

# Landfill Gas Monitoring Plan

**Washington County C&D Landfill (Permit 94-04)**

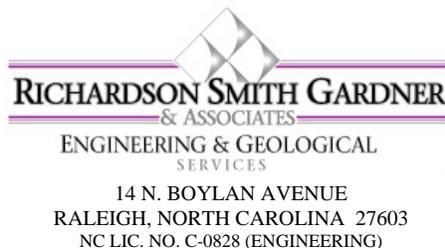
**Roper, North Carolina**



Prepared For:

**Washington County Public Utilities  
396 Millpond Road  
Roper, North Carolina 27970**

Prepared By:



**November 2011**

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# LANDFILL GAS MONITORING PLAN

## Washington County C&D Landfill Roper, North Carolina

Prepared for:  
**Washington County Public Utilities**  
Roper, North Carolina

RSG Project No. WASH-11-1



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



**November 2011**

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**WASHINGTON COUNTY C&D LANDFILL  
LANDFILL GAS MONITORING PLAN**

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    Figure 2 – Site Map with 2000’ Property Radius

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## 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 Washington County C&D Landfill (NCDENR Solid Waste Permit 94-04). The site is located at 718 Landfill Road, Roper, NC 27970 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 landfill and to satisfy NCDENR Solid Waste Management Rules [15A NCAC 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% methane (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 updates over time to accommodate changing landfill conditions, changing receptors in areas adjacent to and around the landfill, or other conditions that cannot be fully anticipated. 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, and overhead hazards, and possess an awareness of changing conditions around these sites.

### 1.2 Contact Information

In case of emergencies, if questions arise during the implementation of this program, or to meet notification requirements outlined in **Section 2.3.4**, please contact the following:

*1.2.1 Owner*

Washington County Dept. of Public Utilities  
396 Millpond Road  
Roper, NC 27970

Mr. Lou Manring, Director  
Phone: (252) 793-7345

Mr. Carl Critcher, Operations Manager  
Phone: (252) 793-5615

*1.2.2 Engineer*

Richardson Smith Gardner & Associates, Inc.  
14 N. Boylan Avenue  
Raleigh, North Carolina 27603  
Phone: (919) 828-0577

Mr. Pieter K. Scheer, P.E., Project Manager  
email: [pieter@rsgengineers.com](mailto:pieter@rsgengineers.com)

Ms. Joan A. Smyth, P.G., Senior Hydrogeologist  
email: [joan@rsgengineers.com](mailto:joan@rsgengineers.com)

*1.2.3 Solid Waste Regulatory Agency*

NCDENR- Division of Waste Management  
1646 Mail Service Center  
Raleigh, NC 27633-1646  
Phone (919) 508-8400

Mr. Ming-Tai Chao, P.E., Environmental Engineer II  
email: [ming.chao@ncdenr.gov](mailto:ming.chao@ncdenr.gov)

NCDENR – Field Operations Branch – Washington Regional Office  
943 Washington Square Mall  
Washington, North Carolina 27889  
Phone (252) 946-6481

Mr. Ray Williams, Waste Management Specialist  
Email: [ray.williams@ncdenr.gov](mailto:ray.williams@ncdenr.gov)

### 1.3 Existing Site Conditions

The Washington County C&D Landfill is located at 718 Landfill Rd. in Roper, NC, as shown in **Figure 1**. The facility property is approximately 71 acres with approximately 2.34 acres currently used for C&D waste placement, as shown in **Figure 2**.

#### 1.3.1 Topography

The landfill site is located adjacent to Swan Bay as shown in **Figure 1**. Existing ground surface elevations vary from approximately two (2) feet above mean sea level to approximately 24 feet (msl) at the top of the closed MSW landfill (located southwest of the C&D landfill). Currently, the surrounding area (2,000 feet from the property line) is undeveloped and generally either wooded or consists of wetlands/swamp.

#### 1.3.2 Adjacent Areas

To the south and east of the C&D landfill, at a distance greater than 2,000 ft., some houses are located. The closed MSW landfill is located to the southwest of the C&D landfill on an adjacent property also owned by Washington County.

There are three (3) structures located on the site, the scalehouse/office, the maintenance building and the animal shelter. These structures are located in the southwest corner of the property at the entrance to the site.

The nearest structures located off-site are located approximately 2,635 feet to the east (although unconfirmed, this building is believed to be a private recreational facility, which includes a basketball court for the owner), and 2,675 feet to the south of the C&D landfill (this building is a residence). These structures are shown on **Figure 2**.

#### 1.3.3 Site Soils Information

The native soil types at, and around the landfill are classified as Conetoe loamy fine sand, Altavista fine sandy loam, Augusta fine sandy loam, Dorovan muck, with minor amounts of Muckalee loam. The predominant soil type across the site is the Conetoe loamy fine sand. This soil is classified as “well drained” and is found on 0% to 3% slopes. The second most predominant soil types on the site are the Altavista fine sandy loam and Augusta fine sandy loam both of which are found on slopes of 0% to 2%. These soils are classified as moderately well drained (Altavista) to somewhat poorly drained (Augusta). The soils located between the property line and Swan Bay consist of the Dorovan muck. This soil type is found at an elevation of 0 feet mean sea level. This soil type is very poorly drained and is found on floodplains. The Muckalee loam is found in a small portion of the site and surrounding area. This soil is poorly drained and is found on floodplains.

Geologic investigations at the site indicate the upper 20 to 30 feet of soils primarily consist of relatively clean sand with interbedded silty clay.

## 2.0 MONITORING PROGRAM

### 2.1 Monitoring Network

Previous investigations of the site indicate groundwater is typically found at a depth of approximately 3 to 6 feet below grade around the C&D landfill. The shallow nature of groundwater at this site prohibits the movement of landfill gas in the subsurface. Additionally, constructing a monitoring well in accordance with drilling requirements (15A NCAC 2C.0108(5) & (6)) would necessitate the screened interval of each well to be a minimum of five (5) feet below grade (allowing for a 1 foot sand pack above the screened interval, 1 foot thick bentonite plug, and three feet of grout to the ground surface). This will put the screened interval below the water table and make any well ineffective for monitoring landfill gas in the uppermost soils at the site.

Further, the area located to the north of the site is at elevation 0 ft, or mean sea level. The swampy soils in this area will prevent any potential landfill gas migration in this area. Wetland areas have historically been mapped to the south and east of the C&D landfill as well. The property to the west contains the closed MSW landfill.

Additionally, On October 26<sup>th</sup> 2011, RSG personnel performed a soil gas survey at the C&D landfill. The soil gas survey consisted of advancing a hand-auger boring to a depth of approximately 5 to 7 feet below grade to reach the approximate depth of groundwater. A slotted section of PVC well screen and solid PVC pipe was inserted into the boring and capped. The piping was allowed to stabilize prior to the collection of readings. Landfill gas readings with a GEM 2000 meter indicated no detectable concentrations of methane in the four locations evaluated. These locations are shown on **Figure 1**.

Based upon the shallow nature of groundwater at the site, well installation requirements, the location of wetlands around the C&D landfill, the lack of detected methane in the area of the C&D landfill and the large distances to any off-site receptors, we recommend that no landfill gas monitoring probes be installed. Instead we recommend that only building monitoring be conducted. Proposed monitoring locations are summarized below.

**Table 1 – Gas Monitoring Locations**

<b>Building</b>	<b>Monitoring Locations (inside each building)</b>
Scalehouse/office	4 corners of scalehouse/office near floor
Animal Shelter	4 corners of animal shelter building near floor
Maintenance Building	4 corners of maintenance building near floor

### 2.1.1 Surrounding Conditions/Potential Receptors

The monitoring probe locations have been evaluated based on the surrounding area conditions, soil types, location of waste on property, and nearby bodies of water. The following is a summary of local conditions within 2,000 feet of the facility property line:

- There are no residences located on nearby properties within 2,000 feet.;
- Swan Bay of the Albemarle Sound is adjacent to the property line to the north;
- The property immediately to the west is the location of the closed MSW landfill; and
- The land surrounding the site to the north, south, and east within 2,000 feet of the property line is primarily undeveloped woodland.

The landfill property with the 2,000-foot buffer shown is included on **Figure 2**. As stated in **Section 1.3.2**, the nearest buildings located off-site are over 2,300 feet from the C&D landfill. No sensitive receptors are located to the west of the C&D landfill. The closed MSW landfill is located on the adjacent property in this direction.

Swan Bay and associated swamp located to the north of the property is a natural barrier to landfill gas migration and should effectively prevent the migration of landfill gas off-property in this direction. Wetlands located south and east of the C&D landfill will also act as a natural barrier to landfill gas migration in these directions.

Due to the location of Swan Bay to the north, and wetlands to the south and east of the site, and the significant distance of homes from the waste toward the south and east, it is unlikely that any potential LFG migration would impact a sensitive receptor.

## 2.3 Monitoring and Reporting

Monitoring of buildings at the site and reporting of LFG gas concentrations will be performed in accordance with NCDENR rules and as outlined below. The buildings will be monitored according to the requirements of this section.

### 2.3.1 Frequency

LFG monitoring will be completed on a quarterly frequency. Monthly or more frequent monitoring will be necessary if concentrations are close to or above the regulatory levels or demonstrate a pattern which indicates that it may be approaching this limit. In the future, the County may opt to install permanent monitoring devices in these buildings. If that is the case, the form included in **Attachment A**, should be filled out with readings from each permanent monitoring device on a quarterly basis.

### 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. Training will be performed to refresh personnel on any site changes or updates to this Plan.

### 2.3.3 Equipment

A Landtec™ GEM-2000 infrared portable gas analyzer (or equivalent) will be used to monitor buildings at the site. This analyzer operates using the infrared spectral property of methane (CH<sub>4</sub>) to measure concentrations in air below the LEL. This meter is calibrated to methane. Measurements of O<sub>2</sub> and CO<sub>2</sub> will also be made with this meter. This meter may be used in oxygen (O<sub>2</sub>) deficient areas (less than 10% O<sub>2</sub>) since oxygen is not required for a chemical combustion of flammable gases within the meter. Measurements of the concentrations of CH<sub>4</sub>, O<sub>2</sub>, and CO<sub>2</sub> can be collected from this meter. On the day of monitoring, prior to monitoring activities, this meter must be field calibrated. Additionally, all monitoring equipment should be regularly calibrated in accordance with manufacturer's specifications and operated only as instructed.

Should permanent monitoring devices be chosen in the future, NCDENR will be notified with specifications of the equipment chosen.

### 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. The form included in **Attachment A** will be used to record landfill gas monitoring data.

Procedures for the LFG monitoring probes should include the following:

- Check calibration date on the meter;
- Perform "bump test" against known gas concentration;
- Record date, time, general weather conditions, ambient temperature;
- Barometric Pressure, name of technician and equipment used;
- Record maximum steady state methane reading<sup>1</sup>, as well as steady state
- CO<sub>2</sub>, and O<sub>2</sub> percentages; and
- If less than 1.25% CH<sub>4</sub>, move to next building location.

If methane gas concentrations are **equal to or greater than 1.25% in any structure**, follow the Contingency Plan presented in **Section 3.0**.

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<sup>1</sup> In accordance with NCDENR LFG Monitoring Guidance (2010).

**IF EXPLOSIVE GAS CONCENTRATIONS EQUAL TO OR GREATER THAN 1.25% METHANE AT ANY OF THE LFG MONITORING LOCATIONS THE FOLLOWING ACTIONS SHALL BE TAKEN BY PERSONNEL:**

1. **Immediately** contact the Washington County Operations Manager and Engineer.
2. Recalibrate monitoring equipment and confirm results.
3. If concentrations still exceed 1.25% methane, Washington County and the Engineer will implement the Compliance Action Plan located in **Section 3.2**.

*2.3.5 Record Keeping*

All readings will be documented with field notes and a monitoring form. A copy of the results will be given to Washington County for their operating record. Should concentrations in excess of compliance levels be detected, these results will be verbally reported to NCDENR within 24-hours and the results will be submitted to NCDENR on the form included in **Attachment A**. The completed forms will be reviewed by the Operations Manager following each monitoring event and placed in the landfill operating records. The monitoring logs will remain on file with other landfill records at the Washington County landfill offices located at 718 Landfill Rd. Roper, NC. These readings should be available for review by NCDENR personnel upon request.

**2.4 Maintenance**

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

- Factory calibration of the gas meter (to be performed in accordance with manufacturer's instructions/recommendations); and
- Observing landfill cover conditions, potential erosion areas, landfill seeps, odors, etc.

Any deficiencies shall be noted on the monitoring forms and reported to the Operations Manager for resolution.

## 3.0 CONTINGENCY PLAN

### 3.1 Introduction

In the event explosive gas concentrations exceed safe levels ( $\geq 1.25\%$  CH<sub>4</sub>), 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 1.25% methane** in any of the LFG monitoring locations, the following actions shall be taken by personnel:

#### 3.2.1 Immediate Action Plan

Washington County will take immediate action to ensure the protection of human health and safety as follows:

1. Evacuate any building where a high concentration was detected;
2. Employ engineering controls (fans, open windows, etc.) to reduce methane concentrations in the building;
3. Determine potential receptors surrounding the site;
4. If warranted by the location of the impact, and degree of intensity of the LFG concentration, measure LFG concentrations in structures or receptors surrounding the site;
5. Notify verbally NCDENR representatives;
6. Investigate and identify the source(s) and potential 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. Evaluate the need to identify the extent of the LFG problem through additional probes 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**, Washington County will take the following actions within five (5) days:

1. Place documentation of the **Immediate Action Plan** in the operating record for the landfill;

2. Provide documentation of the **Immediate Action Plan**, a description of the steps taken to protect human health, and the data collected in writing to the NCDENR within 5 days; and
3. Evaluate the monitoring schedule to determine if more frequent monitoring is needed.

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 assess/remediate the problem.

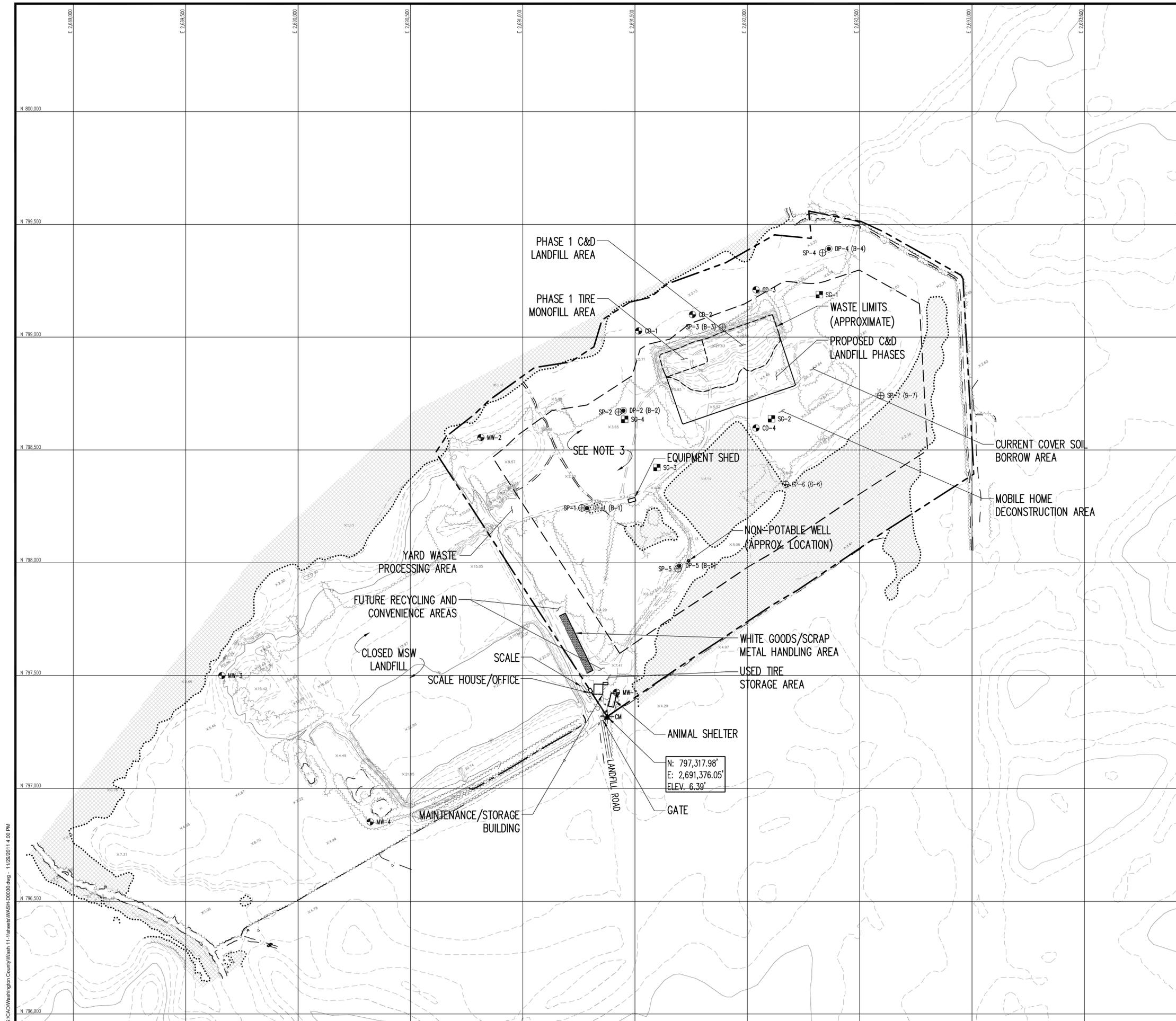
### *3.2.3 Remediation Plan*

In the event the prolonged explosive gas concentrations exist and as identified during the **Immediate Action Plan** and in follow-up monitoring, Washington County will prepare and implement a Remediation Plan to mitigate the migration of landfill gas.

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## **Figures**

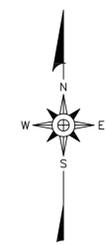
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- LEGEND**
- 10' — EXISTING 10' CONTOUR (SEE REFERENCE 1)
  - 2' — EXISTING 2' CONTOUR
  - - - - - APPROXIMATE PROPERTY LINE
  - - - - - 200 FOOT BUFFER FROM PROPERTY LINE
  - - - - - APPROXIMATE EXISTING WASTE LIMITS
  - - - - - STREAM/POND/DITCH BOUNDARY
  - - - - - PROPOSED LANDFILL AREA
  - ⋯⋯⋯ WETLANDS (APPROXIMATE)
  - MW-1 MONITORING WELL (CLOSED MSWLF)
  - CD-1 MONITORING WELL (C&D/L)
  - ▲ CM EXISTING CONCRETE MONUMENT
  - SG-1 SOIL GAS SURVEY LOCATIONS
  - ⊕ B-6 ABANDONED SOIL BORING (S&ME, 1994)
  - B-1 ABANDONED PIEZOMETER (S&ME 1994)

- NOTES**
1. THE TIRE MONOFILL IS NO LONGER USED BY THE COUNTY. THIS AREA WAS PREVIOUSLY INCORPORATED INTO THE C&D LANDFILL FOOTPRINT.
  2. 100-YEAR FLOODPLAIN IS AT ELEVATION 7.0.
  3. THIS AREA IS DESIGNATED AS A DISASTER DEBRIS HANDLING AREA.

- REFERENCES**
1. OVERALL SITE BASE TOPOGRAPHY WETLAND, STREAM, AND DITCH BOUNDARIES PROVIDED BY SANBORN, BASED ON MARCH 28, 2009 AERIAL SURVEY. ADDITIONAL WETLAND AREAS OBTAINED FROM DRAWING "PROPOSED C&D CAP SECTION" BY THE WOOTEN COMPANY, DATED DECEMBER 2004.
  2. COORDINATE SYSTEM IS STATE PLANE GRID.
  3. SITE PROPERTY LINE (NORTHEASTERN HALF) OBTAINED FROM DRAWING "PROPOSED C&D CAP SECTION" BY THE WOOTEN COMPANY, DATED DECEMBER 2004. SITE PROPERTY LINE (SOUTHEASTERN HALF) FROM DRAWING "MAP OF WASHINGTON COUNTY SANITARY LAND" SURVEYED AND PREPARED BY DOWNEAST LAND SURVEYS.
  4. WELL LOCATIONS OBTAINED FROM FROM THE WASHINGTON COUNTY LANDFILL MONITOR WELL SURVEY REPORT DATED APRIL 24, 2009.
  5. FLOODPLAIN INFORMATION FROM NC FIRM MAP NO. 3720678800L.



DATE	NO.	REVISION

**RICHARDSON SMITH GARDNER & ASSOCIATES**  
 14 N. Boylan Ave.  
 Raleigh, N.C. 27603  
 ph: 919-228-0577  
 fax: 919-228-3889  
 www.rsgengineers.com

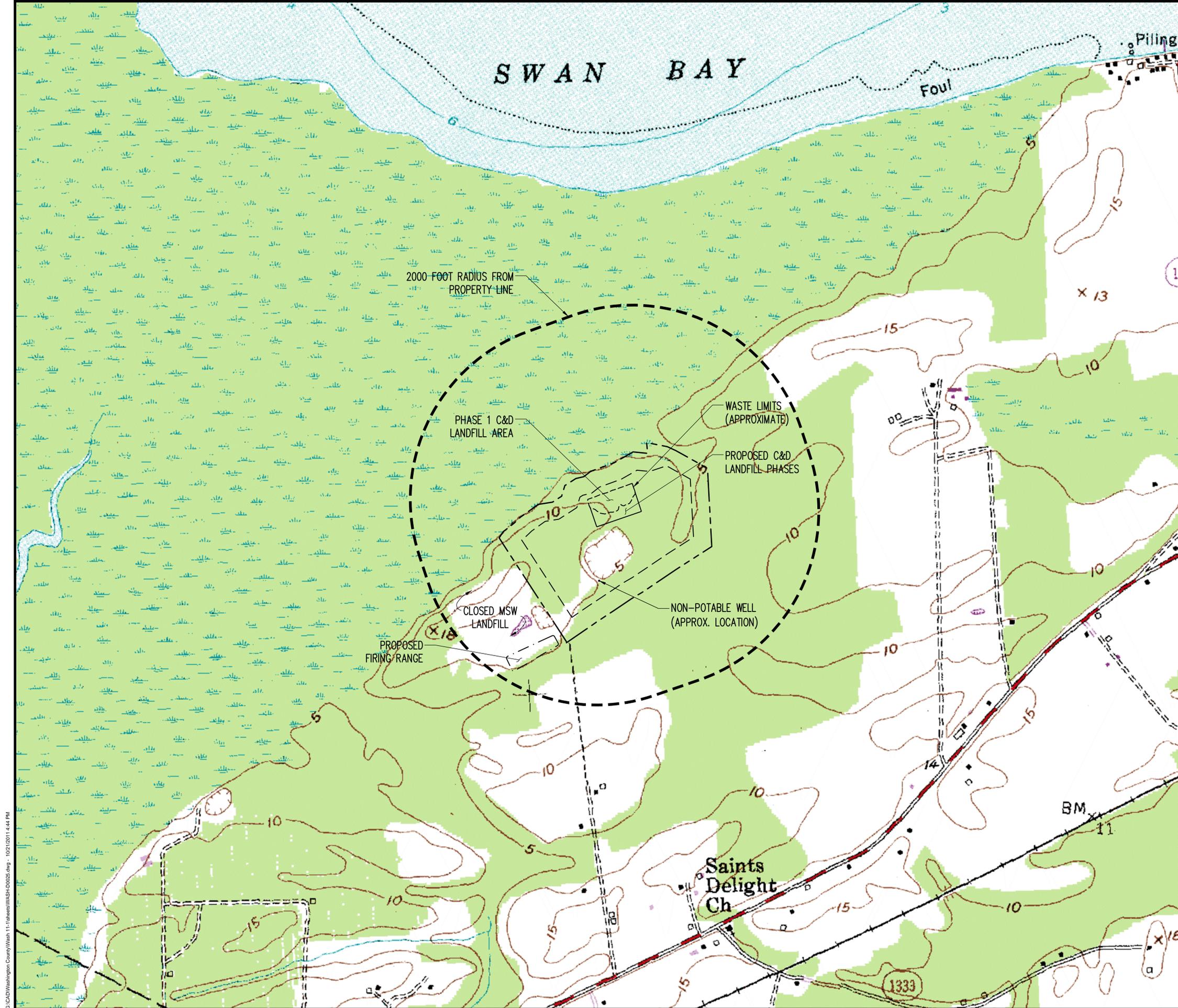
PROJECT TITLE:  
**WASHINGTON COUNTY  
 C&D LANDFILL PHASE 2  
 PERMIT AMENDMENT DRAWINGS**

DRAWING TITLE:  
**EXISTING CONDITIONS**

DESIGNED BY: J.A.S.	DRAWN BY: C.T.J.
CHECKED BY:	PROJECT NO.: WASH 09-1
SCALE: AS SHOWN	DATE: OCT. 2011
FILE NAME: WASH-D0030	DRAWING NO.:

**FIG. 1**

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**LEGEND**

	APPROXIMATE PROPERTY LINE
	200 FOOT BUFFER FROM PROPERTY LINE
	2000 FOOT RADIUS FROM PROPERTY LINE
	APPROXIMATE EXISTING WASTE LIMITS
	PROPOSED LANDFILL AREA

**NOTES**

1. 100-YEAR FLOODPLAIN IS AT ELEVATION 7.0.

- REFERENCES**
1. U.S.G.S. 7.5 MIN. QUADRANGLE "WESTOVER, NC" DATE 1954, PHOTOREVISED 1978.
  2. COORDINATE SYSTEM IS STATE PLANE GRID.
  3. SITE PROPERTY LINE (NORTHEASTERN HALF) OBTAINED FROM DRAWING "PROPOSED C&D CAP SECTION" BY THE WOOTEN COMPANY, DATED DECEMBER 2004. SITE PROPERTY LINE (SOUTHEASTERN HALF) FROM DRAWING "MAP OF WASHINGTON COUNTY SANITARY LAND" SURVEYED AND PREPARED BY DOWNEAST LAND SURVEYS.
  4. FLOODPLAIN INFORMATION FROM NC FIRM MAP NO. 3720678800J.



REVISION	NO.	DATE

**RICHARDSON SMITH GARDNER & ASSOCIATES**  
 14 N. Boylan Ave.  
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PROJECT TITLE:  
 WASHINGTON COUNTY  
 C&D LANDFILL PHASE 2  
 PERMIT AMENDMENT DRAWINGS  
 DESIGN HYDROGEOLOGIC REPORT

**SITE CHARACTERIZATION AREA**

FIG. 2

DESIGNED BY: J.A.S.	DRAWN BY: C.T.J.
CHECKED BY:	PROJECT NO.: WASH 09-1
SCALE: AS SHOWN	DATE: OCT. 2011
FILE NAME: WASH-0025	DRAWING NO.:

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## **Appendix A**

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