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October 22, 2012

Transmitted by Email
Elizabeth.Werner@ncdenr.gov

Ms. Elizabeth Werner
North Carolina Department of Environment and Natural Resources
Division of Waste Management - Solid Waste Section
217 West Jones Street
Raleigh, North Carolina 27603

Subject: Groundwater Monitoring Program - Sampling and Analysis Plan
Marshall Steam Station, Duke Energy Carolinas, LLC
Dry Ash Landfill, Permit No. 1804
Catawba County, North Carolina

Dear Ms. Werner,

On behalf of Duke Energy Carolinas (Duke), Altamont Environmental, Inc. submits this Sampling and Analysis Plan for Marshall Steam Station Dry Ash Landfill, Permit No. 1804.

Please feel free to call or respond with any questions or comments related to this project.

Sincerely,

ALTAMONT ENVIRONMENTAL, INC.

Stuart A. Ryman, P.G.

Enclosures: Groundwater Monitoring Program - Sampling and Analysis Plan, Marshall Steam Station Dry Ash Landfill, Permit No. 1804, October 22, 2012.

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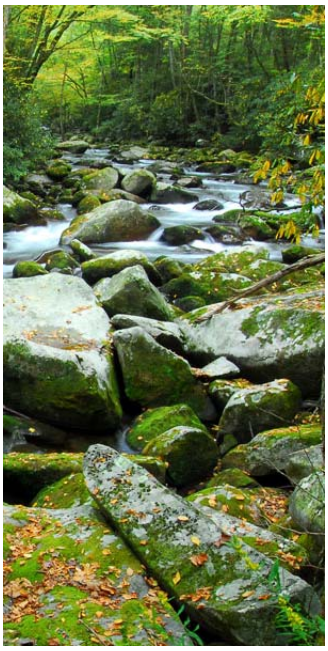

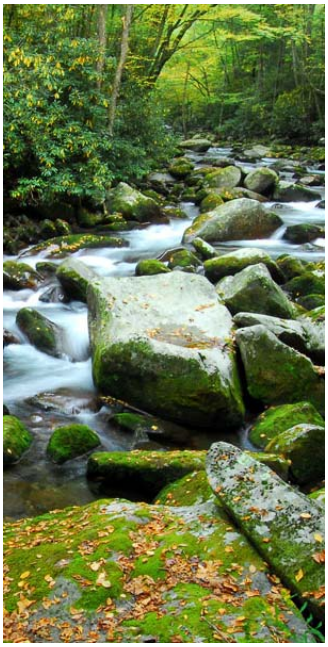

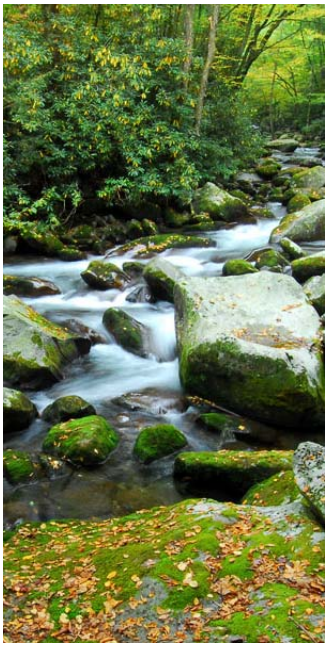

ALTAMONT ENVIRONMENTAL, INC.

ENGINEERING & HYDROGEOLOGY

Groundwater Monitoring Program
Sampling and Analysis Plan

Marshall Steam Station
Dry Ash Landfill
Permit No. 1804

October 22, 2012

Permit No.	Date	Document ID No.
1804-INDUS-1983	**October 22, 2012**	**18329**

APPROVED DOCUMENT
Division of Waste Management
Solid Waste Section
Date **August 12, 2015** By **ES Werner**

Prepared for
Duke Energy Carolinas, LLC
Marshall Steam Station
Catawba County, NC
Project Number: 2371.1103

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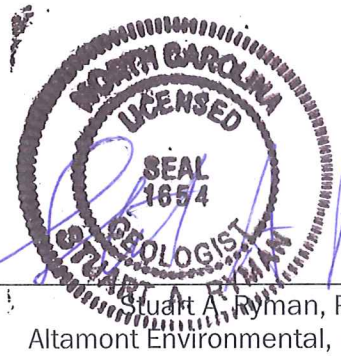
Groundwater Monitoring Program Sampling and Analysis Plan

Marshall Steam Station Dry Ash Landfill Permit No. 1804

October 22, 2012



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1.0 Program Description

1.1 Scope of Work

This Groundwater Monitoring Program Sampling and Analysis Plan is designed to address the requirement for groundwater monitoring to determine the effects of the Marshall Steam Station (MSS) Dry Ash Landfill on the groundwater in the area. This plan has been prepared in general accordance with the *Solid Waste Section Guidelines for Groundwater, Soil, and Surface Water Sampling* developed by the North Carolina Department of Environment and Natural Resources (DENR) Division of Waste Management, Solid Waste Section and documents the methodologies of field sampling, record-keeping protocols, data quality objectives, and data validation procedures that will be used in this program.

1.2 Background and Site Hydrogeological Description

The MSS Dry Ash Landfill (Permit No. 1804) is located at the Duke Energy Carolinas, LLC (Duke) Marshall Steam Station, near Terrell, North Carolina, in Catawba County on Lake Norman (Figure 1). The station generates electricity by combustion of coal. The fly ash disposed in the landfill was generated from the combustion of coal.

The Permit to Operate (Permit No. 1804) for the MSS Dry Ash Landfill was issued on December 30, 1983. The permitted area includes the following disposal areas:

- Fly ash disposal—two areas—46.2 acres (approximate) and 14.5 acres (approximate)
- Asbestos disposal—38.5 acres (approximate); permitted December 21, 1987
- Construction and demolition debris disposal—2.75 acres (approximate); permitted October 17, 1989

The two fly ash disposal (landfill) areas are located north and east of the steam station and are located adjacent to the Marshall Ash Basin. The Marshall Ash Basin is used to treat various waste streams generated by operations at MSS. The discharge from the ash basin is permitted under the National Pollutant Discharge Elimination System (NPDES) program as NPDES Permit # NC0004987.

The location of these areas is shown on Figure 1. The approximate limit of waste for each landfill is shown on Figure 2. These landfills were constructed as unlined landfills and have a soil cover. The fly ash landfill was closed in 2001 and the Asbestos and C&D landfills were closed in 2008.

The ground surface in the area of the 46.2-acre landfill slopes from the elevation along Island Point Road (located north of MW-4 at an approximate elevation 880 feet to 890 feet) toward the Marshall Ash Basin, with a surface water elevation of approximately 790 feet. Lake Norman is located to the east of the Marshall Ash Basin. The normal pond elevation of Lake Norman is 760 feet.

The 14.5-acre landfill is located on the eastern shore of the Marshall Ash Basin. A cove feature of Lake Norman is located to the east of the 14.5-acre landfill.

The landfill site is located in the Piedmont physiographic province (Piedmont). Piedmont bedrock primarily consists of igneous and metamorphic bedrock. The fractured bedrock is overlain by a mantle of unconsolidated material known as regolith. The regolith includes, where present, 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 clay and coarser granular material up to boulder size, and may reflect the texture of the rock from which it was formed. The

weathering product of granitic rocks may be quartz-rich and sandy-textured, whereas rocks poor in quartz and rich in feldspar and other soluble minerals form a more clayey saprolite (LeGrand 2004).

This mantle of residual soil, saprolite, and weathered rock (regolith) is a special hydrogeologic 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 fractured rock commonly occurs. A transition zone at the base of the regolith is present in many areas of the Piedmont (Harned and Daniel, 1989). In this zone, the unconsolidated material grades into the bedrock. It consists of partially weathered bedrock and lesser amounts of saprolite.

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 bedrock. Typically, the residuum/saprolite is partly saturated and the water table fluctuates within it.

Groundwater recharge in this area is derived entirely from infiltration of local precipitation. Groundwater recharge occurs in areas of higher topography (i.e., hilltops) and groundwater discharge occurs to areas of lower topography (i.e., valley creeks and streams).

As is typical in the groundwater systems located in the Piedmont region, groundwater at the landfill site is expected to occur within the residuum and saprolite under unconfined aquifer conditions.

The monitoring well construction records and boring logs (see Appendix A) indicate that the subsurface conditions in the landfill area consist of residual soils and partially to fully weathered rock (saprolite). Soil borings at four of the eight boring locations were advanced to auger refusal at depths of 27.4 feet to 80.5 feet below the ground surface. No borings were advanced to a depth below auger refusal.

Based on water level elevations measured in the existing monitoring wells and on the Piedmont groundwater system described in LeGrand, groundwater flow in the region of the 46.2-acre landfill is expected to be generally from Island Point Road toward the ash basin. The ash basin is expected to be the discharge area for groundwater flow in the area.

The groundwater flow in the region near the smaller fill area (14.5-acre landfill) appears to be from the ash basin (elevation 790 feet) toward the arm of Lake Norman (elevation 760 feet) located east of wells OB-1 and MW-1.

1.3 Well Locations and Installation

Groundwater quality at the landfills is monitored using five groundwater monitoring wells. Three observation wells are used to provide water level information only for developing groundwater contours. Well locations and construction information are provided in Table 1. The locations of these wells are shown on Figure 2. The monitoring wells and observation wells were constructed of 2-inch diameter polyvinyl chloride (PVC) well screen and casing. The well screens were installed to intercept the surficial aquifer and have slot sizes of 0.010 inch. The screen lengths are shown in Table 1.

The monitoring wells were installed by a well driller registered in North Carolina in accordance with applicable DENR regulations. Wells MW-1, MW-2, MW-3, MW-4, and observation well OB-1 were installed in July 1989. Well MW-5 was installed in May 2000. Observation wells OB-2 and OB-3 were installed in December 2010. These wells were installed as MW-6 and MW-7, respectively, and were then renamed.

Monitoring well MW-4 is located upgradient of the landfill and will be used as the background well for this sampling program.

Figure 3 shows a typical construction diagram for the monitoring wells. All monitoring wells are equipped with dedicated bladder-type pump systems. Well construction records for the monitoring wells are included in Appendix A.

A brief description of the monitoring locations and their monitoring function is provided below.

Monitoring Well MW-1

This monitoring well is located at the southeastern end of the 14.5-acre landfill inside of the Review Boundary, near the approximate limit of waste. Monitoring well MW-1 is screened to monitor groundwater in the saprolite layer.

Monitoring Well MW-2

This monitoring well is located near the southern end of the 46.2-acre landfill, between the landfill and the ash basin. The well is located inside of the Review Boundary. Monitoring well MW-2 is screened to monitor groundwater in the saprolite layer.

Monitoring Well MW-3

This monitoring well is located at the northern end of the 46.2-acre landfill, between the Review Boundary and the Compliance Boundary. This well is located between two ponded areas that appear to be former areas associated with the ash basin. Monitoring well MW-3 is screened to monitor groundwater in the saprolite layer.

Monitoring Well MW-4

This monitoring well is located upgradient of the 46.2-acre landfill and is outside of the Compliance Boundary. Monitoring well MW-4 is screened to monitor groundwater in the saprolite layer. This monitoring well is used as the background monitoring well for this sampling program.

Monitoring Well MW-5

This monitoring well is located to the east of the 46.2-acre adjacent landfill and is inside of the Review Boundary. Monitoring well MW-5 is screened to monitor groundwater in the saprolite layer.

Observation Well OB-1

This observation well is located to the southeast of the 14.5-acre landfill and is inside of the Review Boundary. Observation well OB-1 is screened to monitor groundwater elevations in the saprolite layer. This well is used only to measure groundwater levels.

Observation Well OB-2

This observation well is located within the footprint of the 46.2-acre landfill. Observation well OB-2 is screened to monitor groundwater elevations in the saprolite layer. This well is used only to measure groundwater levels.

Observation Well OB-3

This observation well is located at the toe of the slope, along the northwest slope of the 46.2-acre landfill. Observation well OB-3 is screened to monitor groundwater elevations in the saprolite layer. This well is used only to measure groundwater levels.

1.4 Monitoring Frequency

The monitoring wells will be sampled semiannually in February and August.

1.5 Parameters

The parameters to be sampled, units of measure, analytical methods, and DENR Solid Waste Section Limits are presented in Table 2.

1.6 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 DENR.

The analytical QA objectives for precision, accuracy, and completeness have been established by the laboratories in accordance with US 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.

As required by the Solid Waste Section Memorandum Regarding New Guidelines for Electronic Submittal of Environmental Data, dated October 27, 2006, data will be reported to laboratory-specific method detection limits and will be quantifiable at or below the Solid Waste Section Limit (SWSL) for groundwater. 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.

2.0 Sampling Procedures

2.1 Sampling Equipment

Development, purging, and sampling equipment were selected to ensure 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 and are dedicated purging and sampling systems.

2.1.1 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 and after use in each well 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.

2.2 Groundwater Sampling

2.2.1 Development of Monitoring Wells

All five monitoring wells addressed in this sampling plan have been developed. If new monitoring wells are installed, they will be developed before they are sampled.

After installation of new monitoring wells, and prior to initial sampling, the monitoring wells will be developed. 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 sandpack 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, referenced to the top of well casing (TOC).

2.2.2 Groundwater Level and Total Depth Measurements

Water level measurements are 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 are referenced to the TOC and recorded to the nearest one-hundredth of a foot.

Water level measurements are 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 is 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 reference to the TOC. The depth and water level measurements are 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)

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, water level measurement, and calculated well volume are recorded on the Groundwater Monitoring Data Sheet (Figure 4).

2.2.3 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% 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.

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 five-minute intervals). When parameters have stabilized within ±0.2 pH units and ±10% for temperature, conductivity, and DO, and ±10 milli-Volts (mV) for ORP over three consecutive readings, representative groundwater has been achieved for sampling. Turbidity is not included as a stabilization parameter, but turbidity levels of 10 nephelometric turbidity units (NTU) or less should be targeted.

Modified Low-Flow Purging

This technique is considered a viable option particularly in the Piedmont region due to clay 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 five-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, ±10% for temperature, conductivity, and DO, and ±10 mV for ORP over three consecutive readings, representative groundwater has been achieved for sampling. Turbidity is not included as a 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. The volume of the pumping system (i.e., the pump bladder, tubing, and flow-through chamber) is calculated for removal. 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.

2.2.4 Sample Collection

After representative groundwater has been obtained by purging and the indicator parameters have stabilized, sampling may begin. Sampling personnel must wear new, clean, disposable, non-powdered nitrile gloves during sample collection for each well. Samples are collected in the order of the volatilization sensitivity of the parameters:

- Metals
- Sulfate and Chloride
- Nitrate
- Total Dissolved Solids (TDS)

All pertinent notations, water-level measurements, removed well volumes, and indicator parameters are documented on the Groundwater Monitoring Data Sheet.

2.2.5 Sample Containers, Volume, Preservative, and Holding Time

All sample containers supplied by the laboratory for the collection of groundwater samples are new and precleaned, 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 are kept closed until used. All sample containers are provided by Duke or vendor laboratories.

2.3 Sample Tracking

The Chain-Of-Custody (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 are 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.

2.4 Sample Labeling

Sample containers are pre-labeled and organized prior to field activities as part of the pre-sampling staging process. As samples are actually collected, the sampling personnel write the following information directly on the label: sampling date/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).

2.5 Field Documentation

Field documentation from each sampling event is recorded on the Groundwater Monitoring Data Sheets, the Field Sampling Calibration Form, and the Chain-of-Custody Record. These loose-leaf sheets are arranged in sequential order and filed by project and date. Additionally, a Groundwater Sampling Site Checklist (Figure 7) is completed indicating monitoring well information such as proper identification (ID) tag and condition of protective casing and pad. Typical field notations made during the course of the field work include:

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

All recorded entries are made on electronic forms or on paper copy in indelible ink. Errors on paper copy should be corrected by drawing one line through the error, initialing and dating the correction, and starting a new entry on the next line (if necessary).

2.6 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 parameter. The record includes the following types of information:

- Sample identification number
- Signature of collector
- Date and time of collection
- Sample type (e.g., groundwater)
- 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

2.7 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 are 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, COC entries are completed on the COC 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 are delivered to these facilities by Duke personnel or courier.

All COC forms received by the laboratory(s) are 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 laboratory personnel are described in detail in the Duke Energy Laboratory Services Procedures Manual.

3.0 Analytical Procedures

The main analytical laboratory used in this program is the Duke Energy Analytical Laboratory, which has North Carolina Laboratory Certification (#248). The organizational structure and staff qualifications of the Duke Energy Analytical Laboratory are discussed in its generic Quality Assurance Program (QAP). The QAP and *Laboratory Services Procedures Manual* are available for review upon request.

Vendor laboratories that meet EPA and North Carolina certification requirements may be used for analyses that cannot be performed in-house.

The analytical methods are listed in Table 2. Indicator parameters are measured in the field according to *Duke Energy Environmental Support Systems Quality Assurance Plan and Procedure 3210*.X.[1]

[1] "X" indicates the most current revision of the procedure.

4.0 Internal Quality Control Checks

Internal laboratory quality control (QC) checks used by the laboratories are described in their 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, and/or field replicates for analysis of all parameters at frequencies described in the laboratory(s) procedures manuals. Equipment rinsate blanks for laboratory-cleaned equipment will be collected quarterly.

The field QC blanks and replicates may be included as internal QC checks are described as below. The specific type and number of blanks used may vary depending on the sampling event and will be determined by the Duke 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 and 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. It is returned to the laboratory with the field samples, and analyzed along with the field samples for parameters of interest.
- 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.
- 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.

5.0 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 procedure consists of the following:

- A review of field data contained on the Groundwater Monitoring Data Sheet for completeness
- Verification that 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 Chain-Of-Custody Record for proper completion, signatures of field personnel and the laboratory sample custodian, dates, and for verification that the correct analyses were specified

6.0 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.

7.0 Report Submittal

A report of monitoring results will be submitted to the DENR Division of Waste Management (DWM) within 120 days following the date of sampling. The report submittal will consist of the following:

- Environmental Monitoring Reporting Form (DENR Form)
- A table with values that attain or exceed the Title 15A, North Carolina Administrative Code, Subchapter 2L Standards (2L Standards). This table will provide a preliminary analysis of the cause and significance of each exceedance
- A table with results of any sample that equal or exceed the SWSLs.
- Generalized Groundwater Contour Map
- Electronic Data Deliverable (EDD) in Excel Format

DWM will be notified in the event that vendor lab analyses have not been completed within this time frame. All Groundwater Monitoring Data Sheet, Field Calibration Forms, Chain-of-Custody Records, Laboratory(s) QA data, and Data Validation Checklists are kept on file by Duke and are available upon request.

8.0 References

1. Environmental Protection Agency Region IV. February 1, 1991. *Standard Operating Procedures and Quality Assurance Manual*.

2. Harned, D. A. and Daniel, C. C., III. 1989. "The transition zone between bedrock and regolith: Conduit for contamination?", p. 336-348, in Daniel, C. C., III, White, R. K., and Stone, P. A., eds., *Groundwater in the Piedmont: Proceedings of a Conference on Ground Water in the Piedmont of the Eastern United States*, October 16-18, 1989, Clemson University, 693p.

3. Legrand Sr., Harry E. 2004. *A Master Conceptual Model for Hydrogeological Site Characterization in the Piedmont and Mountain Region of North Carolina, A Guidance Manual*.

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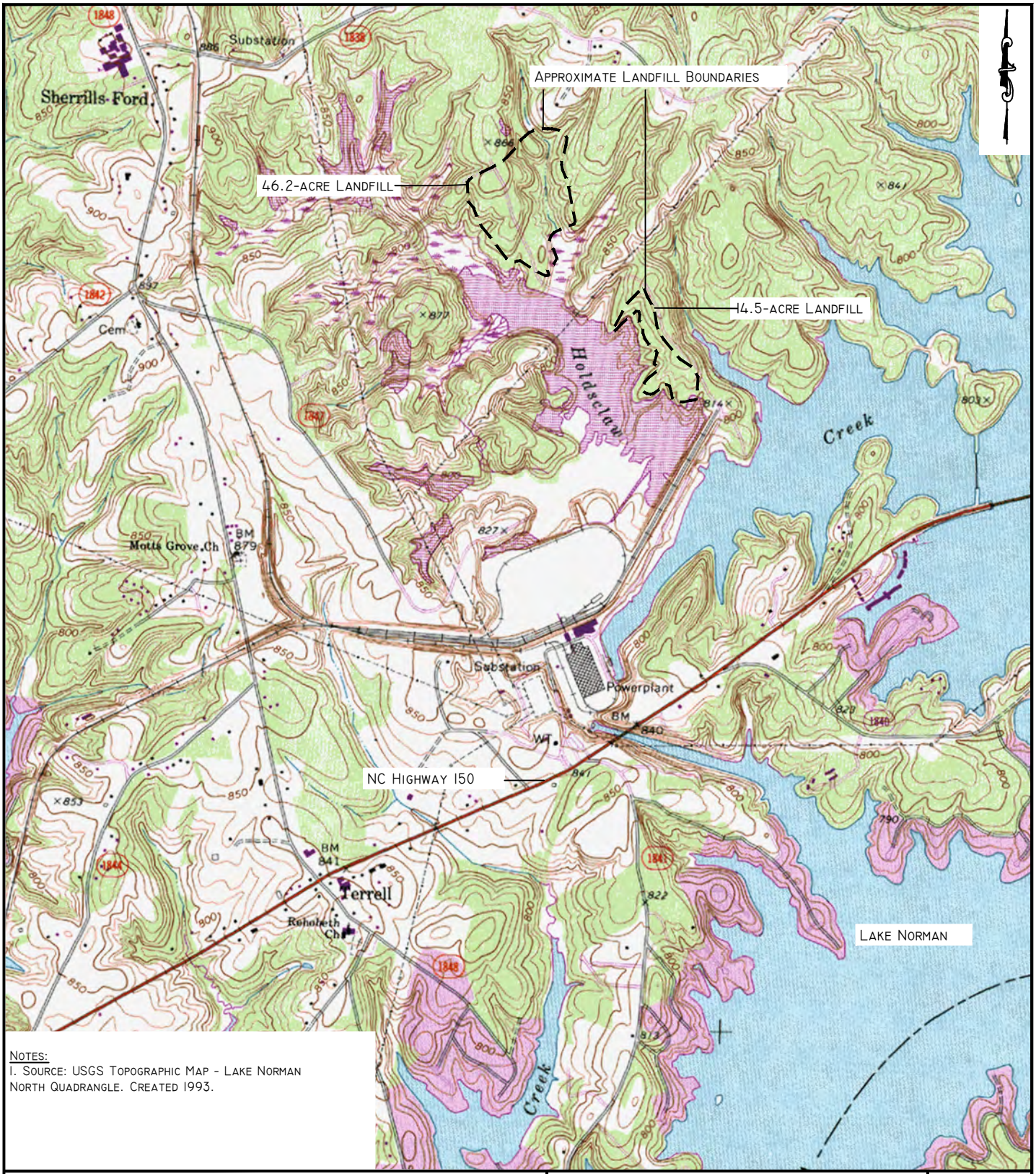
FIGURES



Notes:
1. Source: USGS Topographic Map - Lake Norman North Quadrangle. Created 1993.

Altamont Environmental, Inc.
Engineering & Hydrogeology
231 Haywood Street, Asheville, NC 28801
Tel. 828.281.3350 Fac. 828.281.3351
www.altamontenvironmental.com

Site Location Map

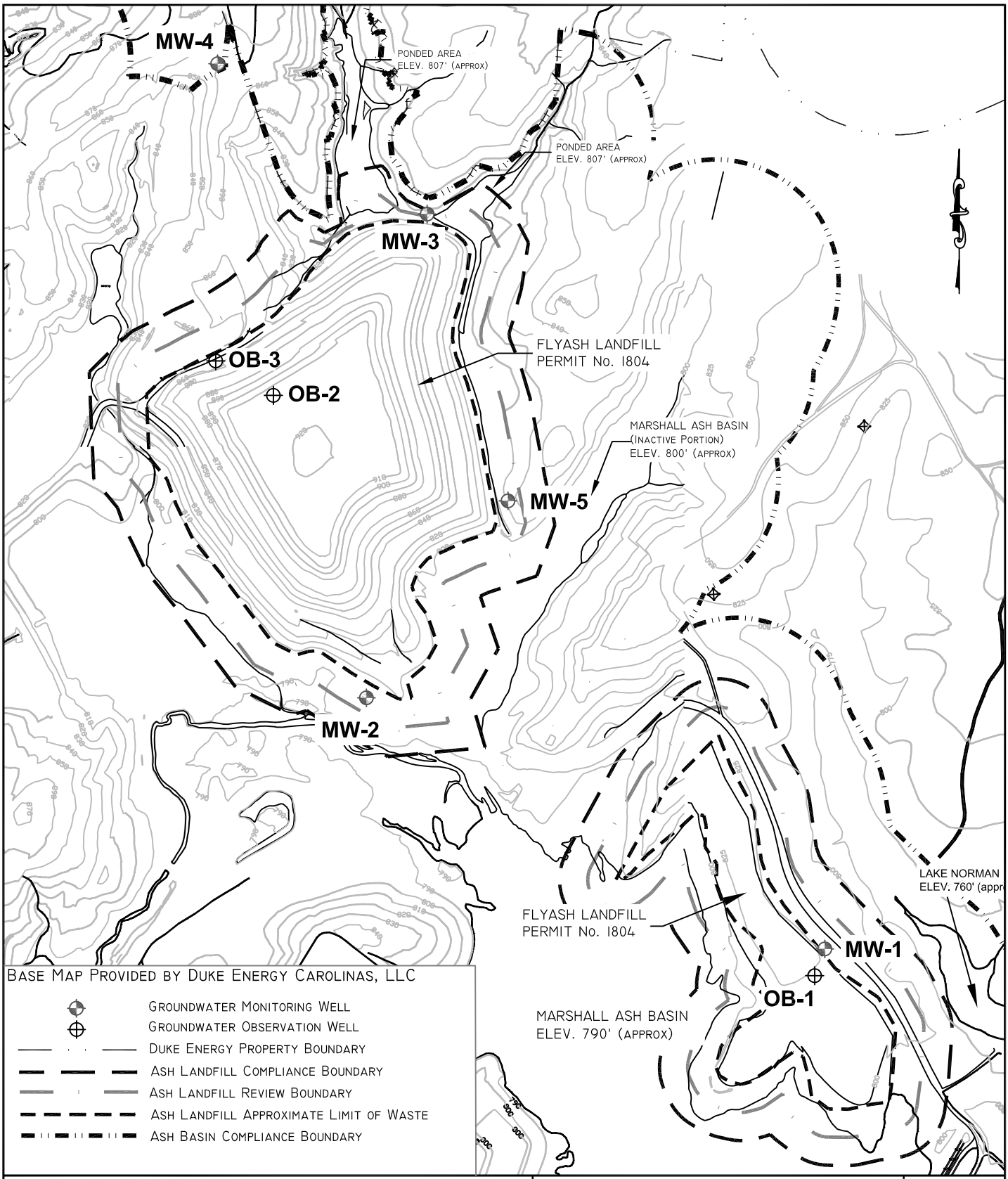
Marshall Steam Station
Dry Ash Landfill Permit No. 1804

Figure 1

DRAWN BY: Andrew Moore
PROJECT MANAGER: Stu Ryman
CLIENT: Duke Energy Carolinas, LLC
DATE: 8/2/12

SCALE (FEET)
1000 0 1000 2000

P:\Duke - Environmental Engineering - 2371\2371.11 Landfill SAPs\2371.1103 MSS Dry Ash LF SAP\Figures\Site Location Map.dwg



ALTAMONT ENVIRONMENTAL, INC.
ENGINEERING & HYDROGEOLOGY
231 HAYWOOD STREET, ASHEVILLE, NC 28801
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WWW.ALTAMONTENVIRONMENTAL.COM

SAMPLE LOCATIONS

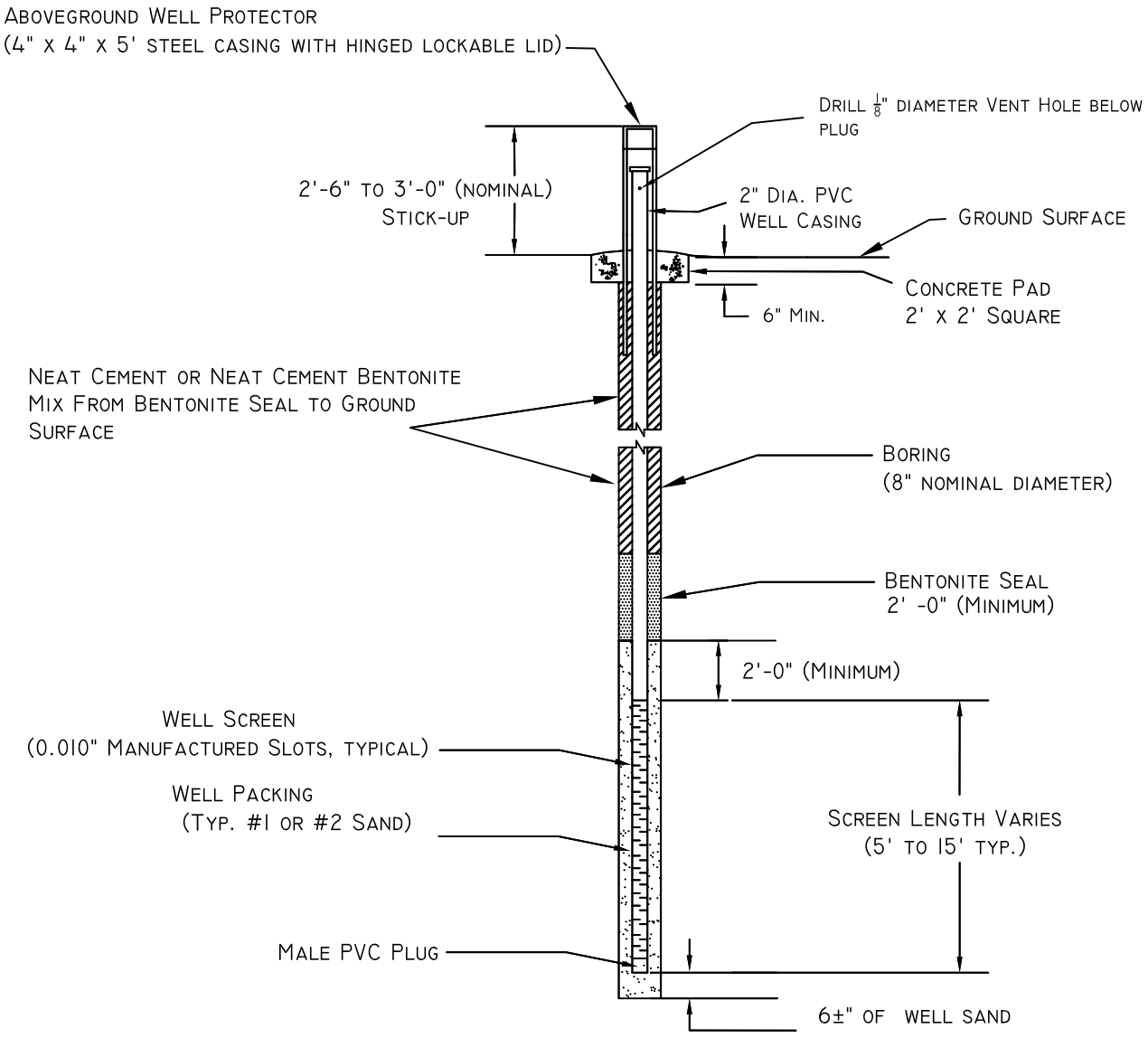
MARSHALL STEAM STATION
DRY ASH LANDFILL PERMIT No. 1804

FIGURE
2

DRAWN BY: ANDREW MOORE
PROJECT MANAGER: STU RYMAN
CLIENT: DUKE ENERGY CAROLINAS, LLC
DATE: 8/2/12

SCALE (FEET)
300 0 300 600

FILE PATH: P:\DUKE-LF GROUNDWATER REPORTS-2369\2369.05 MSS ASH LF\2011\AUGUST SAMPLING\FIGURES\MARSHALL ASH LANDFILL



Typical Well Construction Details
(no scale)

INFORMATION PROVIDED BY DUKE ENERGY CAROLINAS

ALTAMONT ENVIRONMENTAL, INC.
ENGINEERING & HYDROGEOLOGY
231 HAYWOOD STREET, ASHEVILLE, NC 28801
TEL.828.281.3350 FAC.828.281.3351
WWW.ALTAMONTENVIRONMENTAL.COM

DRAWN BY: JENNIFER HILL-VERDE
PROJECT MANAGER: STU RYMAN
CLIENT: DUKE ENERGY CAROLINAS, LLC
DATE: 8/8/12

NO SCALE

TYPICAL MONITORING WELL CONSTRUCTION DETAILS

FIGURE
3

FILE PATH: P:\DUKE - ENVIRONMENTAL ENGINEERING - 2371\2371.11 LANDFILL SAPS\FIGURE 3 TYPICAL MW-2004_NONLOCKCAP.DWG

DUKE ENERGY

GROUNDWATER MONITORING DATA SHEET

FOR CONVENTIONAL SAMPLING

PROCEDURE NO	3175.1

SITE NAME	MARSHALL STEAM STATION		PERMIT #	18-04	SITE ID: N/A
PROJECT NAME	DRY ASH LANDFILL		FIELD CREW	LDC, RLW, MJR	
SAMPLING DATE(s)	☑ 27-Aug-2012 ☐ ☐ ☐		WELL/LOCATION NAME	MW-1	

MONITORING WELL INFORMATION

WELL DIAMETER (in)	2	TOC ELEV (ft msl)	823.70	MIDDLE OF WETTED SCREEN (ft toc)			73.75
WELL DEPTH (ft TOC)	78.75	GS ELEV (ft msl)	821.20	PUMP INTAKE DEPTH (ft TOC)			77.80
SCREEN LENGTH (ft)	10.00	ELEV REF	NAVD 88	SCREEN INTERVAL (ft TOC)	68.75	TO	78.75

EQUIPMENT INFORMATION

LEVEL METER SERIAL#		SAMPLING EQUIPMENT	QED T1200	PURGE METHOD	
		TUBING DIAMETER (in)	1/2 OD	Conventional	

PUMP CONTROLLER SETTINGS								
PRESSURE	40	(psi)	RECHARGE	10	(sec)	DISCHARGE	10	(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-NHE)	☐ DISSOLVED OXYGEN (mg/L)	☐ (gal) WELL VOL (recalculates on current water level)
							N/A	N/A	

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			8/27/2012	@	0

QC By:

WELL CONDITION

PROTECTIVE CASING	Good Condition	
WELL PAD	Good Condition	
WELL CASING	Good Condition	
WELL TAG	Good Tag	

ADDITIONAL WELL CONDITION NOTES

SAMPLING NOTES

FIGURE 4

FIELD SAMPLING CALIBRATION FORM

STUDY: MARSHALL STEAM STATION - DRY ASH LANDFILL GROUNDWATER MONITORING

DATE (s):

COLLECTORS: 0

ANALYZER MODEL#: MS5

OTHER EQUIPMENT: TURBIDIMETER NO.1 - 3260.1

SURFACE UNIT READER: LDC

SURFACE UNIT SERIAL #: S05042

ANALYZER SERIAL #: 47630

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		—/—►	75			—/—►	75	
pH (units)	B (7.00)		—►				—/—►		
	B (4.00)		—►				—/—►		
	B (10.00)		—/—►				—/—►		
		Buffer Temp.				Buffer Temp.			
☐ ORP (mV)	SS (7.00)	N/A	—/—►	N/A		N/A	—/—►	N/A	
	SS (4.00)	N/A	—/—►	N/A		N/A	—/—►	N/A	
☐ DO (mg/L)	W								
	W								
	AW	N/A	—/—►	N/A		N/A	—/—►	N/A	
☑ 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

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.

Customer to complete appropriate columns to right

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	[16]Analyses Required	[20]Total # of Containers
									6

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

NORTH CAROLINA GROUNDWATER SAMPLING SITE CHECKLIST

LOCATION / SITE Marshall Steam Station - Dry Ash Landfill Groundwater Monitoring PERMIT # 18-04 **SAMPLE DATE**
SITE CONTACT Donna Burrell **FIELD CREW**
WEATHER
PAGE 1 OF 1

		MW-1	MW-2	MW-3	MW-4	MW-5	OB-1										
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

TABLES

Table 1
Well Construction Information
Marshall Steam Station–Dry Ash Landfill

	MW-1	MW-2	MW-3	MW-4	MW-5	OB-1	OB-2	OB-3
North (ft)	682767.3	683834.2	685990.7	686658.4	684782	682648.4	685227.06	685380.11
East (ft)	1417124.7	1415046.3	1415309.4	1414395.4	1415744	1417080.7	1414674.45	1414418.05
Top of PVC Casing Elevation (ft)	823.70	797.21	813.07	867.15	822.69	825.85	919.65	859.16
Well Diameter	2”	2”	2”	2”	2”	2”	2”	2”
Well Stick-Up (ft)	2.55	2.31	2.07	2.65	2.5	2.3	2.5	2.5
Type of Casing	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC
Total Depth (ft)	80.5	34.9	27.4	49.6	35	64.5	117.5	54
Screen Length (ft)	10	10	10	10	10	10	15	15
Screen Interval (ft below ground surface)	67.1 to 77.1	23.0 to 33.0	15.9 to 25.9	37.4 to 47.4	18.0 to 28.0	53.2 to 63.2	102.5 to 117.5	39.0 to 54.0

Notes:

1. As-built well coordinates and top of PVC casing elevations provided by Duke Energy.
2. Well depth and screen information were obtained from the Well Installation Records.
3. Coordinates: NC State Plane Grid, NAD83. Information provided by Duke Energy.
4. Well elevations referenced to NAVD 29: MW-1, MW-2, MW-3, MW-4, MW-5, and OB-1. Well elevations referenced to NAVD 88: OB-2 and OB-3.
5. OB-2 and OB-3 were originally installed under the names MW-6 and MW-7, respectively, but have since been renamed.
6. Observation wells OB-1, OB-2, and OB-3 are for water level only.

Table 2
Sample Parameters, Analytical Methods, and Solid Waste Section Limits
Marshall Steam Station–Dry Ash Landfill

PARAMETER	UNITS	ANALYTICAL METHOD	SWSL
In Situ Parameters			
Field pH	SU	Hydrolab	N/A
Specific Conductance	µmhos/cm	Hydrolab	N/A
Temperature	°C	Hydrolab	N/A
Water Level	ft	Water Level Meter	N/A
Laboratory Analyses			
Arsenic	µg/L	EPA 200.8/EPA 6020	10
Barium	µg/L	EPA 200.7/EPA 6010	100
Boron	µg/L	EPA 200.7/EPA 6010	NE
Cadmium	µg/L	EPA 200.8/EPA 6020	1
Chloride	µg/L	EPA 300.0	NE
Chromium	µg/L	EPA 200.7/EPA 6010	10
Copper	µg/L	EPA 200.7/EPA 6010	10
Fluoride	µg/L	EPA 300.0	2,000
Iron	µg/L	EPA 200.7/EPA 6010	300
Lead	µg/L	EPA 200.8/EPA 6020	10
Manganese	µg/L	EPA 200.7/EPA 6010	50
Mercury	µg/L	EPA 245.1	0.2
Nickel	µg/L	EPA 200.7/EPA 6010	50
Nitrate as N	µg/L	EPA 300.0	10,000
Selenium	µg/L	EPA 200.8/EPA 6020	10
Silver	µg/L	EPA 200.7/EPA 6010	10
Sulfate	µg/L	EPA 300.0	250,000
Total Dissolved Solids	µg/L	SM 2540 C	NE
Zinc	µg/L	EPA 200.7/EPA 6010	10

Notes:

1. SU—Standard Units
2. N/A—Not Applicable
3. µmhos/cm—micromhos per centimeter
4. ft—feet
5. µg/L—micrograms per liter
6. SWSL—Solid Waste Environmental Monitoring Reporting Limits and Standards, updated on June 13, 2011.
7. NE—Not established

Table 3
Sample Containers, Preservatives, and Holding Times
Marshall Steam Station–Dry Ash Landfill

PARAMETER	CONTAINERS	PRESERVATIVES	HOLDING TIMES
In Situ Parameters			
Field pH	In Situ	None	Analyze Immediately
Specific Conductance	In Situ	None	Analyze Immediately
Temperature	In Situ	None	Analyze Immediately
Laboratory Analyses			
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°C	28 days
Chromium	500 mL HDPE	pH<2 HNO_3	6 months
Copper	500 mL HDPE	pH<2 HNO_3	6 months
Fluoride	500 mL HDPE	Cool 4°C	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 N	500 mL HDPE	Cool 4°C	48 hours
Selenium	500 mL HDPE	pH<2 HNO_3	6 months
Silver	500 mL HDPE	pH<2 HNO_3	6 months
Sulfate	500 mL HDPE	Cool 4°C	28 days
Total Dissolved Solids	500 mL HDPE	Cool 4°C	7 days
Zinc	500 mL HDPE	pH<2 HNO_3	6 months

Notes:

1. mL HDPE—milliliter high density polyethylene
2. HNO_3—nitric acid

APPENDICES

APPENDIX A
BORING LOGS AND WELL CONSTRUCTION RECORDS

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT – GROUNDWATER SECTION
P.O. BOX 27687 – RALEIGH,N.C. 27611, PHONE (919) 733-5083

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR DUKE POWER CO.
DRILLER REGISTRATION NUMBER 921
STATE WELL CONSTRUCTION PERMIT NUMBER: 18-04

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: DENVER
HIGHWAY # 150
(Road, Community, or Subdivision and Lot No.)
County: CATAWBA

2. OWNER DUKE POWER CO.
ADDRESS P.O. Box 33189 (Street or Route No.)
CHARLOTTE NC 28242
City or Town State Zip Code

3. DATE DRILLED 6-27-89 USE OF WELL MONITORING
4. TOTAL DEPTH 80.5 CUTTINGS COLLECTED ☑ Yes ☐ No
5. DOES WELL REPLACE EXISTING WELL? ☐ Yes ☑ No
6. STATIC WATER LEVEL: 49.4 FT. ☐ above ☑ below TOP OF CASING,
TOP OF CASING IS 2.3 FT. ABOVE LAND SURFACE.
7. YIELD (gpm): N/A METHOD OF TEST N/A
8. WATER ZONES (depth): N/A
9. CHLORINATION: Type N/A Amount N/A

DRILLING LOG

Depth From	Depth To	Formation Description
		SEE ATTACHED SOIL TEST BORING FIELD REPORT FOR # MW-1

If additional space is needed use back of form.

10. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0	To 67.1	Ft.	2" I.D.	.154	PVC
From	To	Ft.			
From	To	Ft.			

11. GROUT:

	Depth		Material	Method
From 0	To 62.0	Ft.	NEAT CEMENT	PUMPED
From	To	Ft.		

12. SCREEN:

	Depth		Diameter	Slot Size	Material
From 67.1	To 77.1	Ft.	2" I.D.	in. .010	in. PVC
From	To	Ft.	in.	in.	
From	To	Ft.	in.	in.	

13. GRAVEL PACK:

	Depth		Size	Material
From 65.0	To 80.5	Ft.		CLEAN SAND NC #25
From	To	Ft.		

14. REMARKS: BENTONITE SEAL PLACED FROM 62.0' – 65.0'

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

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

[signature] 9-15-89
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 Revised 11/84

Submit original to Division of Environmental Management and copy to well owner.

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRAN P. O. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE:	PERMIT NO.:
MARSHALL STEAM STATION 1	18-04
ADDRESS:	**OWNER (print):**
HIGHWAY #150 TERRELL, NC	DUKE POWER CO.
DRILLING CONTRACTOR:	**REGISTRATION NO.:**
DUKE POWER CO.	421

Casing Type: TAPER THREADED PVC dia. 2" in. Grout Depth: from 0 to 62.0 ft. - dia. 6" in.
Casing Depth: from 0 to 67.1 ft. - dia. 2" in. Bentonite Seal: from 62.0 to 65.0 ft. - dia. 6" in.
Screen Type: TRUCTHREADED PVC dia. 2" in. Sand/Gravel PK: from 65.0 to 80.5 ft. - dia. 6" in.
Screen Depth: from 67.1 to 77.1 ft. - dia. 2" in. Total Well Depth: from 0 to 80.5 ft. - dia. 6" in.

Static Water Level: 49.4' feet from top of casing Date Measured 7/6

Yield (gpm): N/A Method of Testing: N/A Casing is 2.3 feet above land su

DRILLING LOG		
DEPTH FROM	TO	FORMATION DESCRIPTION
SEE ATTACHED SOIL		
TEST BORING FIELD		
REPORT FOR MW-#1.		

LOCATION SKETCH

(show distance to numbered roads, or other map reference po

REMARKS: SCREENS ARE PLACED IN THE MOST HYDRAULICALLY CONDUCTIVE ZONE PER CONVERSATIONS WITH KIRK STOKES AND ED SULLIVAN

DATE: 7/15/87 SIGNATURE: [signature]

Form 25630 (R3-87)

FORM M-26C	REVISION 2
	PAGE 1 OF 3

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MASHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
JOB NAME FLYASH LANDFILL
DATE 6-27-89 WEATHER HOT

STARTING TIME N/A
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
INSPECTOR D. DICKSON BORING NO. MW4-1

SAMPLING		1ST 6"	2ND 6"	3RD 6"	SCALE	UD	SOIL CLASSIFICATION AND REMARKS
					0		AD-2 DRILL RIG #2555
1	4.5 6.0	3	5	5	5		YELLOW MICA. SILTY FINE TO COARSE SAND.
2	9.5 11.0	4	5	6	10		YELLOW MICA - SILTY FINE TO COARSE SAND
3	14.5 16.0	3	5	6	15		LT. OLIVE GRAY MICA. SILTY FINE TO COARSE SAND.
4	19.5 21.0	3	5	7	20		LT. OLIVE GRAY MICA. SILTY FINE TO COARSE SAND.
5	24.5 26.0	7	7	7	25		YELLOW MICA. SILTY FINE TO COARSE SAND
					30		
6	29.5 31.0	3	4	7			REDDISH YELLOW MICA. FINE TO MEDIUM SANDY SILT.
7	34.5 36.0	5	6	6	35		LT. OLIVE GRAY MICA. SILTY FINE TO COARSE SAND.
8	39.5 41.0	5	6	8	40		YELLOW MICA. SILTY FINE TO COARSE SAND.

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

BORING TERMINATED @ 80.5
BORING REFUSAL AUGER @ 80.5'
WATER TOB DEPTH 65.0' @ 2:30 P.M 6-27-89
WATER 24 HR: DEPTH 47.1 @ 7:30 A.M. 6-28-89
WATER LOSSES N/A
CASING SIZE N/A LENGTH 0

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO 80.5
~~HAND CHOP: W/MUD: W/WATER~~	TO
~~ROTARY DRILL: W/MUD: W/WATER~~	TO
~~DIAMOND CORE~~	TO

Form 25630 (R3-87)

FORM M–26C	REVISION 2
	PAGE 2 OF 3

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
JOB NAME FLYASH LANDFILL MW's
DATE 12-27-89 WEATHER NOT
STARTING TIME N/A
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
INSPECTOR D. DICKSON BORING NO. MW-1

	SAMPLING				SCALE	UD	SOIL CLASSIFICATION AND REMARKS
		1ST 6"	2ND 6"	3RD 6"	40		
9	44.5 46.0	5	8	9	45		LT. OLIVE GRAY MICA. SILTY FINE TO COARSE SAND
							LT. OLIVE GRAY MICA. SILTY FINE TO COARSE SAND.
10	49.5 51.0	5	7	8	50		SAMPLE #10 WAS NOTICEABLY DAMP
11	54.5 56.0	8	7	11	55		LT. OLIVE GRAY MICA. SILTY FINE TO MEDIUM SAND.
							SPLIT SPOON SAMPLER RETURNED WET.
12	59.5 61.0	9	16	21	60		OLIVE GRAY MICA. SILTY FINE TO COARSE SAND
13	64.5 66.0	19	31	43	65		LT. OLIVE BRN. MICA. SILTY FINE TO MEDIUM SAND.
14	69.5 71.0	16	36	48	70		LT. OLIVE BRN. MICA. SILTY FINE TO MEDIUM SAND.
15	74.5 75.4	40	50=5"		75		OLIVE GRAY MICA. SILTY FINE TO COARSE SAND WITH GRAVELS
16	79.5 ~~81.0~~ 80.4	30	50=5"		80		DARK YELLOWISH BRN. MICA. SILTY FINE TO COARSE SAND WITH GRAVELS

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

BORING TERMINATED @ 80.5
BORING REFUSAL AUGER @ 80.5
WATER TOB DEPTH 65.0 @ 2:30 P.M. 6-27-89
WATER 24 HR: DEPTH 47.1 @ 7:30 A.M. 6-28-89
WATER LOSSES N/A
CASING SIZE N/A LENGTH 0

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO 80.5
~~HAND CHOP: W/MUD: W/WATER~~	—TO—
~~ROTARY DRILL: W/MUD: W/WATER~~	—TO—
~~DIAMOND CORE~~	—TO—

Form 25630 (R3-87)

FORM M-26C	REVISION 2
	PAGE 3 OF 3

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
JOB NAME FLYASH CANDLER MW'S
DATE 6-27-89 WEATHER HOT INSPECTOR D. DICKSON

STARTING TIME N/A
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
BORING NO. MW-1

SAMPLING 1ST 6"	2ND 6"	3RD 6"	SCALE	UD	SOIL CLASSIFICATION AND REMARKS
			80		AUGER REFUSAL @ 80.5
					BORING TERMINATED
					SET MONITOR WELL PER ATTACHED SKETCH
			85		
			90		
			5		
			0		
			5		
			0		
			5		
			0		

BORING TERMINATED @ 80.5
BORING REFUSAL AUGER @ 80.5
WATER TOB DEPTH 65.0 @ 2:30 P.M 6-27-89
WATER 24 HR: DEPTH 41.1' @ 7:30 AM 6-28-89
WATER LOSSES N/A
CASING SIZE N/A LENGTH 0

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO 80.5 ~~74.5~~
~~HAND CHOP: W/MUD: W/WATER~~	— TO —
~~ROTARY DRILL: W/MUD: W/WATER~~	— TO —
~~DIAMOND CORE~~	— TO —

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

Form CI-51P	Revision 0	Page

DUKE POWER COMPANY — MARSHALL STEAM STA.

AS-BUILT INSTALLATION SKETCH

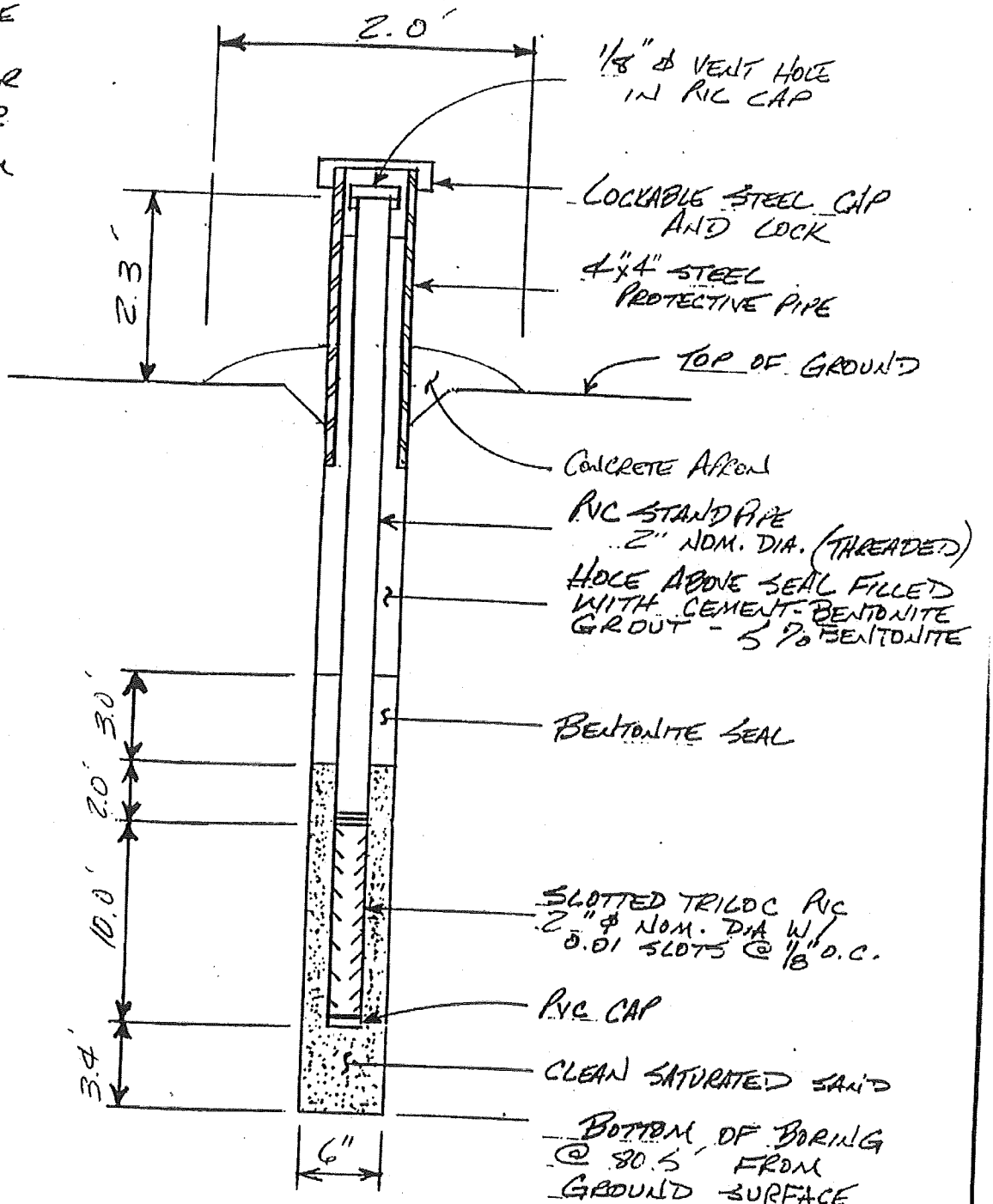
Instrument No. MW-1 Station N/A Offset N/A

By D. DICKSON Date 7-15-89

NOTE:
NOT TO SCALE

INITIAL WATER LEVEL RDG @ 49.4' FROM TOP/PIPE ON 7-6-89

T/PIPE ELEV. IS



NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT – GROUNDWATER SECTION
P.O. BOX 27687 – RALEIGH,N.C. 27611, PHONE (919) 733-5083

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR DUKE POWER CO.
DRILLER REGISTRATION NUMBER 921
STATE WELL CONSTRUCTION PERMIT NUMBER: 18-04

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: DENVER
HIGHWAY #150
(Road, Community, or Subdivision and Lot No.)
County: CATAWBA

2. OWNER DUKE POWER CO.
ADDRESS P. O. BOX 33189 (Street or Route No.)
CHARLOTTE (City or Town) NC (State) 28242 (Zip Code)

3. DATE DRILLED 6-28-89 USE OF WELL MONITORING
4. TOTAL DEPTH 34.9 CUTTINGS COLLECTED ☑ Yes ☐ No
5. DOES WELL REPLACE EXISTING WELL? ☐ Yes ☑ No
6. STATIC WATER LEVEL: 7.2 FT. ☐ above ☑ below TOP OF CASING,
TOP OF CASING IS 2.2 FT. ABOVE LAND SURFACE.
7. YIELD (gpm): N/A METHOD OF TEST N/A
8. WATER ZONES (depth): N/A
9. CHLORINATION: Type N/A Amount N/A

DRILLING LOG

Depth From	Depth To	Formation Description
		SEE ATTACHED SOIL TEST BORING FIELD REPORT FOR # MW-2.

If additional space is needed use back of form.

10. CASING:

	Depth From	Depth To	Diameter	Wall Thickness or Weight/Ft.	Material
	0	23.0 Ft.	2" I.D.	~~SCH 80~~	PVC
		Ft.			
		Ft.			

11. GROUT:

	Depth From	Depth To	Material	Method
	0	18.0 Ft.	NEAT CEMENT	PUMPED
		Ft.		

12. SCREEN:

	Depth From	Depth To	Diameter	Slot Size	Material
	23.0	33.0 Ft.	2" I.D.	.010 in.	PVC
		Ft.	in.	in.	
		Ft.	in.	in.	

13. GRAVEL PACK:

	Depth From	Depth To	Size	Material
	21.0	34.9 Ft.		CLEAN SAND
		Ft.		NC-25

14. REMARKS: BENTONITE SEAL PLACED FROM 18.0' – 21.0'

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

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

[signature] 7-15-89
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 Revised 11/84
Submit original to Division of Environmental Management and copy to well owner.

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

C MPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRAN P. O. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE: MARSHALL STEAM STATION	PERMIT NO.: 18 04
ADDRESS: HIGHWAY # 150, TERRELL, NC	OWNER (print): DUKE POWER CO.
DRILLING CONTRACTOR: DUKE POWER CO.	REGISTRATION NO.: 921

Casing Type:	FLUSH THREADED PVC dia. 2" in.	Grout Depth:	from 0 to 15.0 ft. - dia. 6
Casing Depth:	from 0 to 23.0 ft. - dia. 2" in.	Bentonite Seal:	from 15.0 to 21.0 ft. - dia. 6"
Screen Type:	FLUSH THREADED PVC dia. 2" in.	Sand/Gravel PK:	from 21.0 to 34.9 ft. - dia. 6"
Screen Depth:	from 23.0 to 33.0 ft. - dia. 2" in.	Total Well Depth:	from 0 to 34.9 ft. - dia. 6

Static Water Level: 7.2 feet from top of casing Date Measured 7 / 6 /

Yield (gpm): N/A Method of Testing: N/A Casing is 2.2 feet above land su

DRILLING LOG		
DEPTH FROM	TO	FORMATION DESCRIPTION
SEE ATTACHED SOIL TEST BORING FIELD REPORT FOR MW-#2.		

LOCATION SKETCH
(show distance to numbered roads, or other map reference poi

REMARKS: SCREEN IS PLACED IN THE MOST HYDRAULICALLY CONDUCTIVE ZONE PER CONVERSATIONS WITH RICH ROBERTS, NANCY AND [illegible]

DATE: 7.18.87 SIGNATURE: [signature]

Form 25630 (R3-87)

FORM M–26C	REVISION 2
	PAGE 1 OF 1

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
JOB NAME FLYASH LANDFILL MW'S
DATE 6-28-89 WEATHER HOT

STARTING TIME N/A
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
INSPECTOR D. DICKSON BORING NO. MW-2

SAMPLING					SCALE	UD	SOIL CLASSIFICATION AND REMARKS
		1ST 6"	2ND 6"	3RD 6"			
					0		AD-2 DRILL RIG # 2555 SURFACE GRASS
1	4.5 6.0	3	4	4	5		REDDISH YELLOW MICA. SILTY FINE TO COARSE SAND.
2	9.5 11.0	3	4	4	10		LT. YELLOWISH BR.N. MICA. SILTY FINE TO COARSE SAND.
3	14.5 16.0	3	3	4	15		LT. OLIVE GRAY MICA SILTY FINE TO COARSE SAND
4	19.5 21.0	4	7	10	20		LT. OLIVE GRAY MICA. SILTY FINE TO COARSE SAND.
5	24.5 26.0	13	26	24	25		LT. OLIVE BROWN MICA. SILTY FINE TO COARSE SAND
6	29.5 31.0	13	23	33	30		LT. OLIVE BROWN MICA. SILTY FINE TO COARSE SAND.
7	34.3 34.8	50=4"			35		NO RECOVERY AUGER REFUSAL @ 34.9 BORING TERMINATED SET 6" ϕ CASING TO 34.9' SET MONITOR WELL PER ATTACHED SKETCH.
					40		

BORING TERMINATED @ 34.9
BORING REFUSAL AUGER @ 34.9'
WATER TOB DEPTH 15.0' ON 6.28.89
WATER 24 HR: DEPTH 5.0' ON 7-6-89
WATER LOSSES NONE
CASING SIZE PW (6"ϕ) LENGTH 34.9'

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO 34.9
~~HAND CHOP: W/MUD: W/WATER~~	—TO—
~~ROTARY DRILL: W/MUD: W/WATER~~	—TO—
~~DIAMOND CORE~~	—TO—

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

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DUKE POWER COMPANY — MARSHALL STEAM STA.

AS-BUILT INSTALLATION SKETCH

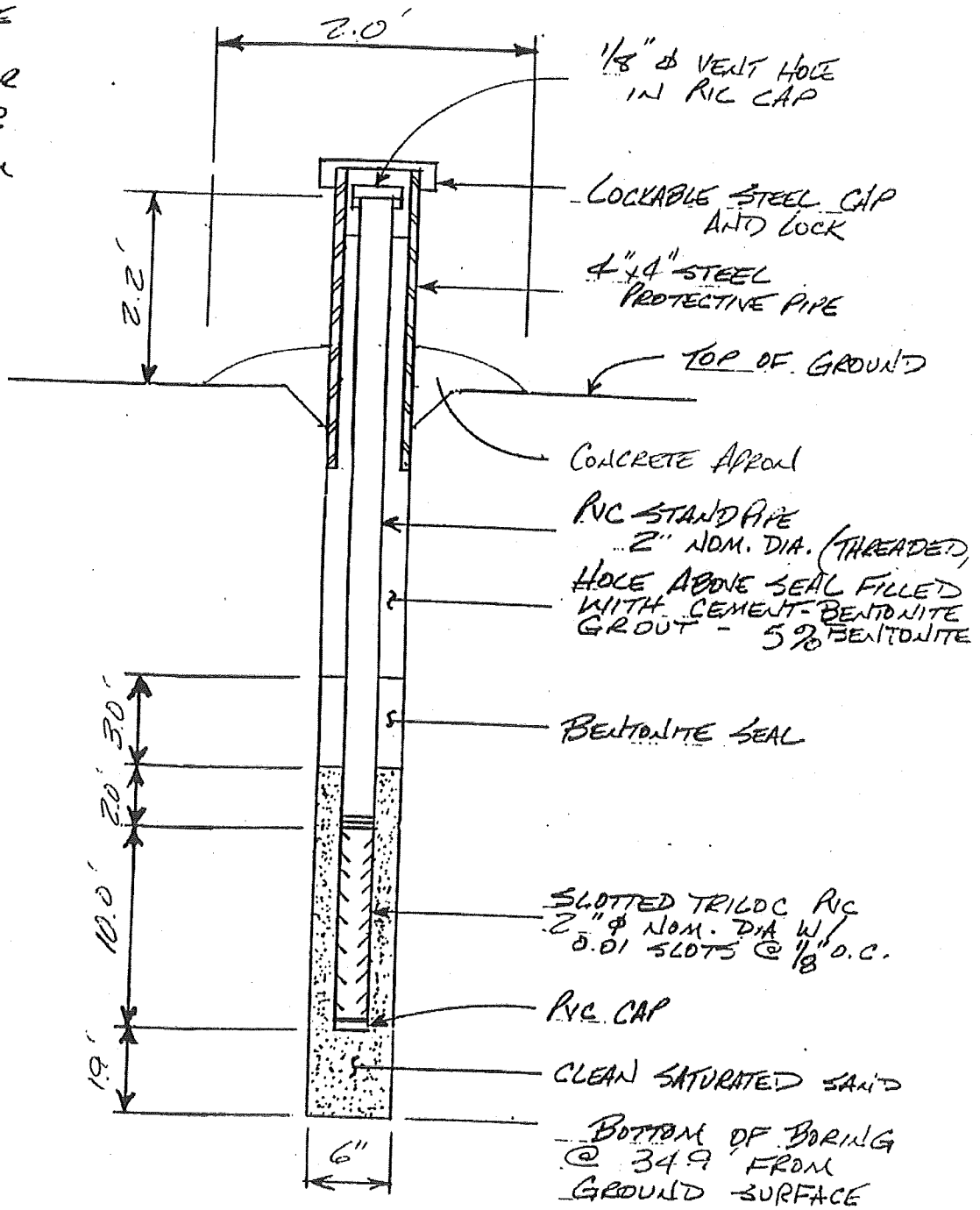
Instrument No. MW-2 Station N/A Offset N/A

By D. DICKSON Date 7-15-89

NOTE:
NOT TO SCALE

INITIAL WATER LEVEL RDG @ 7.2' FROM TOP/PIPE ON 7-6-89

T/PIPE ELEV. 15



NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH,N.C. 27611, PHONE (919) 733-5083

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR Duke Power Co.
DRILLER REGISTRATION NUMBER 921
STATE WELL CONSTRUCTION PERMIT NUMBER: 18-04

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Denver
Highway #150
(Road, Community, or Subdivision and Lot No.)
County: Catawba

2. OWNER Duke Power Co.
ADDRESS P.O. Box 33189 (Street or Route No.)
Charlotte NC 28242
City or Town State Zip Code

3. DATE DRILLED 6-29-87 USE OF WELL Monitoring
4. TOTAL DEPTH 27.4 CUTTINGS COLLECTED ☑ Yes ☐ No
5. DOES WELL REPLACE EXISTING WELL? ☐ Yes ☑ No
6. STATIC WATER LEVEL: 8.9 FT. ☐ above ☑ below TOP OF CASING,
TOP OF CASING IS 2.1 FT. ABOVE LAND SURFACE.
7. YIELD (gpm): N/A METHOD OF TEST N/A
8. WATER ZONES (depth): N/A
9. CHLORINATION: Type N/A Amount N/A

DRILLING LOG

Depth From	Depth To	Formation Description
		See Attached Soil Test Boring Field Report for #MW-3

If additional space is needed use back of form.

10. CASING:

	Depth From	Depth To	Diameter	Wall Thickness or Weight/Ft.	Material
	0	15.9 Ft.	2" I.D.	.154	PVC
		Ft.			
		Ft.			

11. GROUT:

	Depth From	Depth To	Material	Method
	0	11.0 Ft.	Neat Cement	Pumped
		Ft.		

12. SCREEN:

	Depth From	Depth To	Diameter	Slot Size	Material
	15.9	25.9 Ft.	2" I.D.	.010 in.	PVC
		Ft.	in.	in.	
		Ft.	in.	in.	

13. GRAVEL PACK:

	Depth From	Depth To	Size	Material
	14.0	27.4 Ft.		NC #2 Sand
		Ft.		

14. REMARKS: Bentonite Seal Placed from 11.0 - 14.0'

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

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

[signature] 7-15-87
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 Revised 11/84
Submit original to Division of Environmental Management and copy to well owner.

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRAN P. O. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE:	PERMIT NO.:
MARSHALL STEAM STATION	18-04
ADDRESS:	**OWNER (print):**
HIGHWAY #150 TERRELL, NC	DUKE POWER CO.
DRILLING CONTRACTOR:	**REGISTRATION NO.:**
DUKE POWER CO.	721

Casing Type: TRILOC THREADED PVC dia. 2" in. Grout Depth: from 0 to 14.0 ft. - dia. 6
Casing Depth: from 0 to 15.3 ft. - dia. 2" in. Bentonite Seal: from 11.0 to 14.0 ft. - dia. 6
Screen Type: TRILOC THREADED PVC dia. 2" in. Sand/Gravel PK: from 14.0 to 27+ ft. - dia. 6
Screen Depth: from 15.9 to 25.9 ft. - dia. 2" in. Total Well Depth: from 0 to 27.0 ft. - dia. 6

Static Water Level: 8.9 feet from top of casing Date Measured 7/6/

Yield (gpm): N/A Method of Testing: N/A Casing is 2.1 feet above land su

DRILLING LOG		
DEPTH FROM	TO	FORMATION DESCRIPTION
SEE ATTACHED SOIL		
TEST BORING FIELD		
REPORT FOR MW-#3.		

LOCATION SKETCH

(show distance to numbered roads, or other map reference po

REMARKS: SCREEN IS PLACED IN THE MOST HYDRAULICALLY CONDUCTIVE ZONE PER CONVERSATIONS WITH RALEIGH REGIONAL AND ED SULLIVAN.

DATE: 7.15.97 SIGNATURE: David L Sullivan

Form 25630 (R3-87)

FORM M-26C	REVISION 2
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DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
JOB NAME FLYASH LANDFILL MW's
DATE 6-29-89 WEATHER HOT

STARTING TIME N/A
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
INSPECTOR D. DICKSON BORING NO. MW-3

SAMPLING					SCALE	UD	SOIL CLASSIFICATION AND REMARKS
		1ST 6"	2ND 6"	3RD 6"			
					0		AD-2 DRILL RIG #2555
1	4.8 6.3	3	3	4	5		STRONG BROWN MICA. FINE TO MED. SANDY SILT.
2	9.8 11.3	9	13	21	10		WHITE MICA. FINE TO COARSE SAND
3	14.8 16.3	12	21	16	15		WHITE MICA. FINE TO COARSE SAND
4	19.8 21.3	15	14	13	20		VERY PALE BROWN MICA. FINE TO COARSE SAND.
5	24.8 26.3	3	5	5	25		STRONG BROWN MICA. SILTY FINE TO MEDIUM SAND.
					30		AUGER REFUSAL @ 27.4' BORING TERMINATED SET MONITOR WELL PER ATTACHED SKETCH
					35		
					40		

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

BORING TERMINATED @ 27.4
BORING REFUSAL AUGER @ 27.4'
WATER TOB DEPTH 21.0 ON 6.29-89
WATER 24 HR: DEPTH 6.8' ON 7-6-89
WATER LOSSES N/A
CASING SIZE N/A LENGTH 0

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO 27.4
~~HAND CHOP: W/MUD: W/WATER~~	—TO—
~~ROTARY DRILL: W/MUD: W/WATER~~	—TO—
~~DIAMOND CORE~~	—TO—

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DUKE POWER COMPANY — MARSHALL STEAM STA.

AS-BUILT INSTALLATION SKETCH

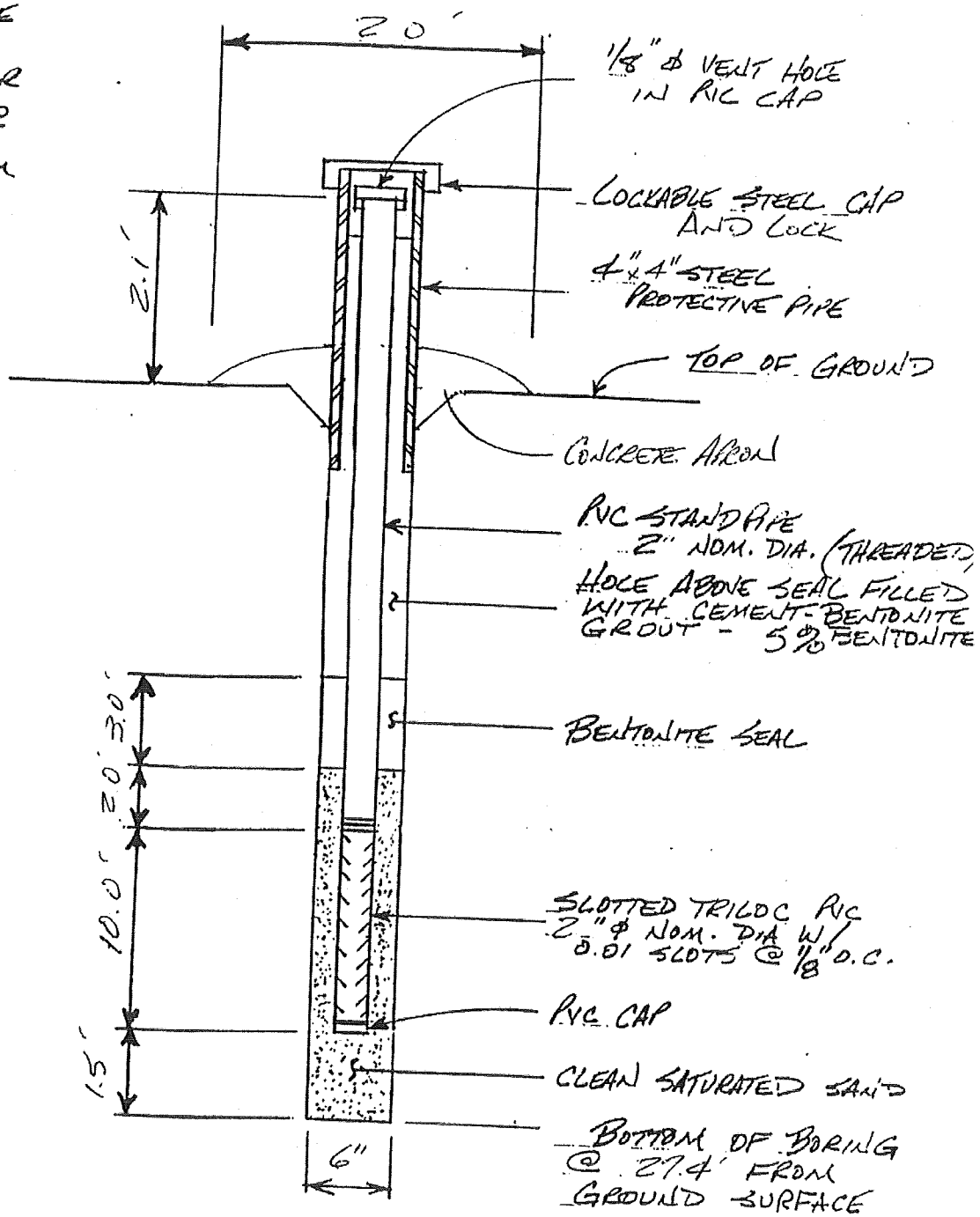
Instrument No. MW-3 Station N/A Offset N/A

By D DICKSON Date 7-15-89

NOTE:
NOT TO SCALE

INITIAL WATER LEVEL RDG @ 8.9' FROM TOP/PIPE ON 7-6-89

T/PIPE ELEV. 15



NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH,N.C. 27611, PHONE (919) 733-5083

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR DUKE POWER CO.
DRILLER REGISTRATION NUMBER 321
STATE WELL CONSTRUCTION PERMIT NUMBER: 18-04

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: DENVER
HIGHWAY # 150
(Road, Community, or Subdivision and Lot No.)
County: CATAWBA

2. OWNER DUKE POWER CO.
ADDRESS P.O. BOX 33189 (Street or Route No.)
CHARLOTTE NC 28242
City or Town State Zip Code

3. DATE DRILLED 6-30-89 USE OF WELL MONITORING
4. TOTAL DEPTH 49.6 CUTTINGS COLLECTED ☒ Yes ☐ No
5. DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
6. STATIC WATER LEVEL: 34.3 FT. ☐ above ☒ below TOP OF CASING,
TOP OF CASING IS 2.6 FT. ABOVE LAND SURFACE.
7. YIELD (gpm): N/A METHOD OF TEST N/A
8. WATER ZONES (depth): N/A
9. CHLORINATION: Type N/A Amount N/A

Depth From	Depth To		DRILLING LOG Formation Description
			SEE ATTACHED
			SOIL TEST BORING
			FIELD REPORT
			FOR # MW-4

If additional space is needed use back of form.

10. CASING:

	Depth From	To		Diameter	Wall Thickness or Weight/Ft.	Material
	0	37.4	Ft.	2" I.D.	.154	PVC
			Ft.			
			Ft.			

11. GROUT:

	Depth From	To		Material	Method
	0	32.5	Ft.	NEAT CEMENT	PUMPED
			Ft.		

12. SCREEN:

	Depth From	To		Diameter		Slot Size		Material
	37.4	47.4	Ft.	2" I.D.	in.	.010	in.	PVC
			Ft.		in.		in.	
			Ft.		in.		in.	

13. GRAVEL PACK:

	Depth From	To		Size	Material
	35.5	49.6	Ft.		NC # 2 SAND
			Ft.		

14. REMARKS: BENTONITE SEAL PLACED FROM 32.5 - 35.5'

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

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

Monica L. Wilson 7-15-89
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 Revised 11/84
Submit original to Division of Environmental Management and copy to well owner.

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

MPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRAN P. O. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE:	PERMIT NO.:
MARSHALL STEAM STATION	15-04
ADDRESS:	**OWNER (print):**
HIGHWAY #150 TERRELL, NC	DUKE POWER CO
DRILLING CONTRACTOR:	**REGISTRATION NO.:**
DUKE POWER CO.	921

Casing Type: TRUOC THREADED PVC dia. 2 in. Grout Depth: from 0 to 32.5 ft. - dia. 6
Casing Depth: from 0 to 37.4 ft. - dia. 2 in. Bentonite Seal: from 32.5 to 35.5 ft. - dia. 6
Screen Type: TRUOC THREADED PVC dia. 2 in. Sand/Gravel PK: from 35.5 to 49.6 ft. - dia. 6
Screen Depth: from 37.4 to 47.4 ft. - dia. 2 in. Total Well Depth: from 0 to 49.6 ft. - dia. 6

Static Water Level: 34.3 feet from top of casing Date Measured 7/6

Yield (gpm): N/A Method of Testing: N/A Casing is 2.6 feet above land su

DRILLING LOG

DEPTH FROM	TO	FORMATION DESCRIPTION
		SEE ATTACHED
		SOIL TEST BORING
		FIELD REPORT
		FOR MH-#4.

LOCATION SKETCH

(show distance to numbered roads, or other map reference po

REMARKS: EXCEED IS RATED AS THE MOST HYDRAULICALLY CONDUCTIVE ZONE PER CONVERSATIONS WITH RALPH ROBERTS AND ED SULLIVAN.

DATE: 7-15-87 SIGNATURE: Mark C. Anderson

Form 25630 (R3-87)

FORM M–26C	REVISION 2
	PAGE 1 OF 2

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT B MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
JOB NAME FLYASH LANDFILL MW'S
DATE 6-29-89 WEATHER HOT

STARTING TIME N/A
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
INSPECTOR D. DICKSON BORING NO. MW-4

	SAMPLING				SCALE	UD	SOIL CLASSIFICATION AND REMARKS
		1ST 6"	2ND 6"	3RD 6"			
					0		AD-2 DRILL RIG #2555
1	4.5 6.0	3	4	4	5		RED MICA. SILTY FINE TO MEDIUM SAND
2	9.5 11.0	6	3	3	10		LT. BROWNISH GRAY MICA. SILTY FINE TO MEDIUM SAND.
3	14.5 16.0	4	5	6	15		LT. BROWNISH GRAY MICA. SILTY FINE TO COARSE SAND.
4	19.5 21.0	2	4	6	20		LT. BROWNISH GRAY MICA. SILTY FINE TO MEDIUM SAND.
5	24.5 26.0	6	8	9	25		LT. BROWNISH GRAY MICA. SILTY FINE TO MEDIUM SAND.
6	29.5 31.0	5	10	12	30		LT. BROWNISH GRAY MICA. SILTY FINE TO MEDIUM SAND.
7	34.5 36.0	3	5	4	35		LT. BROWNISH GRAY MICA. SILTY FINE TO MEDIUM SAND.
8	39.5 41.0	5	8	13	40		LT. BROWNISH GRAY MICA. SILTY FINE TO MEDIUM SAND.

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

BORING TERMINATED
BORING REFUSAL
WATER TOB DEPTH
WATER 24 HR: DEPTH
WATER LOSSES
CASING SIZE LENGTH

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	TO
HAND CHOP: W/MUD: W/WATER	TO
ROTARY DRILL: W/MUD: W/WATER	TO
DIAMOND CORE	TO

DRY BORING - SEE MW-4A

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	PAGE 2 OF 2

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
JOB NAME FLYASH LANDFILL MW'S
DATE 6-29-89 WEATHER HOT

STARTING TIME N/A
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
INSPECTOR D. DICKSON BORING NO. MW-4

SAMPLING					SCALE	UD	SOIL CLASSIFICATION AND REMARKS
		1ST 6"	2ND 6"	3RD 6"			
					40		
9	44.5				45		LT. GRAY MICA. SICTY FINE TO MEDIUM SAND.
	~~45.0~~		50=6"				FOR CLARIFICATION - 44.5 - 45.0 50=6"
							AUGER REFUSAL @ 47.9'
					50		DRY BORING - MOVED TO ALTERNATE BORING SITE # MW-4A
					55		
					60		
					65		
					70		
					75		
					80		

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

BORING TERMINATED
BORING REFUSAL
WATER TOB DEPTH
WATER 24 HR: DEPTH
WATER LOSSES
CASING SIZE LENGTH

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	TO
HAND CHOP: W/MUD: W/WATER	TO
ROTARY DRILL: W/MUD: W/WATER	TO
DIAMOND CORE	TO

17 9

Form 25630 (R3-87)

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	PAGE 1 OF 2

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
STARTING TIME N/A
JOB NAME PLYASH LANDFILL MW'S
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
DATE 6-30-89 WEATHER HOT INSPECTOR D. DICKSON BORING NO. MW-4A

	SAMPLING				SCALE	UD	SOIL CLASSIFICATION AND REMARKS
		1ST 6"	2ND 6"	3RD 6"			
					0		AD-2 DRILL RIG # 2655
1	4.2 5.7	6	7	8			YELLOWISH RED MICA. SICTY FINE TO MEDIUM SAND.
					5		
2	9.2 10.7	7	C	C			WHITE MICA. FINE TO COARSE SAND
					10		
3	14.2 15.7	4	6	7			STRONG BROWN MICA. FINE TO MEDIUM SANDY SILT.
					15		
4	19.2 20.7	3	5	7			BROWNISH YELLOW MICA. SILTY FINE TO MEDIUM SAND
					20		
5	24.2 25.7	5	6	7			LT. OLIVE BROWN MICA. SILTY FINE TO MEDIUM SAND.
					25		
6	29.2 30.7	5	7	7			OLIVE MICA. SICTY FINE TO MEDIUM SAND.
					30		
7	34.2 35.7	4	6	7			OLIVE MICA. SILTY FINE TO MEDIUM SAND.
					35		
8	39.2 40.7	13	26	18			OLIVE GRAY MICA. SILTY FINE TO COARSE SAND. SPLIT SPOON SAMPLER RETRIEVED INTACT
					40		

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

BORING TERMINATED @ 49.6
BORING REFUSAL AUGER @ 49.6'
WATER TOB DEPTH 46.0' ON 6-30-89
WATER 24 HR: DEPTH 31.7 ON 7-6-89
WATER LOSSES N/A
CASING SIZE N/A LENGTH 0

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO 49.6
~~HAND CHOP: W/MUD: W/WATER~~	—TO—
~~ROTARY DRILL: W/MUD: W/WATER~~	—TO—
~~DIAMOND CORE~~	—TO—

Form 25630 (R3-87)

FORM M-26C | REVISION 2

PAGE 2 OF 2

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
JOB NAME FLYASH LANDFILL MW'S
DATE 6-30-89 WEATHER HOT

STARTING TIME N/A
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
INSPECTOR D. DICKSON BORING NO. MW-4A

SAMPLING					SCALE	UD	SOIL CLASSIFICATION AND REMARKS
		1ST 6"	2ND 6"	3RD 6"			
					40		
9	44.2						OLIVE BROWN MICA. SILTY FINE
	45.0	12	50=4"		45		TO COARSE SAND.
10	49.2						LT. OLIVE GRAY MICA. SILTY FINE
	49.5	50=3"			50		TO COARSE SAND
							AUGER REFUSAL @ 49.6'
							BORING TERMINATED
					55		SET MONITOR WELL
							PER ATTACHED SKETCH.
					60		
					65		
					70		
					5		
					0		

BORING TERMINATED @ 49.6
BORING REFUSAL AUGER @ 49.6
WATER TOB DEPTH 46.0' on 6-30-89
WATER 24 HR: DEPTH 31.7' on 9-6-89
WATER LOSSES N/A
CASING SIZE N/A LENGTH 0

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO 49.6
~~HAND CHOP: W/MUD: W/WATER~~	TO
~~ROTARY DRILL: W/MUD: W/WATER~~	TO
~~DIAMOND CORE~~	TO

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

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DUKE POWER COMPANY -- MARSHALL STEAM STA.

AS-BUILT INSTALLATION SKETCH

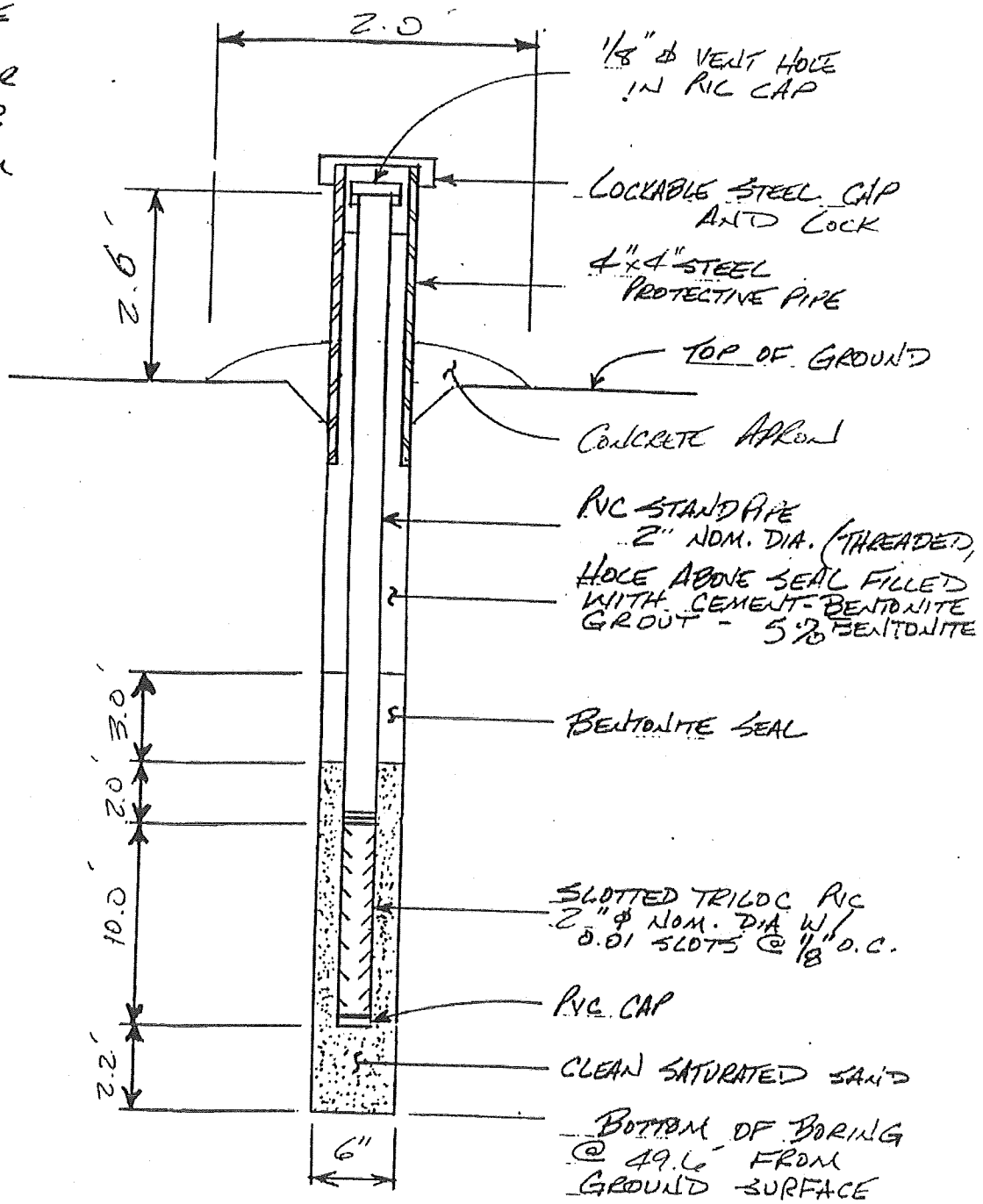
Instrument No. MW-4 Station N/A Offset N/A

By D. DICKSON Date 7-15-89

NOTE:
NOT TO SCALE

INITIAL WATER LEVEL RDG @ 34.3' FROM TOP/PIPE ON 7-6-89

T/PIPE ELEV. 15



North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section
1636 Mail Service Center - Raleigh, N.C. 27699-1636-Phone (919) 733-3221

WELL CONSTRUCTION RECORD

WELL CONTRACTOR: Duke Engineering & Services Charles A. Medlin
WELL CONTRACTOR CERTIFICATION #: 2172
STATE WELL CONSTRUCTION PERMIT#: _____

1. WELL USE (Check Applicable Box): Residential ☐ Municipal ☐ Industrial ☐ Agricultural ☐ Monitoring ☑
   Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use: _____
2. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: Terrell, N.C. County: ~~Davidson~~ CAM Catawba
   (Road Name and Numbers, Community, or Subdivision and Lot No.)
3. OWNER Duke Power CO.
   Address 422 South Church St. (Street or Route No.)
   Charlotte, NC. 28242 (City or Town, State, Zip Code)
4. DATE DRILLED 5/23/00
5. TOTAL DEPTH 35.0'
6. CUTTINGS COLLECTED YES ☑ NO ☐
7. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☑
8. STATIC WATER LEVEL Below Top of Casing: 21.4' FT. (Use "+" If Above Top of Casing)
9. TOP OF CASING IS 2.5' FT. Above Land Surface*

*Top of casing terminated at/or below land surface requires a variance in accordance with 15A NCAC 2C .0118

10. YIELD (gpm): N/A METHOD OF TEST N/A
11. WATER ZONES (depth): N/A
12. CHLORINATION: Type N/A Amount N/A
13. CASING:

	Depth From	Depth To	Diameter	Wall Thickness or Weight/Ft.	Material
	0.0'	18.0' Ft.	2"	Sch. 40	PVC
		Ft.			
		Ft.			

14. GROUT:

	Depth From	Depth To	Material	Method
	0.0'	14.5' Ft.	Neat Cement	Pumped
		Ft.		

15. SCREEN:

	Depth From	Depth To	Diameter	Slot Size	Material
	18.0'	28.0' Ft.	2" in.	.010 in.	PVC
		Ft.	in.	in.	
		Ft.	in.	in.	

16. SAND/GRAVEL PACK:

	Depth From	Depth To	Size	Material
	17.0'	35.0' Ft.	#1	clean SAND
		Ft.		

17. REMARKS: Note: A Bentonite seal is from 14.5' to 17.0'

DRILLING LOG

From	To	DEPTH Formation Description
	See Attached Field Report	Soil test Boring For MW-5

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

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.

Charles A. Medlin 5-29-00
SIGNATURE OF PERSON CONSTRUCTING THE WELL DATE

Submit original to Division of Water Quality, Groundwater Section within 30 days

FOR OFFICE USE ONLY
Quad No: _____
Serial No. _____

GW-1 REV. 12/99

Form 269683 (R11-92) • Previously Form 25630 | FORM M-26C | REVISION 3 | PAGE 1 OF 1

DUKE POWER COMPANY

PROJECT Marshall Steam Sta.

SOIL TEST BORING FIELD REPORT

BORING NO. MW-5 | STARTING TIME
JOB NO. Fly Ash Landfill | GROUND SURFACE ELEV.
JOB NAME Monitoring Well | HRS. DRILLING | HRS. MOVING
DATE 5-22-00 WEATHER Clear Hot INSPECTOR/DRILLER C.A. Medlin / Jim Barker / Ricky Dickard

	SAMPLING		1ST 6"	2ND 6"	3RD 6"	SCALE	UD	SOIL CLASSIFICATION AND REMARKS
						0		
1	3.5'	5.0'	2	3	5	5		BRN, MICA, Fine sandy SILT
2	8.5'	10.0'	2	3	5	10		BRN, Very MICA, Very Silty Fine SAND
3	13.5'	15.0'	2	2	3	15		Yellowish BRN, Very MICA, Fine sandy SILT
4	18.5'	20.0'	3	5	7	20		Yellowish BRN, Very MICA, Fine sandy SILT
5	23.5'	25.0'	3	3	5	25		Yellowish BRN, Very MICA, Silty Fine SAND
6	28.5'	30.0'	3	3	5	30		Yellowish BRN, Very MICA, Silty Fine SAND
7	33.5'	35.0'	6	9	13	35		Yellowish BRN, Very MICA, Silty Fine SAND
						40		Hole terminated @ 35.0'

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

BORING TERMINATED 35.0'
BORING REFUSAL N/A
WATER TOB DEPTH 23.35'
WATER 24 HR:DEPTH 21.40' 5-23-00
WATER LOSSES None Used
CASING SIZE N/A LENGTH N/A

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER 7¼" Auger	0.0' TO 35.0'
~~HAND CHOP:W/MUD:W/WATER~~	— TO —
~~ROTARY DRILL:W/MUD:W/WATER~~	— TO —
~~DIAMOND~~ CORE	— TO —

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT
DIVISION OF ENVIRONMENTAL MANAGEMENT – GROUNDWATER SECTION
P.O. BOX 27687 – RALEIGH,N.C. 27611, PHONE (919) 733-5083

FOR OFFICE USE ONLY
Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: DUKE POWER CO.
DRILLER REGISTRATION NUMBER: 921
STATE WELL CONSTRUCTION PERMIT NUMBER: 18-04

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: DENVER
HIGHWAY # 150
(Road, Community, or Subdivision and Lot No.)

County: CATAWBA

2. OWNER: DUKE POWER CO.
ADDRESS: P.O. BOX 33189 (Street or Route No.)
CHARLOTTE (City or Town) NC (State) 28242 (Zip Code)

3. DATE DRILLED: 6-28-89 USE OF WELL: OBSERVATION
4. TOTAL DEPTH: 64.5' CUTTINGS COLLECTED: ☐ Yes ☒ No
5. DOES WELL REPLACE EXISTING WELL? ☐ Yes ☒ No
6. STATIC WATER LEVEL: 44.9 FT. ☐ above ☒ below TOP OF CASING,
TOP OF CASING IS 2.3 FT. ABOVE LAND SURFACE.
7. YIELD (gpm): N/A METHOD OF TEST: N/A
8. WATER ZONES (depth): N/A
9. CHLORINATION: Type N/A Amount N/A

DRILLING LOG

Depth From	Depth To	Formation Description
		SEE ATTACHED SOIL TEST BORING FIELD REPORT FOR # OB-1
		SEE ALSO BORING FIELD REPORT FOR MW-#1 WHICH IS LOCATED APPROX. 30' AWAY

If additional space is needed use back of form.

10. CASING:

	Depth From	Depth To	Diameter	Wall Thickness or Weight/Ft.	Material
	0	53.2 Ft.	2" I.D.	.154	PVC
		Ft.			
		Ft.			

11. GROUT:

	Depth From	Depth To	Material	Method
	0	3.5 Ft.	NEAT CEMENT	POURED
		Ft.		

12. SCREEN:

	Depth From	Depth To	Diameter	Slot Size	Material
	53.2	63.2 Ft.	2" I.D.	.010 in.	PVC
		Ft.	in.	in.	
		Ft.	in.	in.	

13. GRAVEL PACK:

	Depth From	Depth To	Size	Material
	6.5	64.5 Ft.		CLEAN SAND NC # 2.5
		Ft.		

14. REMARKS: BENTONITE SEAL PLACED FROM 3.5' – 6.5'

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

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

David L. Nichols 7-15-89
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 Revised 11/84

Submit original to Division of Environmental Management and copy to well owner.

N. C. Department of Human Resources
Division of Health Services

WELL COMPLETION RECORD

C .MPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE I
DEPARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRAN
P. O. BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE:	PERMIT NO.:
MARSHALL STEAM STATION	15-04
ADDRESS: HIGHWAY # 150 TERRELL, NC	**OWNER (print):** DUKE POWER CO.
DRILLING CONTRACTOR: DUKE POWER CO.	**REGISTRATION NO.:** 421

Casing Type: TRILOC THREADED PVC dia. 2 in. Grout Depth: from 0 to 3.5 ft. - dia. 6
Casing Depth: from 0 to 53.2 ft. - dia. 2 in. Bentonite Seal: from 3.5 to 6.5 ft. - dia. 6
Screen Type: TRILOC THREADED PVC dia. 2 in. Sand/Gravel PK: from 6.5 to 64.5 ft. - dia. 6
Screen Depth: from 53.2 to 63.2 ft. - dia. 2 in. Total Well Depth: from 0 to 64.5 ft. - dia. 6

Static Water Level: 44.9 feet from top of casing Date Measured 7 / 6 /

Yield (gpm): N/A Method of Testing: N/A Casing is 2.3 feet above land su

DRILLING LOG		
DEPTH FROM	TO	FORMATION DESCRIPTION
SEE ATTACHED SOIL		
TEST BORING FIELD		
REPORT FOR OB-#1		
SEE ALSO BORING		
FIELD REPORT FOR MW-#1		
WHICH IS LOCATED APPROX		
80' AWAY.		

LOCATION SKETCH

(show distance to numbered roads, or other map reference poi

REMARKS: FOR WATER TABLE ONLY - BOTTOM OF SCREEN PLACED 20' BELOW STATIC WATER TABLE IN LIEU OF FUTURE DROUGHT CONDITIONS PER RALPH ROBERTS.

DATE: 7-15-89 SIGNATURE: David L. Jackson

Form 25630 (R3-87)

FORM M-26C	REVISION 2
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DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT MARSHALL

SOIL TEST BORING FIELD REPORT

JOB NO. N/A
JOB NAME FLYASH LANDFILL PH I'S
DATE 6-28-89 WEATHER HOT

STARTING TIME N/A
GROUND SURFACE ELEV.
HRS. DRILLING N/A HRS. MOVING N/A
INSPECTOR D. DICKSON BORING NO. OB-1

SAMPLING 1ST 6"	2ND 6"	3RD 6"	SCALE	UD	SOIL CLASSIFICATION AND REMARKS
			0		AD-2 DRILL RIG # 2555
NO SAMPLING REQUIRED PER RALPH ROBERTS			5		AUGERED TO 64.5'
					SET OBSERVATION WELL PER ATTACHED SKETCH.
			0		
			5		
			0		
			5		
			0		
			5		
			0		

BORING TERMINATED @ 64.5'
BORING REFUSAL N/A
WATER TOB DEPTH 63.0' @ 11:00 A.M. 6-28-89
WATER 24 HR: DEPTH 42.6 @ 7:00 A.M. 6-29-89
WATER LOSSES N/A
CASING SIZE N/A LENGTH 0

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	0 TO 64.5
~~HAND CHOP: W/MUD: W/WATER~~	—TO—
~~ROTARY DRILL: W/MUD: W/WATER~~	—TO—
~~DIAMOND CORE~~	—TO—

+ STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES

Form CI-61P	Revision 0	Page

DUKE POWER COMPANY — MARSHALL STEAM STATION

AS-BUILT INSTALLATION SKETCH

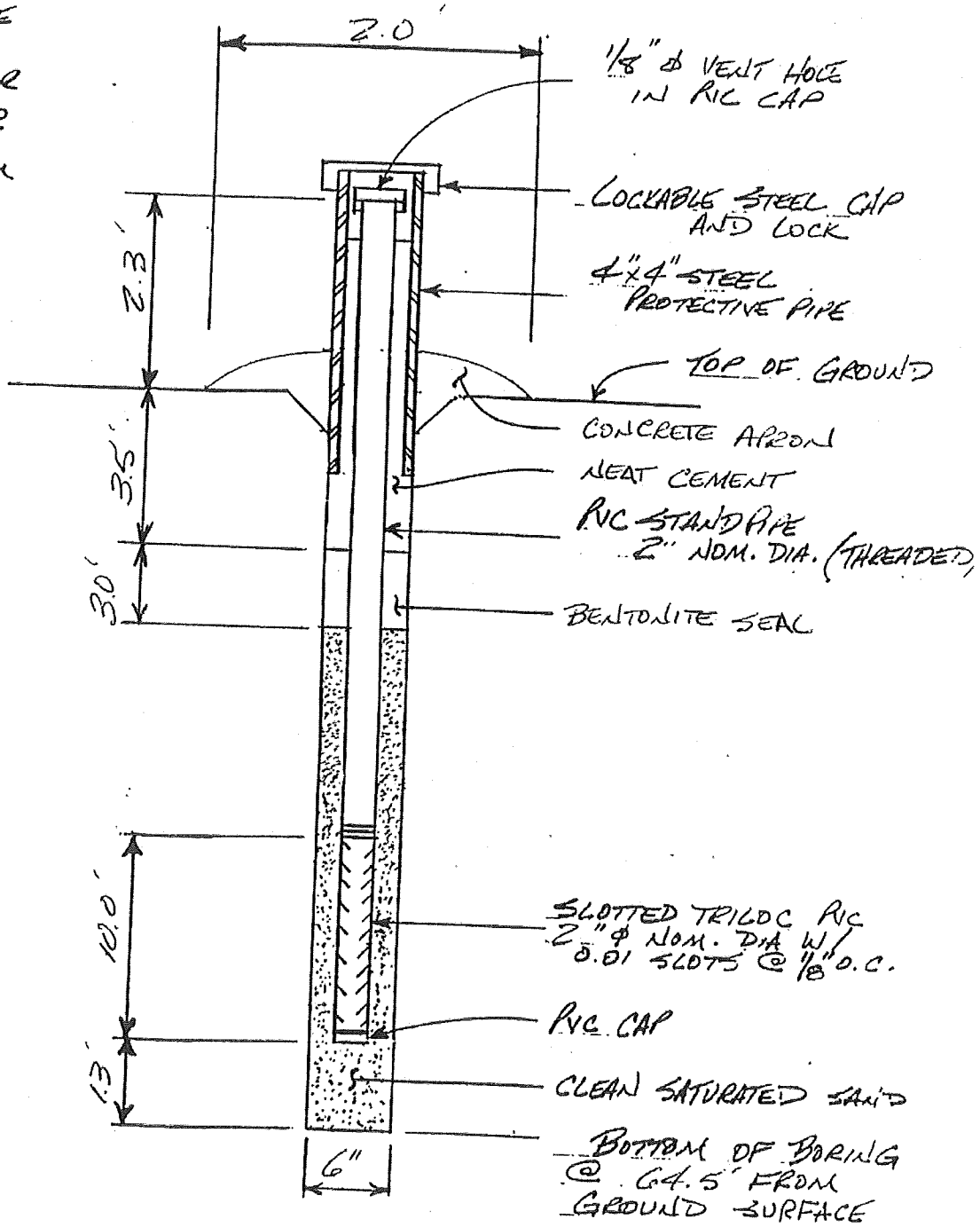
Instrument No. OB-1L Station N/A Offset N/A

By D. DICKSON Date 7-13-89

NOTE:
NOT TO SCALE

INITIAL WATER LEVEL RDG @ 44.9' FROM TOP/PIPE ON 7-6-89

T/PIPE ELEV. IS



NON RESIDENTIAL WELL CONSTRUCTION RECORD

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

WELL CONTRACTOR CERTIFICATION # 3455-A

1. WELL CONTRACTOR:

Well Contractor (Individual) Name: A E DRILLING SERVICES, LLC

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) MW-6 *(OB-2)

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐

Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐

Irrigation ☐ Other ☐ (list use)

DATE DRILLED 12/17/10

4. WELL LOCATION:

8320 E. NC Highway 150

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: Terrell COUNTY Catawba

TOPOGRAPHIC / LAND SETTING: (check appropriate box)

☐ Slope ☐ Valley ☑ Flat ☐ Ridge ☐ Other

LATITUDE 35.617031

LONGITUDE -80.969764

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.)

Marshall Steam Station

Facility Name / Facility ID# (if applicable)

8320 E. NC Highway 150

Street Address

Terrell NC 28682

City or Town / State / Zip Code

Jim Lindquist

Contact Name

SAME

Mailing Address

City or Town / State / Zip Code

(828) 478-7622

Area code Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 117.5

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☑

c. WATER LEVEL Below Top of Casing: 109.36 FT.

(Use "+" if Above Top of Casing)

d. TOP OF CASING IS +2.5 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 +2.5 Bottom 102.5 Ft.	2"	SCH 40	PVC
Top Bottom Ft.			
Top Bottom Ft.			

8. GROUT:

Depth	Material	Method
Top 0 Bottom 97 Ft.	cement/bentonite	pressure
Top Bottom Ft.		
Top Bottom Ft.		

9. SCREEN:

Depth	Diameter	Slot Size	Material
Top 102.5 Bottom 117.5 Ft.	2 in.	.010 in.	PVC
Top Bottom Ft.	in.	in.	
Top Bottom Ft.	in.	in.	

10. SAND/GRAVEL PACK:

Depth	Size	Material
Top 100 Bottom 117.5 Ft.	#1	silica sand
Top Bottom Ft.		
Top Bottom Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description
0	88	coal ash
88	119.5	weathered bedrock

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.

Gary Winbourn 12/28/10

SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

Gary Winbourn

PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 807-6300

Form GW-1b
Rev. 11/08

* The name of MW-6 has been changed to OB-2.

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	Dark bluish gray (Gley 2 4/1 10B) coal ash, firm to hard						
				SS-1		2-8-10	
				SS-2		9-12-14	
				SS-3		9-12-20	
				SS-4		4-4-7	
				SS-5		8-11-10	
				SS-6		7-9-13	
				SS-7		8-8-8	
				SS-8		4-9-12	
				SS-9		5-6-17	

SOIL_BORING_LOGS.GPJ 2/1/11

DRILLER: Dan Bergman/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: Duke Energy Marshall Steam Station
WELL ID: MW-6

December 16, 2010
PROJ. NO.: 6228-10-5284 **PAGE 1 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
45	Dark bluish gray (Gley 2 4/1 10B) coal ash, firm to hard						
				SS-10	X	4-3-4	
50							
				SS-11	X	4-3-4	
55							
				SS-12	X	8-10-13	
60							
				SS-13	X	4-5-28	
65							
				SS-14	X	12-12-11	
70							
				SS-15	X	5-6-6	
75							
				SS-16	X	10-13-11	
80							
				SS-17	X	8-10-13	
85							
				SS-18	X	7-8-9	
90	Yellow (10 YR 8/6) weathered bedrock, firm, contains quartz and potassium feldspar						

SOIL_BORING_LOGS.GPJ 2/1/11

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

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SOIL TEST BORING RECORD

PROJECT: Duke Energy Marshall Steam Station
WELL ID: MW-6

December 16, 2010
PROJ. NO.: 6228-10-5284

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	Yellow (10 YR 8/6) weathered bedrock, firm, contains quartz and potassium feldspar						
95				SS-19		5-6-10	
	Brownish yellow (10YR 6/4) saprolitic silt (ML), very stiff to very hard						
100				SS-20		6-8-9	
105				SS-21		WOH-8-9	
110				SS-22		7-9-12	
115				SS-23		20-32-50/5	
120				SS-24		37-50/4	
125							
130							
135							

SOIL_BORING_LOGS.GPJ 2/1/11

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

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SOIL TEST BORING RECORD

PROJECT: Duke Energy Marshall Steam Station
WELL ID: MW-6

December 16, 2010
PROJ. NO.: 6228-10-5284

MACTEC

NON RESIDENTIAL WELL CONSTRUCTION RECORD

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

WELL CONTRACTOR CERTIFICATION # 3455-A

1. WELL CONTRACTOR:
Gary Winbourn
Well Contractor (Individual) Name
A E DRILLING SERVICES, LLC
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) MW-7 *(OB-3)

3. WELL USE (Check One Box) Monitoring ☑ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☐ (list use)
DATE DRILLED 12/16/10

4. WELL LOCATION:
8320 E. NC Highway 150
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)
CITY: Terrell COUNTY Catawba
TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐Slope ☐Valley ☑Flat ☐Ridge ☐Other
LATITUDE 35.617219
LONGITUDE -80.970392
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.)
Marshall Steam Station
Facility Name Facility ID# (if applicable)
8320 E. NC Highway 150
Street Address
Terrell NC 28682
City or Town State Zip Code
Jim Hudquist
Contact Name
SAME
Mailing Address
City or Town State Zip Code
(828) 478-7622
Area code Phone number

6. WELL DETAILS:
a. TOTAL DEPTH: 54
b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☑
c. WATER LEVEL Below Top of Casing: 46.04 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS 2.5 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 39	Bottom 39 Ft.	2"	Sch 40	PVC
Top	Bottom Ft.			
Top	Bottom Ft.			

8. GROUT:

	Depth	Material	Method
Top 0	Bottom 32 Ft.	cement/bentonite	pressure
Top	Bottom Ft.		
Top	Bottom Ft.		

9. SCREEN:

	Depth	Diameter	Slot Size	Material
Top 39	Bottom 54 Ft.	2 in.	.01 in.	PVC
Top	Bottom Ft.	in.	in.	
Top	Bottom Ft.	in.	in.	

10. SAND/GRAVEL PACK:

	Depth	Size	Material
Top 34	Bottom 54 Ft.	#1	Silica Sand
Top	Bottom Ft.		
Top	Bottom Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description
0	54	silt and 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.

SIGNATURE OF CERTIFIED WELL CONTRACTOR 12/20/10 DATE

Gary Winbourn
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

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1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 807-6300

Form GW-1b
Rev. 11/08

* The name of MW-7 has been changed to OB-3.

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) clayey silt (ML), dry, stiff						some coal fragments
5				SS-1	X	4-6-6	
10	Pink (7.5 YR 8/3) fine sand (SW), firm			SS-2	X	4-4-3	
15	White (10 YR 8/1) fine sand (SW), some quartz pebbles, stiff			SS-3	X	4-3-4	
20				SS-4	X	4-3-5	
25				SS-5	X	5-6-6	
30	Brownish yellow (10 YR 6/6) saprolitic silt (ML), stiff to very hard			SS-6	X	3-4-7	
35				SS-7	X	9-13-20	
40				SS-8	X	9-10-10	moist
45				SS-9	X	13-16-13	quartz, mica

SOIL BORING LOGS.GPJ 2/1/11

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

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SOIL TEST BORING RECORD

PROJECT: Duke Energy Marshall Steam Station
WELL ID: MW-7

December 15, 2010
PROJ. NO.: 6228-10-5284

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	Brownish yellow (10 YR 6/6) saprolitic silt (ML), stiff to very hard						
50				SS-10	X	20-22-28	spoon wet
55				SS-11	X	50/3	
60							
65							
70							
75							
80							
85							
90							

SOIL_BORING_LOGS.GPJ 2/1/11

DRILLER: Dan Bergman/AE Drilling
EQUIPMENT: CME-750
METHOD: 4.25" (ID) HSA
HOLE DIA.: 8"
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SOIL TEST BORING RECORD

PROJECT: Duke Energy Marshall Steam Station
WELL ID: MW-7

December 15, 2010
PROJ. NO.: 6228-10-5284 **PAGE 2 OF 2**

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