DENR USE ONLY: ☐Paper Report ☐Electronic Data - Email CD (data loaded: Yes / No) Doc/Event #:

NC DENR
Division of Waste Management - Solid Waste

Environmental Monitoring Reporting Form

Notice: This form and any information attached to it are "Public Records" as defined in NC General Statute 132-1. As such, these documents are available for inspection and examination by any person upon request (NC General Statute 132-6).

Instructions:

- **Prepare one form for each individually monitored unit.**
- **Please type or print legibly.**
- Attach a notification table with values that attain or exceed NC 2L groundwater standards or NC 2B surface water standards. The notification must include a preliminary analysis of the cause and significance of each value. (e.g. naturally occurring, off-site source, pre-existing condition, etc.).
- Attach a notification table of any groundwater or surface water values that equal or exceed the reporting limits.
- Attach a notification table of any methane gas values that attain or exceed explosive gas levels. This includes any structures on or nearby the facility (NCAC 13B .1629 (4)(a)(i).
- In accordance with NC General Statutes Chapter 89C and 89E and NC Solid Waste Management Rules 15A NCAC 13B, be sure to affix a seal to the bottom of this page, when applicable.
- Send the original signed and sealed form, any tables, and Electronic Data Deliverable to: Compliance Unit, NCDENR-DWM, Solid Waste Section, 1646 Mail Service Center, Raleigh, NC 27699-1646.

Solid Waste Monitoring Data Submittal Information

Name of entity submitting data (laboratory, consultant, facility owner):

S&ME, Inc. (Consultant)

Contact for questions about data formatting. Include data preparer's name, telephone number and E-mail address:

Name: Willam M. Miller Phone: 828-687-9080 Ext 315

E-mail: wmiller@smeinc.com

Facility name:	Facility Address:	Facility Permit #	NC Landfill Rule: (.0500 or .1600)	Actual sampling dates (e.g., October 20-24, 2006)
Marshall Steam Station Dry Ash Landfill	8320 East Hwy 150 Catawba County, NC	18-04	.0500	February 16, 2009

Environmental Status: (Check all that apply)

☐ Initial/Background Monitoring ☒ Detection Monitoring ☐ Assessment Monitoring ☐ Corrective Action

Type of data submitted: (Check all that apply)

☒ Groundwater monitoring data from monitoring wells
☐ Groundwater monitoring data from private water supply wells
☐ Leachate monitoring data
☐ Surface water monitoring data
☐ Methane gas monitoring data
☐ Corrective action data (specify) _____
☐ Other(specify)

Notification attached?

☐ No. No groundwater or surface water standards were exceeded.
☒ Yes, a notification of values exceeding a groundwater or surface water standard is attached. It includes a list of groundwater and surface water monitoring points, dates, analytical values, NC 2L groundwater standard, NC 2B surface water standard or NC Solid Waste GWPS and preliminary analysis of the cause and significance of any concentration.
☐ Yes, a notification of values exceeding an explosive methane gas limit is attached. It includes the methane monitoring points, dates, sample values and explosive methane gas limits.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. Furthermore, I have attached complete notification of any sampling values meeting or exceeding groundwater standards or explosive gas levels, and a preliminary analysis of the cause and significance of concentrations exceeding groundwater standards. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

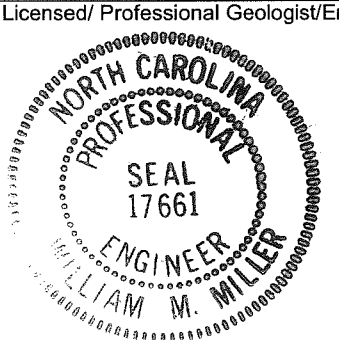
William Morton Miller | Senior Project Engineer | 828-687-9080 x315

Facility Representative Name (Print) | Title | (Area Code) Telephone Number

William Morton Miller | 4/2/09

Signature | Date

Affix NC Licensed/ Professional Geologist/Engineer Seal here:



Revised 01/2007

DUKE ENERGY
MARSHALL STEAM STATION
DRY ASH LANDFILL PERMIT #18-04
GROUNDWATER MONITORING REPORT
FEBRUARY 2009 SAMPLING EVENT

S&ME Project No. 11411-08-140

Prepared For:

Prepared By:

S&ME, Inc.
44 Buck Shoals Road Suite C-3
Arden, North Carolina 28704

April 2, 2009

S&ME

Celebrating 35 Years
1973 • 2008

April 2, 2009

Ms. Jackie Drummond
North Carolina Department of Environment and Natural Resources
Division of Waste Management
Solid Waste Section
1646 Mail Service Center
Raleigh, N.C. 27699-1646

Subject: Duke Energy Carolinas – Marshall Steam Station
Dry Ash Landfill
Permit # 18-04
Groundwater Monitoring Report

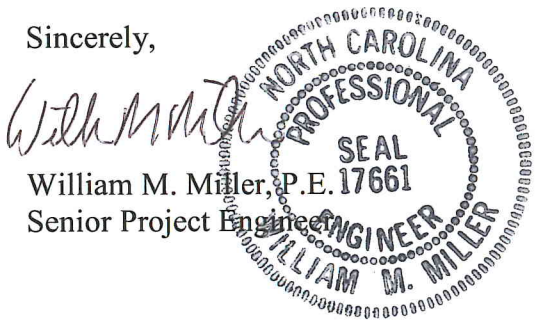
Dear Ms. Drummond:

Attached is the groundwater monitoring report for the Marshall Steam Station Dry Ash Landfill (Permit # 18-04). Groundwater sampling for the landfill was performed on February 16, 2009.

The Groundwater Monitoring Report for the sampling event includes a summary of the analytical results, a figure showing groundwater contours at the site, and the preliminary analyses of values in excess of the NC 2L groundwater standards. Also attached is the Environmental Monitoring Reporting Form. An EXCEL file containing the laboratory results in the Electronic Data Deliverable format will be sent to you by e-mail.

If you have questions or require additional information, please contact me by at 828-687-9080.

Sincerely,



William M. Miller, P.E.
Senior Project Engineer

Larry Armstrong, P.E.
Senior Engineer/Vice President

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

Five monitoring wells were sampled at the Marshall Dry Ash Landfill on February 16, 2009. These wells are located at the Dry Ash Landfill at Marshall Steam Station, located near Terrell, North Carolina. Groundwater elevations were measured at these wells and at observation well, OB-1, on that date. Groundwater wells MW-1, MW-2, MW-3, MW-4, and MW-5 comprise the groundwater monitoring system for the closed dry flyash landfills permitted under NCDENR Solid Waste Permit #18-04.

The sampling was conducted by Duke Energy according to North Carolina Solid Waste Management Guidelines and the parameters sampled determined by Duke and NCDENR Division of Solid Waste. Samples were analyzed by a North Carolina certified laboratory.

Results from the five monitoring wells were below the corresponding NCAC 2L groundwater quality standards with the exceptions noted below:

- pH – pH values below 6.5 were measured at all five wells (MW-1, MW-2, MW-3, MW-4, MW-5).
- Boron – Concentrations of boron in excess of 31.5 mg/l were measured in wells MW-1 and MW-2.
- Manganese – Concentrations of manganese in excess of 0.50 mg/l were measured in wells MW-3 and MW-5.

Results from the five monitoring wells were below the corresponding SWSL values with the exceptions noted below:

- Barium - Concentrations of barium in excess of 100 ug/l were measured in well MW-3.
- Manganese – Concentrations of manganese in excess of 50 ug/l were measured in wells MW-3 and MW-5.
- Selenium - Concentrations of selenium were measured in excess of 10 ug/l in well MW-2.
- Zinc - Concentrations of zinc were measured in excess of 10 ug/l in well MW-3.

The preliminary analysis of the cause and significance of these values is provided in Section 4.2. A summary of the laboratory analytical results is provided in Table 1.

2. BACKGROUND

Marshall Steam Station is owned and operated by Duke Energy Carolinas (Duke). Marshall Steam Station is located in Catawba County, on Highway NC 150, just west of Lake Norman. The Marshall plant generates 2090 MW of electric power by combustion of coal. Marshall is the second largest coal facility owned by Duke Energy. The

Marshall station generates enough electricity to power over one and a half a million homes.

The plant is located in the Piedmont physiographic region. The subsurface conditions in the plant area consist of residual soils and partially weathered rock which have been formed by the in-place weathering of the parent rock.

The permitted landfill areas are located north and east of the steam station and are located adjacent to the Marshall Ash Basin. The location of the permitted landfill areas and the wells is shown on **Figure 1**.

Two dry fly ash fills are permitted under this permit; the larger fill has an area of approximately 47 acres and is adjacent to the Marshall Ash Basin. Monitoring wells MW-2, MW-3, and MW-5 are located adjacent to this fill. The smaller fill is located adjacent to the Marshall Ash Basin and is approximately 14.5 acres in area. Monitoring well MW-1 and observation well OB-1 are located adjacent to this fill.

Monitoring well MW-4 is located upgradient from the 47 acre landfill and serves as the background well. Observation OB-1 is located adjacent to the smaller fill and is used only to measure groundwater levels.

The ground surface in the area of the landfill slopes from the elevation along Island Point Road (located north of MW-4), approximate elevation 880 feet to 890 feet, towards 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.

3. SCOPE OF WORK

To complete the scope of work, S&ME completed the following tasks:

- Received information provided by Duke on field sampling and measurement of groundwater elevations (performed by Duke) for monitoring wells MW-1, MW-2, MW-3, MW-4, MW-5, and observation well OB-1. This sampling was conducted on February 16, 2009.
- Review of laboratory analytical results for samples. These analyses were performed by a North Carolina certified laboratory, using State approved methods. These results were provided in both in paper format and in the form of an EXCEL file. The EXCEL file was manipulated to conform to the format requirements of the NCDENR Electronic Data Deliverable template.
- Develop a groundwater flow contour map using map data and groundwater elevation data supplied by Duke.
- Develop a preliminary analysis of the cause and significance of values exceeding NC 2L groundwater standards.

- Prepared and submitted this Groundwater Monitoring Report to Duke and to NCDENR.

4. RESULTS

4.1 Site Groundwater Flow

Groundwater flow contours for the site are shown on **Figure 1**. These contours were developed using the measured groundwater elevations in the wells from the February 16, 2009 sampling and from using the approximate surface water elevations for the Marshall Ash Basin and the adjacent Lake Norman.

Groundwater flow at the site is from areas of higher topography towards the Ash Basin and on towards Lake Norman. Well MW-4 is located north of the landfill and is at the highest topographic elevation. Groundwater flow is generally from MW-4 towards the 47 acre portion of the landfill and to the ash basin. It is expected that flow would be from the topographically higher region north of MW-3 and MW-5 towards the landfill, or in the case of MW-5, towards the portion of Ash Basin located to the east of the landfill.

The water elevation in well MW-2 is approximately the same as the pond elevation in the Ash Basin. Well MW-2 is located approximately 200 feet from the shore of the Ash Basin. Based in the location of the well and the observed water levels in the well relative to the Ash Basin, the well is likely influenced more by the water levels in the Ash basin than from groundwater flowing from the landfill.

The water elevation at well MW-3 is approximately the same as the pond elevation of the two adjacent ponded areas. These ponded areas are part of the ash basin that was cut off from the remainder of the ash basin by construction of the landfill.

Well MW-5 is located adjacent to the landfill and to an arm that was a part of the ash basin. This arm no longer contains appreciable free water and is filled with ash that was sluiced from the ash basin.

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

4.2 Groundwater Analytical Results

The results of the laboratory analyses for the groundwater monitoring well samples are summarized in **Table 1.**

Results from the five monitoring wells were below the corresponding NCAC 2L groundwater quality standards with the exceptions noted below. The preliminary analyses of the causes of these exceptions are provided below:

- pH – pH values below 6.5 were measured at all five wells (MW-1, MW-2, MW-3,

MW-4, MW-5). Values for pH ranged from 6.0 at MW-4 to 4.8 measured at MW-3. Well MW-4 is considered to be the background well and should not be impacted by effects from the landfill or the ash basin.

The values for pH in wells MW-1 and MW-2 are likely influenced by groundwater from the landfill areas and the water quality in the ash basin. Values for pH in wells MW-3 and MW-5 could be influenced by the landfill and by the adjacent former portions of the ash basin.

- Boron – Concentrations of boron in excess of 31.5 mg/l were measured in wells MW-1 and MW-2. The concentration of boron in these wells is likely from the water quality in the ash basin. As described in Section 4.1, these two wells are likely influenced by water levels and flow in the ash basin.
- Manganese – Concentrations of manganese in excess of 0.50 mg/l were measured in wells MW-3 and MW-5. These wells are located adjacent to areas that are former portions of the ash basin. The manganese concentrations observed in these wells could be caused by either the landfill or the former ash basin areas located adjacent to these wells.

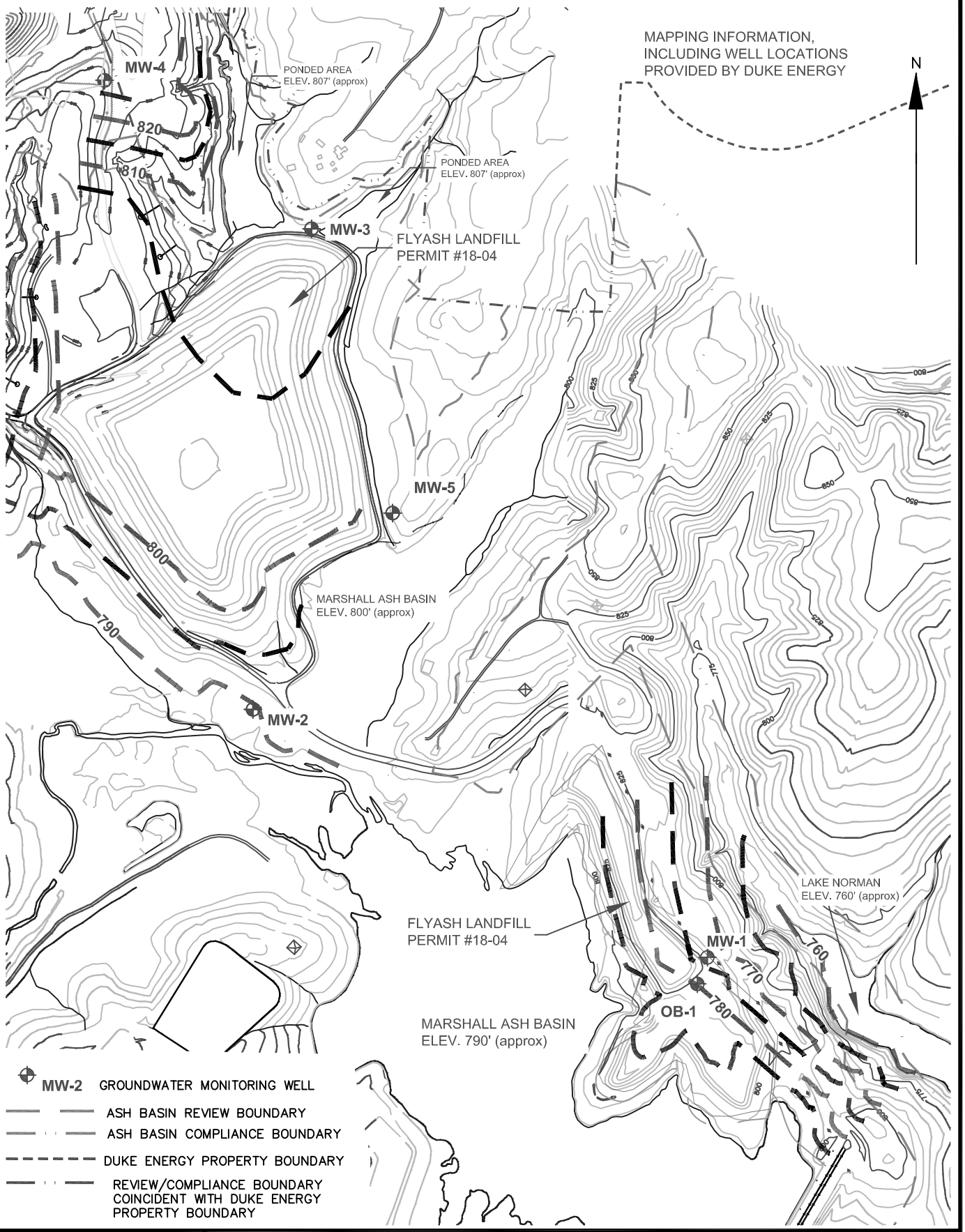
DUKE ENERGY - MARSHALL STEAM STATION **April 2, 2009**
FLY ASH LANDFILL - PERMIT #18-04
GROUNDWATER MONITORING REPORT
TABLE 1 - SUMMARY OF FIELD AND ANALYTICAL RESULTS
S&ME PROJECT 1411-08-140

Sample Date: February 16, 20098 (Field and Geochemistry Data)
Field parameters, analytical results, well data, and well elevations provided by Duke Energy.

Certificate Codes:
Duke Power Lab #248
Duke Power Field #5193
Pace Analytical #12

Parameter	SW ID	Units	Certificate Codes	Monitoring Well Identification						Field Blank	SWSL	15A NCAC 2L*
				1804-MW-1	1804-MW-2	1804-MW-3	1804-MW-4	1804-MW-5	1804-OB-1			
Field pH	320	Std. Units	5193	**5.7**	**5.2**	**4.8**	**6.0**	**5.4**				**6.5-8.5**
Field Spec. Conductance	323	umho/cm	5193	148	293	98	41	38				
Temperature	325	C	5193	15.0	15.0	15.0	14.0	14.0				
Top Casing	328	msl-feet		823.70	797.22	813.07	867.38	822.69	825.85			
Depth to Water	318	feet		51.2	8.0	6.1	39.7	25.2	46.07			
Water Elevation	319	msl-feet		772.47	789.24	806.98	827.70	797.46	779.78			
Well Depth	41	feet		78.75	35.10	28.15	50.20	30.71	65.50			
Arsenic	14	ug/L	12	*5.0* U	*5.0* U	*5.0* U	*5.0* U	*5.0* U		5.0 U	**10**	**50**
Barium	15	ug/L	12	77.4 J	60.0 J	364.0	49.5 J	47.2 J		5.0 U	**100**	**2000**
Boron	316	ug/L	12	**706**	**2490**	14 J	13 J	11 J		6.2 J	**NE**	**315**
BOD, 5 day	NE	mg/L	12	*2.0* U	*2.0* U	*2.0* U	*2.0* U	*2.0* U			**NE**	**NE**
Cadmium	34	ug/L	12	*1.0* U	*1.0* U	*1.0* U	*1.0* U	*1.0* U		1.0 U	**1.0**	**1.75**
Chemical Oxygen Demand	317	ug/L	12	*25000* U	*25000* U	*25000* U	*25000* U	*25000* U		25000 U	**NE**	**NE**
Chloride	301	ug/L	12	*5000* U	6540	11800	*5000* U	*5000* U		5000 U	**NE**	**250000**
Chromium	51	ug/L	12	7.8 J	*5.0* U	1.3 J	1.2 J	*5.0* U		5.0 U	**10**	**50**
Copper	54	ug/L	12	*5.0* U	*5.0* U	*5.0* U	*5.0* U	*5.0* U		5.0 U	**10**	**1000**
Fluoride	312	ug/L	12	140 J	*100* U	*100* U	*100* U	*100* U		100 U	**2000**	**2000**
Iron	340	ug/L	12	46.4 J	*50.0* U	265.0 J	102.0 J	225.0 J		50.0 U	**300**	**300**
Lead	131	ug/L	12	*5.0* U	*5.0* U	*5.0* U	*5.0* U	*5.0* U		5.0 U	**10**	**15**
Manganese	342	ug/L	12	6.8 J	9.0 J	**65.9**	3.8 J	**110.0**		5.0 U	**50**	**50**
Mercury	132	ug/L	12	*0.20* U	*0.20* U	*0.20* U	*0.20* U	*0.20* U		0.20 U	**0.20**	**1.05**
Nickel	152	ug/L	12	*5.0* U	*5.0* U	4.1 J	*5.0* U	*5.0* U		5.0 U	**50**	**100**
Nitrogen, Nitrate	303	ug-N/L	12	114 J	452 J	7010 J	*100* U	*100* U		100 U	**1000**	**10000**
Selenium	183	ug/L	12	*10.0* U	25.2	*10.0* U	*10.0* U	*10.0* U		10.0 U	**10**	**50**
Silver	184	ug/L	12	0.87 J	1.70 J	*5.00* U	0.28 J	0.37 J		0.1 J	**10**	**17.5**
Sulfate	315	ug/L	12	39000 J	101000 J	*5000* U	*5000* U	*5000* U		5000 U	**250000**	**250000**
Total Dissolved Solids	311	ug/L	12	138000	222000	50000	60000	80000			**NE**	**500000**
Total Organic Carbon	357	ug/L	12	10800	16100	5120	6950	8950		1000 U	**NE**	**NE**
Total Organic Halide	396	ug/L	12	30	50	40	40	30		30	**NE**	**NE**
Zinc	213	ug/L	12	0.87 J	*10.0* U	14.8	*10.0* U	4.8 J		10.0 U	**10**	**1050**

NCAC 2L stds. = *15A NCAC 2L .0200, Groundwater Quality Standards for Class GA groundwater* *** Maximum Contaminant Level (MCL)**
NC SWSL = *North Carolina Solid Waste Section Limit* ***NE*** = *Not Established*
J = *Parameters are estimated values between the detection limit and the NC SWSL.*
U = *Value below Laboratory Reporting Limit*
BOLD VALUES indicate a values that attain or exceed the 15A NCAC 2L Groundwater Standards.
Values in gray cells indicate values that attain or exceed the SWSL.
Values shown in italics represent values reported by the laboratory as Non Detect. Duke has chosen to present these values as equal to the SWSL value.



SCALE: 1 inch =600 ft	S&ME	DUKE ENERGY MARSHALL STEAM STATION FLYASH LANDFILL PERMIT #18-04 GROUNDWATER CONTOURS FEBRUARY 2009	FIGURE NO: 1
CHECKED BY: L ARMSTRONG			
DRAWN BY: W.MILLER			
DATE: 4-2-09		JOB NO: 1411-08-140	