

# LANDFILL GAS MONITORING PLAN

Davidson County C&D Landfill  
Lexington, North Carolina  
NC Solid Waste Permit No. 29-06

Prepared for:



**APPROVED**  
DIVISION OF WASTE MANAGEMENT  
SOLID WASTE SECTION  
DATE 7/6/2011 BY Brian Weston  
ID# 14308

Davidson County Integrated Solid Waste Management Dept.  
Thomasville, North Carolina

Prepared by:



14 N. BOYLAN AVENUE  
RALEIGH, NORTH CAROLINA 27603  
NC LICENSE NO. C-0828 (ENGINEERING)

April 2011



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Prepared for:



Davidson County Integrated Solid Waste Management Dept.  
Thomasville, North Carolina

RSG Project No. **Davdco-10-2**

A handwritten signature in blue ink that reads "Joan A. Smyth".

Senior Hydrogeologist



April 2011



14 N. BOYLAN AVENUE  
RALEIGH, NORTH CAROLINA 27603  
NC LICENSE NO. C-0828 (ENGINEERING)



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**DAVIDSON COUNTY C&D LANDFILL**  
**NC SOLID WASTE PERMIT NO. 29-06**

**LANDFILL GAS MONITORING PLAN**  
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**DAVIDSON COUNTY C&D LANDFILL**  
NC SOLID WASTE PERMIT NO. 29-06

**LANDFILL GAS MONITORING PLAN**

**1.0 INTRODUCTION**

**1.1 Project Description**

This Landfill Gas Monitoring Plan (Plan) has been prepared by Richardson Smith Gardner & Associates, Inc. (RSG) to present a comprehensive landfill gas (LFG) monitoring program at the Davidson County C&D Landfill (NC Solid Waste Permit 29-06). The site is located off of Roy Lopp Road in Lexington, North Carolina as shown in **Figure 1**. The proposed plan presents the rationale for the monitoring program as well as necessary actions required by the Owner to protect and safeguard the area surrounding the C&D landfill and to satisfy North Carolina Solid Waste Management Rules [13B.0544(d)] for monitoring and controlling LFG.

At a minimum, these regulations require owners of landfills to ensure that the facility does not exceed:

- *25% of the lower explosive limit (LEL) or 1.25% CH<sub>4</sub> by volume in structures; and*
- *100% of the LEL or 5% CH<sub>4</sub> by volume at the facility property boundary.*

The Engineer has utilized the best available site data, practices, experience, and judgment to develop this plan. However, the program may require modifications and maintenance over time to accommodate changing landfill conditions, changing receptors in areas adjacent and around the landfill, or other conditions that cannot be fully anticipated. Maintenance suggestions are also included in this plan to assist in the identification of secondary conditions that may require updates to this Plan.

Uncontrolled migration of LFG can result in loss of property, loss of life, injury, vegetative damage and intolerable odors. The monitoring of landfills includes exposure to explosive gases. All operational and/or monitoring staff should be specifically trained in the management and response for situations such as fire or explosion, confined space, drilling, and overhead hazards, and possess and awareness of changing conditions around these sites.

**1.2 Contact Information**

In case of emergencies, or if questions arise during the implementation of this program, please contact the following:

*1.2.1 Owner*

Davidson County Integrated Solid Waste Management Department  
1242 Old Highway 29  
Thomasville, NC 27  
Phone: (336) 242-2284  
Fax: (336) 249-7524  
Director of Integrated Solid Waste: Charles Brushwood  
email: [charlie.brushwood@davidsoncountync.gov](mailto:charlie.brushwood@davidsoncountync.gov)

### *1.2.3 Engineer*

Richardson Smith Gardner & Associates, Inc.

14 N. Boylan Avenue

Raleigh, North Carolina 27603

Phone: (919) 828-0577

Ms. Joan A. Smyth, P.G., Senior Hydrogeologist

email: [joan@rsgengineers.com](mailto:joan@rsgengineers.com)

Mr. Pieter K. Scheer, P.E., Senior Engineer

email: [pieter@rsgengineers.com](mailto:pieter@rsgengineers.com)

### *1.2.4 Solid Waste Regulatory Agency*

North Carolina Department of Environment and Natural Resources

Division of Waste Management:

Raleigh Central Office (RCO)

401 Oberlin Road, Suite 150

Raleigh, North Carolina 27605

Phone: (919) 508-8400

Ms. Jaclynne Drummond, Hydrogeologist II

email: [jaclynne.drummond@ncdenr.gov](mailto:jaclynne.drummond@ncdenr.gov)

Winston-Salem Regional Office (WRO)

585 Waughtown Street

Winston-Salem, NC 27107-2241

Phone: (336) 771-5000

Mr. Hugh Jernigan, Environmental Senior Specialist (Solid Waste Section)

email: [hugh.jernigan@ncdenr.gov](mailto:hugh.jernigan@ncdenr.gov)

### *1.2.5 Air Quality Regulatory Agency*

North Carolina Department of Environment and Natural Resources

Division of Air Quality:

Raleigh Regional Office

1628 Mail Service Center

Raleigh, North Carolina 27699

Phone: (919) 791-4200

Mr. Patrick Butler, Regional Supervisor

## **1.3 Existing Site Conditions**

The facility operates as a Construction and Demolition (C&D) landfill. Facilities located on the property include:

- A + 32 acre Subtitle D municipal solid waste (MSW) landfill (Phase 1);
- A recently constructed Phase 2 landfill (approximately 58.6 acres);
- A separate C&D landfill unit;
- A white goods area;
- A recycling building;
- A landfill office, scales and scalehouse;
- Two closed unlined MSW landfill units; and
- Leachate Storage.

### *1.3.1 Topography*

The landfill site lies adjacent to a small valley located east of the landfill as shown in **Figure 1**. Existing ground surface elevations range from El. 725 (feet mean sea level) near the edge of Phase 2 to approximately El. 695 at the lowest point within the C&D landfill footprint. The predominant development in the area is the Davidson County Landfill complex which surrounds the C&D landfill to the north, west and south.

### *1.3.2 Adjacent Areas*

The facility is divided into two (2) areas; the area to the south of the railroad track right of way owned by Southern Railway, and the area to the north of the tracks. The area to the south of the railroad tracks includes the Phase I landfill, the C&D landfill, the unlined MSW landfill units and a leachate storage pond. The area to the north of the tracks includes the recently constructed Phase 2 landfill, a leachate storage tank and the landfill office. Access to the C&D and Phase I landfill areas is via Roy Lopp Road and access to the northern area is by Old Highway 29.

### *1.3.3 Site Geology*

The Davidson County Landfill facility is located in the Piedmont Physiographic Province of North Carolina. More specifically, the Geologic Map of North Carolina (1985) indicates that the site lies within, but at the western margin of, the Carolina Slate Belt. This belt includes predominantly volcanic and sedimentary rocks of Late Proterozoic to Cambrian age that have been metamorphosed and intruded by numerous igneous plutons. The boundary zone between the Carolina Slate Belt and the adjacent Charlotte Belt is known as the Gold Hill/Silver Hill shear zone.

The most detailed mapping of the area was published by the US Geological Survey in the Geologic Map of Charlotte by Goldsmith, Milton and Horton (1988). This mapping indicates that the site vicinity is underlain by three stratigraphic units: metavolcanic rocks, and felsic metavolcanic rocks.

The metavolcanic rocks include mafic, intermediate and felsic volcanic rocks, rocks from the Flat Swamp Member of the Cid Formation, and metavolcanic rocks of the Battleground Formation. The Battleground Formation is characterized as a quartz-sericite schist and phyllite. It contains subordinate beds of quartz-pebble conglomerate, quartzite, kyanite or sillmanite quartzite and manganeseiferous schist. The felsic metavolcanic rocks (mvf) are fine to medium grained rhyolitic and rhyodacitic metatuffs. Locally these are coarse-grained. This unit contains minor intermediate and

mafic metavolcanic rocks and is probably correlative, at least in part, with felsic metavolcanic rocks of the Battleground Formation. Metamorphosed granitic plutons are also mapped in the area of the site. These plutons are megacrystic and well foliated. The rocks of this region are intruded by a swarm of metagabbro and metabasalt dikes and conformable sheets. This metagabbro typically crops out as round residual boulders that show no foliation except in the Gold Hill/Silver Hill shear zone.

Soils encountered include sandy silt and partially weathered rock. In this instance, partially weathered rock is defined as soils with a standard penetration test blow count of 100+ blows per foot.

## **1.4 Regulatory Status**

According to 15A NCAC 13B.0544(d), a gas control plan is required for C&D landfills. This landfill gas monitoring plan is prepared in accordance with NCDENR's landfill gas monitoring guidance<sup>1</sup>.

## **2.0 MONITORING PROGRAM**

### **2.1 Perimeter Monitoring Network**

#### *2.1.1 Introduction*

The monitoring network for the Davidson County C&D Landfill includes four (4) proposed LFG monitoring wells (CDLFG-1 through CDLFG-4) are shown on **Figure 1**. The perimeter LFG monitoring system is designed with wells located to intercept potential migrating LFG .

#### *2.1.2 Well Placement*

The LFG monitoring well locations have been evaluated based on the surrounding area conditions, soil types, location of waste on property, and nearby bodies of water. As described below:

- There are residences approximately 500' (or more) to the east of the C&D landfill; and
- Surface water located north and east of the C&D landfill. Surface water will prevent the migration of LFG in the subsurface in this area; and
- The location of the Phase 1 MSW landfill to the north of the C&D landfill. This landfill currently has a LFG monitoring network and is monitored quarterly.

These conclusions directed the placement of proposed LFG monitoring wells in the areas shown on **Figure 1**. These should be sufficient to monitor subsurface LFG migration in the vicinity of the C&D landfill. Additionally, site structures including the scalehouse, vehicle maintenance facility and office (all located to the west of the C&D landfill) will be monitored.

---

<sup>1</sup> NC Dept. Of Environment and Natural Resources Solid Waste Section Landfill Gas Monitoring Guidance, November 2010.

### 2.1.3 *Monitoring Well Construction*

The LFG monitoring wells will be installed using a Geoprobe™ rig and will be constructed of two-inch diameter, manufactured PVC well screens with 10-slot per inch intake spacings to the approximate depth of groundwater or bedrock (whichever is encountered first). Wells will be completed with two (2) to ten (10) feet of solid PVC riser pipe. A sand filter pack will be placed around each screened interval, to a height of up to two (2) feet above the screen, and a hydrated bentonite plug of two (2) to five (5) feet in thickness will be placed above the sand pack to seal each well. Wells will be completed with a steel protective casing and a cement pad for surface protection as shown on **Figure 2**. Each well casing will be distinguishable as a LFG monitoring well rather than an on-site ground water monitoring well. A “female” Colder® type quick-connect (or equivalent) fitting will be installed on the PVC portion of the well or in the cap as a monitoring port. Once the LFG monitoring wells are completed, the boring logs will be submitted to NCDENR and Davidson County under separate cover. This information will also be added to **Appendix A** of this plan.

## 2.2 **Monitoring and Reporting**

Monitoring and reporting of LFG gas concentrations shall be performed in accordance with guidance by the Division of Waste Management document “[Methane Monitoring Guidance](http://www.wastenotnc.org/swhome/met_mon.html)” ([www.wastenotnc.org/swhome/met\\_mon.html](http://www.wastenotnc.org/swhome/met_mon.html)) and as outlined below.

### 2.3.1 *Frequency*

LFG monitoring will be completed on a quarterly frequency. Monthly or more frequent monitoring may be necessary if concentrations are close to the regulatory levels or demonstrate a pattern which indicate that it may be approaching this limit.

### 2.3.2 *Personnel*

LFG monitoring will be performed by trained personnel knowledgeable of the LFG hazard and the use of explosive gas meters. A designated landfill technician will be assigned to regular LFG monitoring duty. Annual training shall be performed and documented on the LFG monitoring training log, provided in **Appendix B**, to refresh personnel on any site changes or updates to this plan.

### 2.3.3 *Equipment*

The County rents a combustible gas indicator for monitoring. Equipment rental insures that all calibrations are performed by properly trained technicians. Rental equipment is received within 24 hours of calibration and used the same day. This meter operates using the infra-red spectral property of methane (CH<sub>4</sub>) to measure concentrations in air below the LEL.

The meter will have Tygon tubing, including a “male” Colder® type quick-connect (or equivalent) fitting, attached to the inlet.

#### 2.3.4 Procedures

Each monitoring event should begin by calibrating the gas meter with a known calibration standard in accordance with manufacturer's recommendations and operated only as instructed.

Procedures for the LFG monitoring wells should include the following:

- Check calibration date on the meter;
  - Perform "bump test" against known gas concentration;
  - Connect tubing to sample port on the monitoring well without removing the cap;
  - Record data on the monitoring log form provided in **Appendix C**; and
  - If less than 50% LEL, move to next LFG monitoring well.
- \* If explosive gas concentrations **equal to or greater than 50%** of the LEL in any of the LFG monitoring wells, personnel should implement Precautionary Action Plan located in **Section 2.3.5**.
- \* IF EXPLOSIVE GAS CONCENTRATIONS EQUAL TO OR GREATER THAN 100% OF THE LEL IN ANY OF THE LFG MONITORING WELLS, THE FOLLOWING ACTIONS SHALL BE TAKEN BY PERSONNEL:**
- (1) **Immediately** contact the Solid Waste Director.
  - (2) Recalibrate monitoring equipment and confirm results.
  - (3) If concentrations still exceed 100% LEL, Davidson County and the Engineer will implement the Compliance Action Plan located in **Section 3.2**.

#### 2.3.5 Precautionary Action Plan

If explosive gas concentrations are **equal to or greater than 50%** of the LEL in any of the LFG monitoring wells, personnel should perform the following additional steps:

- Monitor gas pressure in each well head (in inches of water) using magnehelic gauge or other appropriate metering device;
- Monitor initial gas concentration through sampling port;
- Open well cap and allow to stabilize for at least three (3) minutes;
- Monitor gas concentration inside well just below the top of casing; and
- Evaluate surrounding areas for potential receptors to or signs of LFG migration. LFG can stress vegetation, can kill trees and grass by root asphyxiation. Note any areas of stressed/dead vegetation on the monitoring form.

Monitoring should be completed in this manner for all wells with concentrations equal to or greater than 50% LEL during all monitoring events. This information should be recorded, kept in the operating record and reported to the Solid Waste Director and to the Engineer for further evaluation.

### 2.3.6 *Record Keeping*

All readings will be documented on the LFG monitoring log form provided in **Appendix C**. The completed forms will be reviewed and initialed by the County Solid Waste Director following each monitoring event and placed in the landfill operating records. The monitoring logs will remain on file with other landfill records in the landfill office at the Davidson County Landfill Offices located at 1242 Old Highway 29 Thomasville, North Carolina. These readings should be available for review by NCDENR and EPA personnel upon request.

If readings above 100% LEL are measured, a copy of the LFG monitoring form and an Environmental Data Reporting Form also provided in **Appendix C** shall be submitted to NCDENR. A copy shall be kept in the landfill operating records.

## 2.4 **Maintenance**

In addition to the monitoring program, periodic maintenance and site observations shall be conducted to the program components as follows (at a minimum):

- Factory calibration of the gas meter;
- Maintaining access to monitoring wells;
- Observing landfill cover conditions, potential erosion areas, landfill seeps, odors, etc.;
- Monitoring well maintenance such accessibility, operational locks, steel casing and concrete pad conditions, etc.

Any deficiencies shall be noted on the monitoring forms and reported to the Solid Waste Director for repair or replacement as necessary.

## 3.0 **CONTINGENCY PLAN**

### 3.1 **Introduction**

In the event explosive gas concentrations exceed safe levels (>100% LEL), a contingency plan is recommended and warranted. The contingency plan includes the specific step by step actions that should be implemented to protect human health and the environment.

### 3.2 **Compliance Action Plan**

If explosive gas concentrations **equal to or greater than 100%** of the LEL in any of the LFG monitoring wells, the following actions shall be taken by personnel:

#### 3.2.1 *Immediate Action Plan*

The Solid Waste Director shall take immediate action to ensure the protection of human health and safety as follows:

- (1) Determine potential receptors surrounding the site;
- (2) If warranted by the degree of intensity of the LFG concentration, check the LFG concentrations in structures of receptors surrounding the site, such as the

- scalehouse, maintenance building and offices;
- (3) If further warranted by the degree of intensity (>25% LEL) of the LFG concentration in structures, evacuate the area;
  - (4) Contact the County Fire Marshal;
  - (5) Notify verbally the Waste Management Specialist in the Winston-Salem Regional Office;
  - (6) Investigate and identify the source(s) and conduit(s) for LFG migration that have caused the excessive readings (i.e. the path that the LFG is taking to the monitoring location);
  - (7) Identify the extent of the LFG problem through additional wells or bar hole punch sampling methodology; and
  - (8) As appropriate, begin to take corrective action to control the LFG levels in building(s) surrounding the landfill site.

### 3.2.2 *Reporting and Documentation*

Following the **Immediate Action Plan**, the County must take the following actions within seven (7) days:

- (1) Place documentation of the **Immediate Action Plan** in the operating records of the landfill; and,
- (2) Provide documentation of the **Immediate Action Plan** and a description of the steps taken to protect human health in writing to the Waste Management Specialist in the Winston-Salem Regional Office.

It is also suggested that at this time, a plan be developed which:

- Describes the nature and extent of the problem; and
- Proposes future actions to access/remediate the problem.

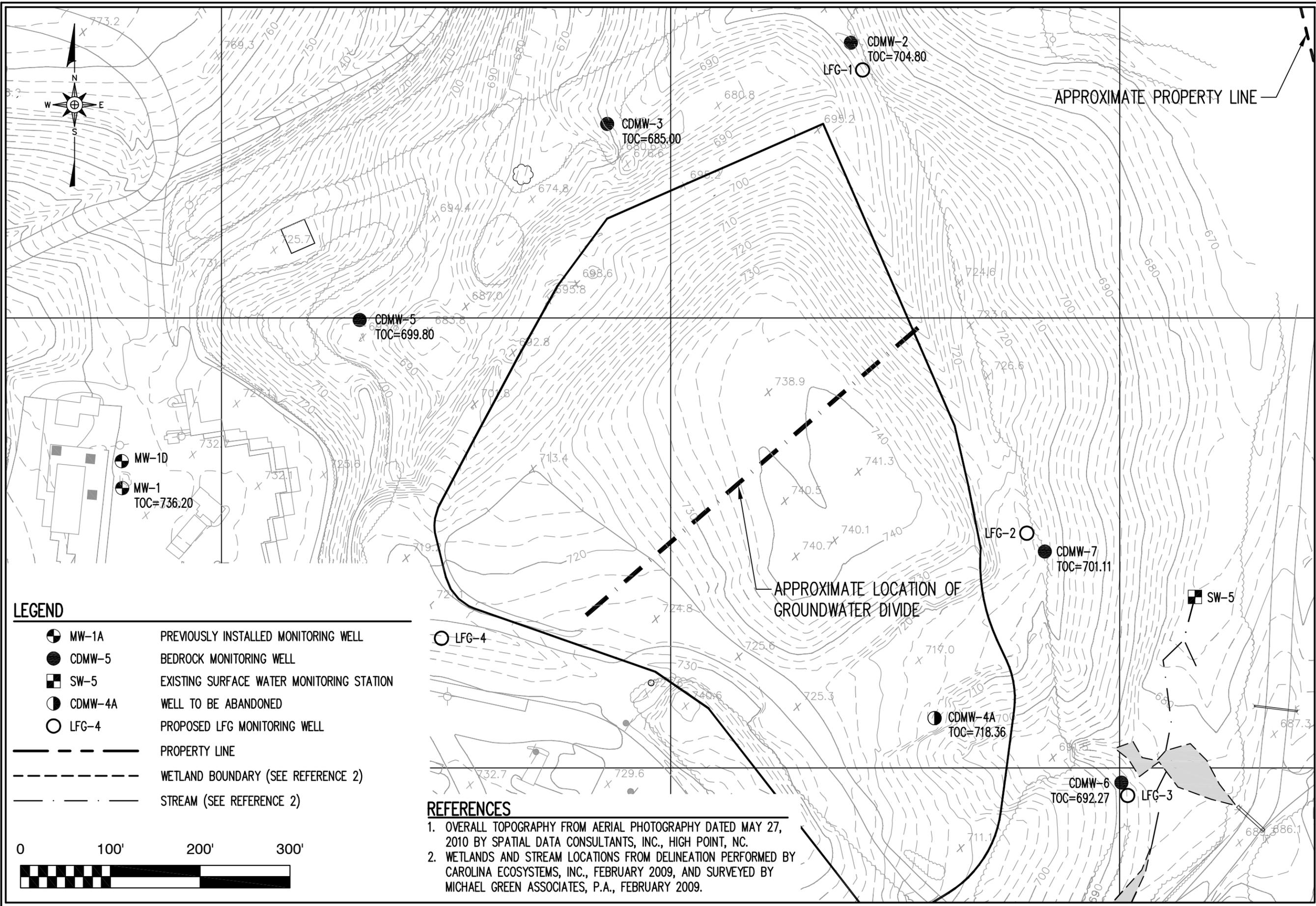
### 3.2.3 *Remediation Plan*

In the event the prolonged explosive gas concentrations exist and as identified during the **Immediate Action Plan**, the County shall prepare and implement a Remediation Plan to mitigate the migration of landfill gas off property. Extensions may be granted by the Division of Waste Management upon written request and depending on severity of the situation.

## **FIGURES**

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**LEGEND**

- MW-1A PREVIOUSLY INSTALLED MONITORING WELL
- CDMW-5 BEDROCK MONITORING WELL
- SW-5 EXISTING SURFACE WATER MONITORING STATION
- CDMW-4A WELL TO BE ABANDONED
- LFG-4 PROPOSED LFG MONITORING WELL
- — — — — PROPERTY LINE
- - - - - WETLAND BOUNDARY (SEE REFERENCE 2)
- - - - - STREAM (SEE REFERENCE 2)

**REFERENCES**

1. OVERALL TOPOGRAPHY FROM AERIAL PHOTOGRAPHY DATED MAY 27, 2010 BY SPATIAL DATA CONSULTANTS, INC., HIGH POINT, NC.
2. WETLANDS AND STREAM LOCATIONS FROM DELINEATION PERFORMED BY CAROLINA ECOSYSTEMS, INC., FEBRUARY 2009, AND SURVEYED BY MICHAEL GREEN ASSOCIATES, P.A., FEBRUARY 2009.

**RICHARDSON SMITH GARDNER & ASSOCIATES**  
INC. LIC. NO. C-288 (ENGINEERING)  
 www.rsgengineers.com

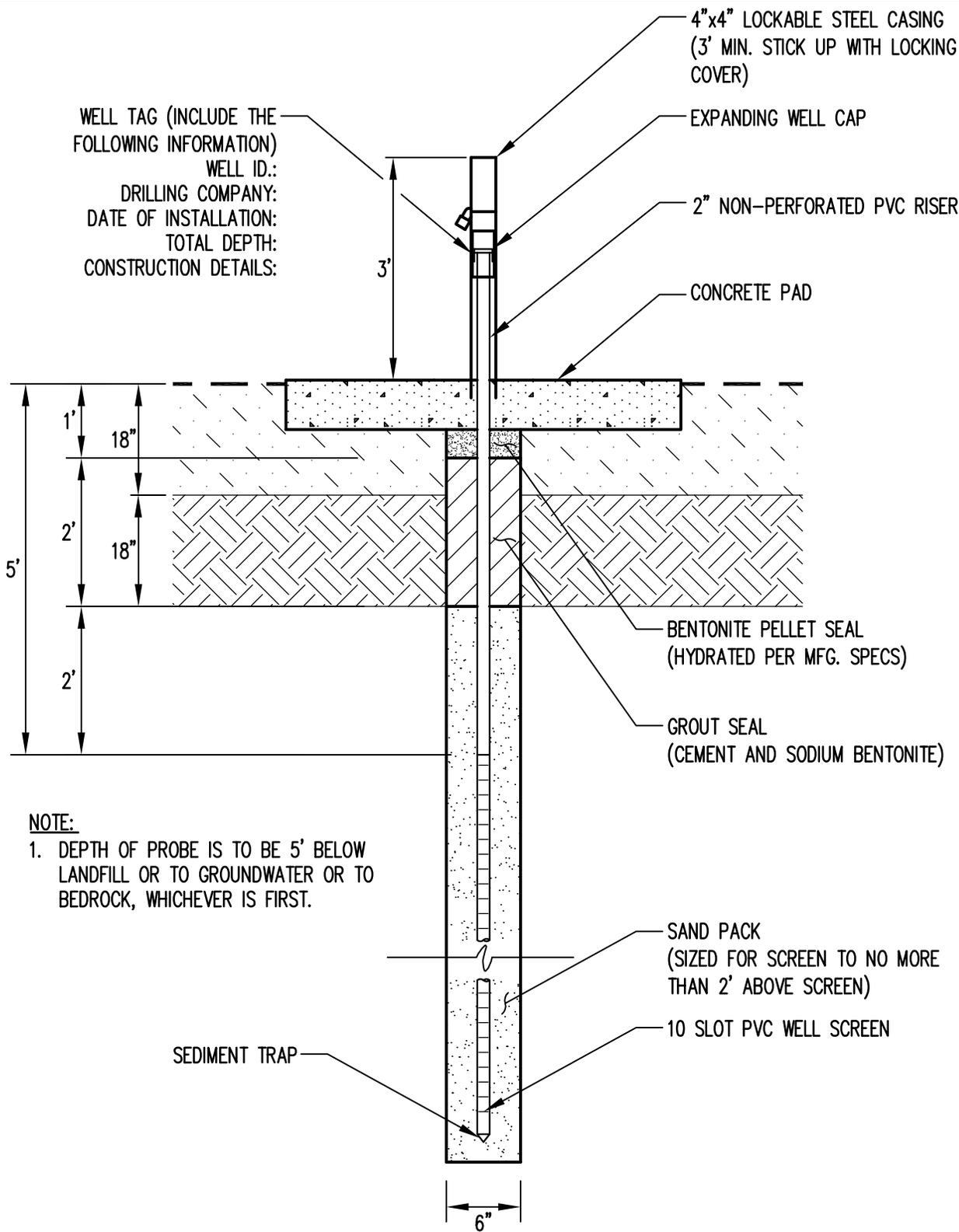
14 N. Boylan Ave.  
 Raleigh, N.C. 27603

ph: 919-826-0577  
 fax: 919-826-3899

DRAWN BY: J.A.L.	CHECKED BY: J.A.S.	SCALE: AS SHOWN	FIGURE NO. 1
DATE: Apr. 2011	PROJECT NO. DAVDCO 08-5	FILE NAME DAVDCO-B0582	

**DAVIDSON COUNTY  
 C&D LANDFILL  
 PROPOSED LANDFILL GAS  
 MONITORING SYSTEM**

TITLE:



LANDFILL GAS  
 MONITORING WELL DETAIL  
 DAVIDSON COUNTY C&D LANDFILL  
 LEXINGTON, NORTH CAROLINA



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 & ASSOCIATES**

14 N. Boylan Ave.  
 Raleigh, N.C. 27603

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[www.rsgengineers.com](http://www.rsgengineers.com)

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 fax: 919-828-3899

SCALE: AS SHOWN	DRAWN BY: J.A.L.	CHECKED BY:	DATE: Jun. 2011	PROJECT NO. DAVDCO 10-2	FIGURE NO. 2	FILE NAME DAVDCO-A0621
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**APPENDIX A**  
**BORING LOGS**

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**APPENDIX B**  
**ANNUAL TRAINING LOGS**

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**LFG MONITORING TRAINING LOG**  
(This log must be completed annually)

**DAVIDSON COUNTY C&D LANDFILL**  
**LEXINGTON, NORTH CAROLINA**  
**NC SOLID WASTE PERMIT NO. 29-06**

**INSTRUCTOR INFORMATION:**

Name(s): \_\_\_\_\_

Company: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

**TRAINING INFORMATION:**

Date(s) (MM/DD/YYYY): \_\_\_\_\_

Program Content: \_\_\_\_\_

\_\_\_\_\_

Instrument Type(s): \_\_\_\_\_

**ATTENDANCE:**

<u>Name</u>	<u>Title</u>	<u>Training Date</u>	<u>Trainee Signature</u>	<u>Instructor Initials</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Instructor Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Davidson County Representative Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Note: This form should be maintained in the landfill operating record.

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**APPENDIX C**

**MONITORING LOG AND REPORTING FORM**

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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)).
- 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):

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

Name: \_\_\_\_\_ Phone: \_\_\_\_\_

E-mail: \_\_\_\_\_

Facility name:	Facility Address:	Facility Permit #	NC Landfill Rule: (.0500 or .1600)	Actual sampling dates (e.g., October 20-24, 2006)

### 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     Methane gas monitoring data  
 Groundwater monitoring data from private water supply wells     Corrective action data (specify) \_\_\_\_\_  
 Leachate monitoring data  
 Surface water monitoring data     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.

Facility Representative Name (Print)

Title

(Area Code) Telephone Number

Affix NC Licensed/ Professional Geologist Seal

Signature

Date

Facility Representative Address

NC PE Firm License Number (if applicable effective May 1, 2009)

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