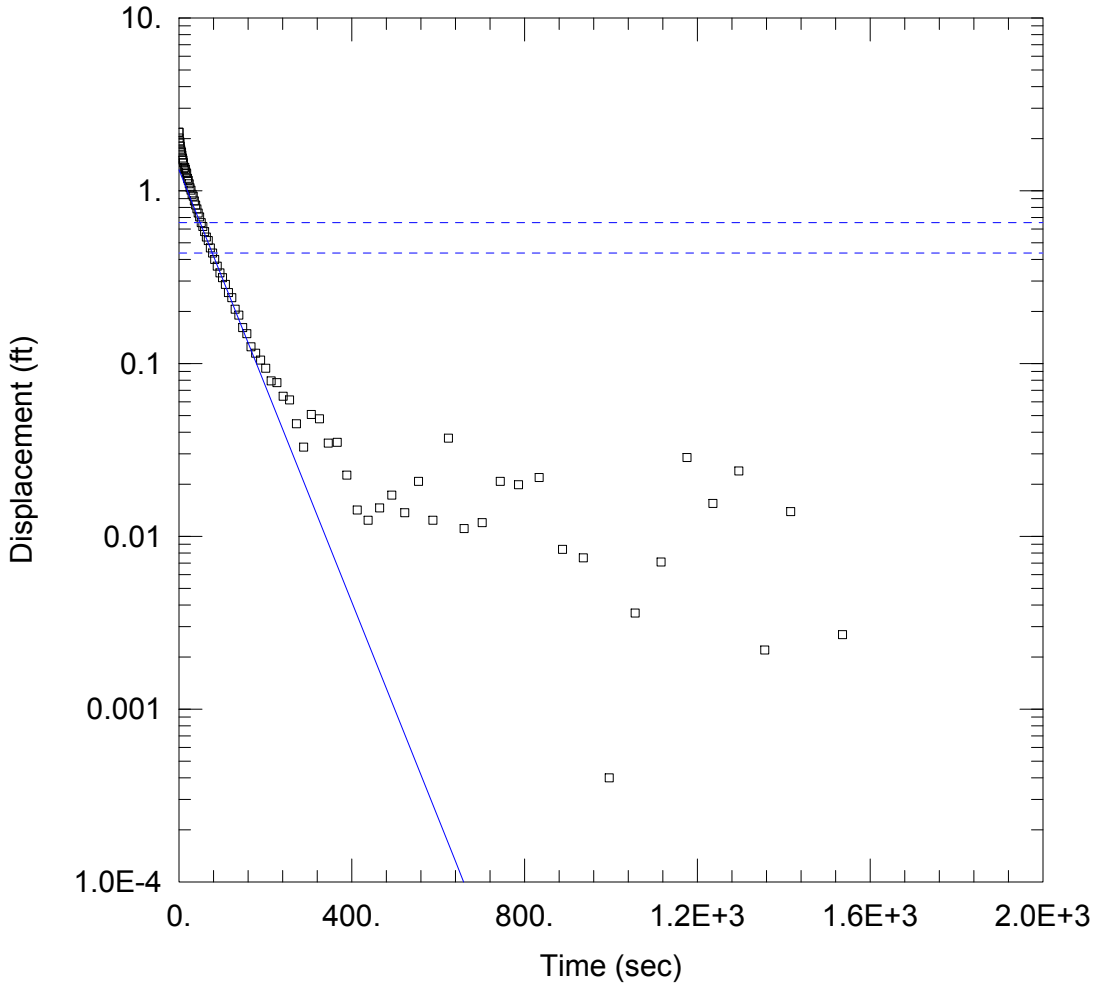
Saturated Thickness: 16.11 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AB-10S)

Initial Displacement: 1.88 ft
Total Well Penetration Depth: 8.89 ft
Casing Radius: 0.083 ft
Static Water Column Height: 8.89 ft
Screen Length: 8.89 ft
Well Radius: 0.34 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0008386 cm/sec
y0 = 1.481 ft



AB-10D RISING HEAD TEST

PROJECT INFORMATION

Company: MACTEC
Client: Duke Energy
Project: 6228-10-5284
Location: Allen Steam Station
Test Well: AB-10D
Test Date: 12/2/10

AQUIFER DATA

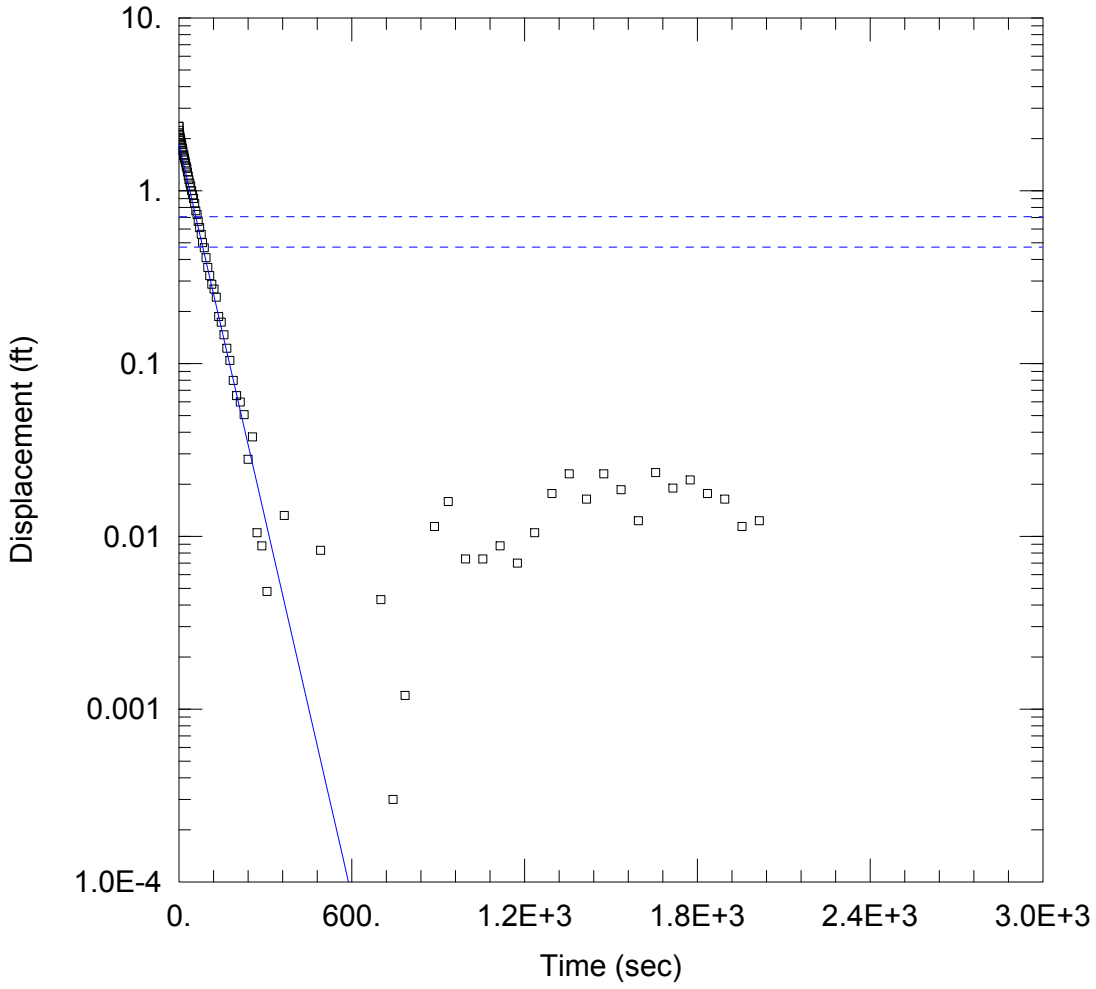
Saturated Thickness: 20. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AB-10D)

Initial Displacement: 2.18 ft
Total Well Penetration Depth: 17.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 53.51 ft
Screen Length: 5. ft
Well Radius: 0.16 ft

SOLUTION

Aquifer Model: Confined
K = 0.0007522 cm/sec
Solution Method: Bouwer-Rice
y0 = 1.32 ft



AB-9D RISING HEAD TEST

PROJECT INFORMATION

Company: MACTEC
Client: Duke Energy
Project: 6228-10-5284
Location: Allen Steam Station
Test Well: AB-9D
Test Date: 12/2/10

AQUIFER DATA

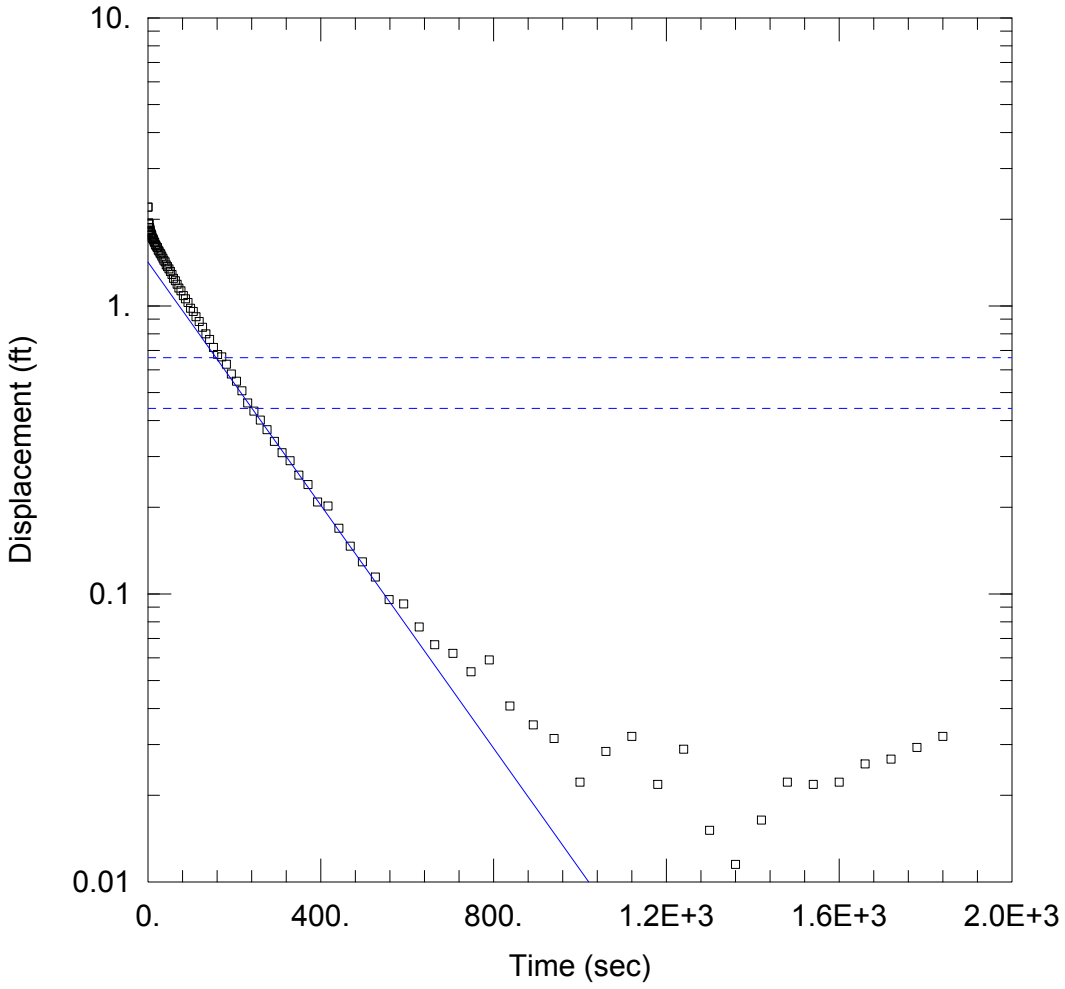
Saturated Thickness: 82. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AB-9D)

Initial Displacement: 2.358 ft
Total Well Penetration Depth: 99.48 ft
Casing Radius: 0.083 ft
Static Water Column Height: 100.5 ft
Screen Length: 5. ft
Well Radius: 0.16 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.001296 cm/sec
y0 = 1.87 ft



AB-14 RISING HEAD TEST

PROJECT INFORMATION

Company: MACTEC
Client: Duke Energy
Project: 6228-10-5284
Location: Allen Steam Station
Test Well: AB-14
Test Date: 12/3/10

AQUIFER DATA

Saturated Thickness: 25. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (New Well)

Initial Displacement: 2.204 ft
Total Well Penetration Depth: 10.99 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 14.99 ft
Screen Length: 10. ft
Well Radius: 0.16 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 0.0001261 cm/sec
y0 = 1.419 ft

B

Appendix B - Permit Condition A (11) Attachment XX, Version 1.1, June 15, 2011

A. (6) GROUNDWATER MONITORING WELL CONSTRUCTION AND SAMPLING

1. The permittee shall conduct groundwater monitoring as may be required to determine the compliance of this NPDES permitted facility with the current groundwater Standards found under 15A NCAC 2L .0200

2. WELL CONSTRUCTION. Within 120 days of permit issuance, monitoring wells, as proposed on Attachment XX, shall be installed to monitor groundwater quality.

   a. Monitoring wells shall be constructed in accordance with 15A NCAC 02C .0108 (Standards of Construction for Wells Other than Water Supply) and any other jurisdictional laws and regulations pertaining to well construction. The general locations for all monitoring wells are indicated on Attachment XX.

   b. Within 30 days of completion of well construction, a completed Well Construction Record (Form GW-1) must be submitted for each monitoring well to Division of Water Quality, Aquifer Protection Section, 1636 Mail Service Center, Raleigh, NC 27699-1636.

   c. The Mooresville Regional Office, telephone number (704) 663-1699, shall approve the location of new monitoring wells prior to installation. The regional office shall be notified at least 48 hours prior to the construction of any monitoring well and such notification to the Aquifer Protection Section's regional supervisor shall be made from 8:00 a.m. until 5:00 p.m. on Monday through Friday, excluding State Holidays.

   d. Within 60 days of completion of the monitoring wells, the Permittee shall submit two original copies of a site map with a scale no greater than 1-inch equals 500 feet. At a minimum, the map shall include the following information:

      i. The location and identity of each monitoring well.
      ii. The location of major components of the waste disposal system.
      iii. The location of property boundaries within 500 feet of the disposal areas.
      iv. The latitude and longitude of the established horizontal control monument.
      v. The elevation of the top of the well casing (i.e., measuring point) relative to a common datum.
      vi. The depth of water below the measuring point at the time the measuring point is established.
      vii. The location of compliance and review boundaries.
      viii. The date the map is prepared and/or revised.
      ix. Topographic contours in no more than ten (10) foot intervals

   e. The above information should be overlaid on the most recent aerial photograph taken of the site. Control monuments shall be installed in such a manner and made of such materials that the monument will not be destroyed due to activities taking place on the property. The map and any supporting documentation shall be sent to the Division of Water Quality, Aquifer Protection Section, 1636 Mail Service Center, Raleigh, NC 27699-1636.

   f. The well(s) must be constructed by a North Carolina Certified Well Contractor, the property owner, or the property lessee according to General Statutes 87-98.4. If the construction is not performed by a certified well contractor, the property owner or lessee, provided they are a natural person, must physically perform the actual well construction activities.

g. The monitoring wells shall be regularly maintained. Such maintenance shall include ensuring that the well caps are rust-free and locked at all times, the outer casing is upright and undamaged, and the well does not serve as a conduit for contamination.

3. GROUNDWATER SAMPLING AND COMPLIANCE. Monitoring wells shall be sampled after construction and thereafter at the frequencies and for the parameters as specified in Attachment XX. All maps, well construction forms, well abandonment forms and monitoring data shall refer to the permit number and the well nomenclature as provided on Attachment XX.

a. Per 15A NCAC 02H .0800, a Division certified laboratory shall conduct all laboratory analyses for the required effluent, groundwater or surface water parameters.

b. The measurement of water levels shall be made prior to purging the wells. The depth to water in each well shall be measured from the surveyed point on the top of the casing. The measurement of pH shall be made after purging and prior to sampling for the remaining parameters.

c. The measuring points (top of well casing) of all monitoring wells shall be surveyed to provide the relative elevation of the measuring point for each monitoring well. The measuring points (top of casing) of all monitoring wells shall be surveyed relative to a common datum.

d. For monitoring wells that are not located at the Compliance Boundary, the Compliance Monitoring Form (GW-59CCR) is not required. However, predictive calculations or modeling shall be submitted to the Regional Office annually (i.e. 12 months after permit issuance) demonstrating groundwater quality standards at the Compliance Boundary.

e. Two copies of the monitoring well sampling shall be submitted on a Compliance Monitoring Form (GW-59CCR), and received no later than the last working day of the month following the sampling month. Copies of the laboratory analyses shall be kept on site, and made available upon request. The Compliance Monitoring Form (GW-59CCR) shall include this permit number and the appropriate well identification number. All information shall be submitted to the following address:

Division of Water Quality
Information Processing Unit
1617 Mail Service Center
Raleigh, North Carolina 27699-1617

f. For groundwater samples that exceed the ground water quality standards in 15A NCAC 02L .0202, the Regional Office shall be contacted within 30 days after submission of the groundwater monitoring report; an evaluation may be required to determine the impact of the waste disposal activities. Failure to do so may subject the permittee to a Notice of Violation, fines, and/or penalties.

4. COMPLIANCE BOUNDARY. The compliance boundary for the disposal system shall be specified in accordance with 15A NCAC 02L .0107(a). This disposal system was individually permitted prior to December 30, 1983; therefore, the compliance boundary is established at either 500 feet from the effluent disposal area, or at the property boundary, whichever is closest to the effluent disposal area. An exceedance of groundwater standards at or beyond the compliance boundary is subject to remediation action according to 15A NCAC 02L .0106(c) as well as enforcement actions in accordance with North Carolina General Statute 143-215.6A through 143-215.6C.

ATTACHMENT XX – GROUNDWATER MONITORING PLAN

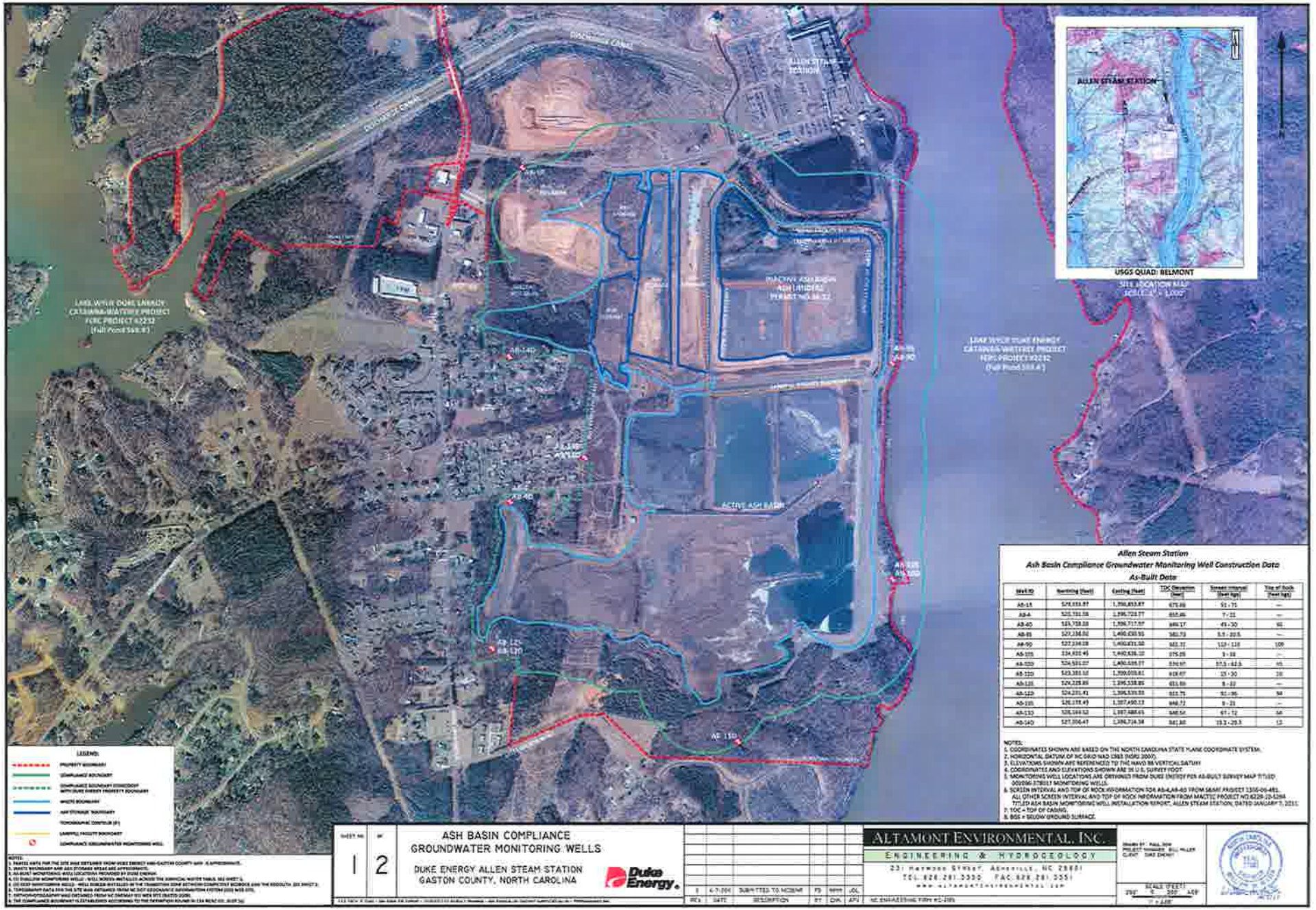
Permit Number: NC0004979 **Version 1.1**

WELL NOMENCLATURE	PARAMETER DESCRIPTION				FREQUENCY
Monitoring Wells: AB-1R, AB-4, AB-4D, *AB-9S, *AB-9D, *AB-10S, *AB-10D, AB-11D, AB-12S, AB-12D, AB-13S, AB-13D, AB-14D	**Antimony**	**Chromium**	**Nickel**	**Thallium**	March, July, November
	Arsenic	**Copper**	**Nitrate**	**Water Level**	
	Barium	**Iron**	**pH**	**Zinc**	
	Boron	**Lead**	**Selenium**		
	Cadmium	**Manganese**	**Sulfate**		
	Chloride	**Mercury**	**TDS**		

Note 1: For locations of monitoring wells, see attached map.

Note 2: Monitoring revisions may be considered, as applicable, if there are no significant detections prior to permit renewal.

Note 3: Monitoring wells inside the compliance boundary are indicated with an asterisk. Please see paragraph 3(d) of the Groundwater Monitoring, Well Construction, and Sampling section for monitoring submittal instructions.


DUKE ENERGY CANAL
ALLEN STEAM STATION
ACTIVE ASH BASIN
ASH STORAGE PERMIT NO. 36-32
LAKE WYLIE DUKE ENERGY CATAWBA-WATEREE PROJECT FERC PROJECT 2232 (Full Pond 569.4')
ACTIVE ASH BASIN
AB-1S
AB-1D
AB-2D
AB-3D
AB-4D
AB-5D
AB-6D
AB-7D
AB-8D
AB-9D
AB-10D
AB-11D
AB-12D
AB-13D
AB-14D
LEGEND:
PROPERTY BOUNDARY
COMPLIANCE BOUNDARY
COMPLIANCE BOUNDARY COINCIDENT WITH DUKE ENERGY PROPERTY BOUNDARY
WASTE BOUNDARY
ASH STORAGE BOUNDARY
TOPOGRAPHIC CONTOUR (FT)
LANDFILL FACILITY BOUNDARY
COMPLIANCE GROUNDWATER MONITORING WELL
NOTES:
1. WASTE DATA FOR THE SITE WAS OBTAINED FROM DUKE ENERGY AND GASTON COUNTY GIS. IS APPROXIMATE.
2. WASTE BOUNDARY AND ASH STORAGE AREAS ARE APPROXIMATE.
3. AB-8SAT MONITORING WELL LOCATION PROVIDED BY DUKE ENERGY.
4. (S) SHALLOW MONITORING WELLS - WELL SCREEN INSTALLED ACROSS THE SAPROLITE WASTE TABLE. SEE SHEET 2.
5. (D) DEEP MONITORING WELLS - WELL SCREEN INSTALLED IN THE TRANSITION ZONE BETWEEN COMPETENT BEDROCK AND THE REGOLITH. SEE SHEET 2.
6. TOPOGRAPHY DATA FOR THE SITE WAS OBTAINED FROM NC DOT EDDOCRAPHIC INFORMATION SYSTEM (EDIS) WEB SITE.
7. TOPOPHOTOGRAPHY WAS OBTAINED FROM NC ONEMAP WEB SITE (DATED 2020).
8. THE COMPLIANCE BOUNDARY IS ESTABLISHED ACCORDING TO THE INFRASTRUCTURE ROUNDS (15A NCAC 02L .0107 (a))
USGS QUAD: BELMONT
SITE LOCATION MAP
SCALE: 1" = 1,000'
Allen Steam Station
Ash Basin Compliance Groundwater Monitoring Well Construction Data
As-Built Data
Well ID	Northing (feet)	Easting (feet)	TOC Elevation (feet)	Screen Interval (feet bgs)	Top of Rock (feet bgs)
AB-1S	574,333.87	1,396,853.87	675.88	51 - 71	—
AB-4	575,701.58	1,396,723.77	655.86	7 - 22	—
AB-4D	575,728.58	1,396,717.97	656.17	45 - 50	45
AB-8S	577,134.92	1,400,430.95	581.73	5.5 - 20.5	—
AB-9D	577,134.28	1,400,431.50	582.31	110 - 115	109
AB-10S	574,833.45	1,400,436.10	575.05	3 - 18	—
AB-10D	574,831.07	1,400,436.77	574.97	57.5 - 62.5	55
AB-11D	573,381.10	1,399,010.61	618.07	15 - 30	10
AB-12S	574,228.85	1,396,338.85	611.59	5 - 22	—
AB-12D	574,231.41	1,396,339.55	612.75	52 - 95	50
AB-13S	576,178.43	1,397,490.13	648.72	9 - 23	—
AB-13D	576,169.52	1,397,488.65	648.54	67 - 72	66
AB-14D	577,006.47	1,396,714.38	641.80	19.3 - 29.3	12
NOTES:
1. COORDINATES SHOWN ARE BASED ON THE NORTH CAROLINA STATE PLANE COORDINATE SYSTEM.
2. HORIZONTAL DATUM OF NC GRID NAD 1983 (NSRS 2007).
3. ELEVATIONS SHOWN ARE REFERENCED TO THE NAVD 88 VERTICAL DATUM
4. COORDINATES AND ELEVATIONS SHOWN ARE IN U.S. SURVEY FOOT.
5. MONITORING WELL LOCATIONS ARE OBTAINED FROM DUKE ENERGY PDF AS-BUILT SURVEY MAP TITLED 002080 378017 MONITORING WELLS.
6. SCREEN INTERVAL AND TOP OF ROCK INFORMATION FOR AB-4,AB-4D FROM SEAWF PROJECT 1206-06-481. ALL OTHER SCREEN INTERVAL AND TOP OF ROCK INFORMATION FROM MACTEC PROJECT NO.6220-10-5266 TITLED ASH BASIN MONITORING WELL INSTALLATION REPORT, ALLEN STEAM STATION, DATED JANUARY 7, 2011.
7. TOC = TOP OF CASING.
8. BGS = BELOW GROUND SURFACE.
SHEET No. 1 OF 2
ASH BASIN COMPLIANCE GROUNDWATER MONITORING WELLS
DUKE ENERGY ALLEN STEAM STATION
GASTON COUNTY, NORTH CAROLINA
Duke Energy
NO.	DATE	DESCRIPTION	BY	CHK	APV
0	6-7-2021	SUBMITTED TO NCDENR	FB	MMM	JDL
NC ENGINEERING FIRM #C-2392
ALTAMONT ENVIRONMENTAL, INC.
ENGINEERING & HYDROGEOLOGY
231 Haywood Street, Asheville, NC 28801
TEL 828.281.3350 FAX 828.281.3351
www.altamontenvironmental.com
DRAWN BY: PAUL DOW
PROJECT MANAGER: BILL MILLER
CLIENT: DUKE ENERGY
SCALE (FEET)
200 0 200 400
1" = 400'
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036772 WILLIAM D. MILLER

C

Appendix C – Monitoring Well Locations

002096-378017 Allen Steam Station Monitoring Well Locations					
Description	**Northing**	**Easting**	**Elevation**	**Description**	**Elevation**
TOP OF PVC AB-1R	529135.87	1396853.87	675.86	MAG NAIL SET AR1-B	673.57
TOP OF PVC AB-4S	525731.58	1396723.77	650.46	MAG NAIL SET AB-4	647.94
TOP OF PVC AB-4D	525728.26	1396717.97	649.17	MAG NAIL SET AB-4D	646.98
TOP OF PVC MW-9S	527138.02	1400630.95	582.73	MAG NAIL SET MW-9S	580.54
TOP OF PVC MW-9D	527134.58	1400631.50	582.72	MAG NAIL SET MW-9D	580.37
TOP OF PVC MW-10S	524935.45	1400636.10	575.05	MAG NAIL SET MW-10S	572.61
TOP OF PVC MW-10D	524935.07	1400639.77	574.97	MAG NAIL SET MW-10D	572.41
TOP OF PVC MW-11	523285.10	1399059.61	618.07	MAG NAIL SET MW-11	615.39
TOP OF PVC MW-12S	524228.86	1396538.86	651.69	MAG NAIL SET MW-12S	649.64
TOP OF PVC MW-12D	524231.41	1396539.93	651.75	MAG NAIL SET MW-12D	649.71
TOP OF PVC MW-13S	526178.49	1397490.13	648.72	MAG NAIL SET MW-13S	645.98
TOP OF PVC MW-13D	526169.12	1397488.65	648.54	MAG NAIL SET MW-13D	645.89
TOP OF PVC MW-14	527206.47	1396716.58	641.80	MAG NAIL SET MW-14	639.36
Note1: Coordinates shown are based on the North Carolina State Plane Coordinate System					
Note2: Horizontal Datum of NC Grid NAD 1983 (NSRS 2007)					
Note3: Elevations shown are referenced to the NAVD 88 vertical datum					
Note4: Coordinates and elevations shown are in U.S. Survey Foot					
Note5: Coordinates and elevations shown only for as-built wells as requested by NCDENR					
Note6: Mag nails set in concrete base of each well for future elevation checks					
Note7: Survey information provided by Duke Energy.					