MONITORING PLAN
FOR
LANDFILL GAS (METHANE)

CASWELL COUNTY LANDFILL (CLOSED)
PERMIT NO. 17-01
CASWELL, NORTH CAROLINA

S&ME Project No. 1584-07-034A

Prepared For:

Caswell County
Post Office Box 98
144 Court Square
Yanceyville, North Carolina 27379

Prepared by:

S&ME, Inc.
3718 Old Battleground Road
Greensboro, North Carolina 27410

June 17, 2014

Edmund Q. B. Henriques, P.G.
Senior Geologist

Wayne H. Watterson, P.E.
Senior Engineer

June 17, 2014

North Carolina Department of Environment and Natural Resources
Division of Waste Management – Solid Waste Section
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

Attention: Ms. Christine Ritter

Reference: Monitoring Plan for Landfill Gas (Methane)
Caswell County Landfill (Closed), Permit No. 17-01
Caswell, North Carolina
S&ME Project No. 1584-07-034A

Dear Ms. Ritter:

S&ME, Inc. (S&ME), on behalf of Caswell County, presents this Monitoring Plan for Landfill Gas at the Caswell County Landfill (Closed). This Monitoring Plan was prepared in response to verbal requests from Mr. Petrone and Ms. Christine Ritter with NCDENR requesting the facility to prepare a methane monitoring and contingency plan for the facility. Caswell County will implement this Monitoring Plan upon NCDENR approval. The plan was revised to address your comments received on June 16, 2014.

If you should have any questions or need additional information please contact us at (336)-288-7180.

Respectfully submitted,

S&ME, Inc.

Edmund Q.B. Henriques, P.G.
Senior Geologist

Senior reviewed by Wayne H. Watterson, Senior Engineer

cc: Tim Smith, Caswell County Solid Waste Manager
Robert M. Murphy, Caswell County (Interim) County Manager

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1. MONITORING PLAN ADMINISTRATION

The following sections detail the purpose and requirements of the Monitoring Plan.

1.1 Purpose

This Monitoring Plan for Landfill Gas is presented to provide the necessary requirements as specified in Solid Waste Management Rules, Sections 0.544(d) and .1626. These rules present criteria for explosive gas control as it relates to requirements for Construction & Demolition (C&D) landfills and Municipal Solid Waste (MSW) landfill facilities. 15A NCAC 13B.1626 (4) (a) states: *"Owners or operators of all MSWLF units must ensure that: (a) the concentration of methane gas generated by the facility does not exceed 25 percent of the lower explosive limit for methane in facility structures (excluding gas control or recovery system components; and (b) The concentration of methane gas does not exceed the lower explosive limit for methane at the facility property boundary."*

The purpose of this Monitoring Plan is to establish the recommended procedures and methods to perform landfill gas monitoring at the closed Caswell County MWS landfill. The methane gas monitoring program shall be implemented to detect possible migration of methane gas off-site from the landfill. Included in this program is the methane monitoring system, methane gas monitoring well locations, methane monitoring procedures, sampling frequency, reporting requirements, and contingency plan.

1.2 Location and Availability of Monitoring Plan

A complete copy of this Monitoring Plan will be maintained in the office of the Solid Waste Manager at the Caswell County Landfill. This Monitoring Plan will remain on-site and be made available to NCDENR for inspection.

1.3 Monitoring Plan Review

The Caswell County Solid Waste Department will review and update this Monitoring Plan as needed to reflect changes in methodology, monitoring, facility modifications, or as directed by the NCDENR. The Caswell County Solid Waste Department will make the needed revisions to the Monitoring Plan and implement the changes as soon as practical following an amendment.

2. FACILITY DESCRIPTION

The following sections describe the facility and past and present operations on site.

2.1 Location

The Caswell Landfill is owned and operated by Caswell County and is located in the northern part of Caswell County. The physical address of the landfill is 162 Landfill Road, Yanceyville, North Carolina 27379. The facility location is illustrated on ***Figure 1, Site Location Map***.

2.2 Landfill Operations

The closed Caswell County Landfill is an unlined landfill that ceased operation in April 9, 1994. Currently, Caswell County utilizes portions of the landfill site as a solid waste convenience site for County residents. The landfilled property is approximately 161.98 acres and is illustrated on ***Figure 2, Existing Site Conditions.***

Because there are limited records for the landfill regarding its operational period, S&ME has estimated that it began operation following the purchase of the land by the County in 1974.

The landfill continued receiving waste until April 1994 when the MSW landfill ceased receiving waste. Based on historical closure design drawings prepared by Dewberry & Davis, dated March 1994, the landfill was to be "closed-out" with approximately 3 feet of soil cover with a conductivity of 10^{-5} centimeter/second placed over the waste, overlain by approximately 12-inches of topsoil on top of the landfill.

2.3 Existing Gas Vents and Methane Monitoring Well Locations

The Caswell County Landfill has a gas venting system to control explosive gasses at the facility. The existing passive gas venting system consists of 6 vents, GV#1, GV#2, GV3#, GV#4, GV#5, and GV#6, installed at the location shown in ***Figure 2, Existing Site Conditions***. This gas control system consists of passive conveyance components intersecting the waste mass. The passive system allows the landfill gas to exit the collection system without mechanical assistance.

We understand that during a 2012 inspection of the landfill, Mr. John Petrone with the North Carolina Department of Environment and Natural Resources, Division of Waste Management, Solid Waste Section (NCDENR-SWS) reported to Tim Smith with Caswell County, the facility was required by regulation to conduct landfill gas monitoring at the closed MSW landfill, an activity not previously performed at the landfill.

During 2013, Caswell County contracted Smith+Gardner to coordinate with the NCDENR-SWS the selection of appropriate landfill gas monitoring well locations and to install methane monitoring wells at the approved locations. As summarized in *Landfill Gas Well Installation* report, dated May 24, 2013, prepared by Smith+Gardner; the methane monitoring well network consists of landfill gas monitoring wells LFG-1 and LFG-2, plus existing groundwater monitoring well MW-1 (see **Appendix I**). Therefore, we understand that the NCDENR-SWS has agreed that the subject facility shall monitor landfill gas at groundwater monitoring well MW-1 plus two new landfill gas monitoring wells LFG-1 and LFG-2 installed by Smith+Gardner.

To date, Caswell County has conducted regular quarterly methane monitoring activities on May 16, 2013 (Smith+Garner), October 7, 2013 (County staff), December 18, 2013 (County staff), and March 10, 2014 (County staff). Based on Landfill Gas Monitoring Data Forms provided by Caswell County, methane gas was not detected greater than 25%

of the lower explosive limit (LEL) and methane (CH_4) was not detected at each of the three methane monitored locations. The data collected is summarized below.

Table 1
Landfill Gas Monitoring Summary
Caswell County Landfill, Caswell County, NC
S&ME Project No. 1584-07-034

Vent ID	Date	LEL (%)	CH4 (% by volume)	O_2 (%)	CO_2 (%)
LFG-1	05/16/13	0	0	11.7	8
	10/07/13	0	0	20.8	1.0
	12/13/13	0	0	18.8	2.3
	04/10/14	0	0	18.4	0.1
LFG-2	05/16/13	0	0	13.5	4
	10/07/13	0	0	20.9	0.1
	12/13/13	0	0	15.0	4.9
	04/10/14	0	0	18.7	0.9
MW-1	05/16/13	0	0	20.0	0.1
	10/07/13	0	0	21.1	1.0
	12/13/13	0	0	18.8	2.3
	04/10/14	0	0	20.8	0.5
Building	05/16/13	0	0	Not Measured	Not Measured
	10/07/13	0	0	Not Measured	Not Measured
	12/13/13	0	0	18.5	4.0
	04/10/14	0	0	20.7	0.0

LEL = Lower explosive limit

2.4 General Site Setting Information

According to the Geologic Map of North Carolina, Region 8, by P. Albert Carpenter, dated 1982; the landfill and vicinity are underlain by metamorphosed rocks of the Carolina Slate belt, described as mica, gneiss, and schist. Residual soil generated from this rock type is generally the Madison Series.

As depicted on ***Figure 2, Existing Site Conditions,*** the close MSW Landfill waste disposal unit is located east of Bear Branch and west of an unnamed tributary to Bear Branch. The former scale house building is the only permanent structure on the property and it is located on the opposite side of the unnamed tributary to Bear Branch, approximately 1,000 feet east of the tributary. The former scale house is now utilized by Caswell County in association with the solid waste convenience site.

Landfill methane gas monitoring well LFG-1 is located in the vicinity of convenience site buildings. Landfill methane gas monitoring well LFG-2 is located to the north of the closed waste management unit and groundwater monitoring well MW-1 is located to the west of the closed waste management unit.

Based on compliance groundwater monitoring data, depths to groundwater at the facility were observed to be as follows on December 11, 2014.

TABLE 2
GROUNDWATER ELEVATION SUMMARY
CASWELL COUNTY LANDFILL
YANCEYVILLE, NORTH CAROLINA
S&ME PROJECT NO. 1584-07-034A

Static Water Levels				
Well No.	**Ground Surface Elevation (topographic)**	**Depth of Well (feet BTOC)**	**December 11, 2013**	
			(feet BTOC)	**Elevation (feet)**
MW-1	572	24.5	20.32	551.7
MW-2	526	22.3	21.07	504.9
MW-3	511	17.8	12.75	498.3
MW-4	526	36.0	24.92	501.1
MW-5	498	24.7	10.39	487.6
MW-6	489	16.2	10.50	478.5

Topographic = ground elevation estimated from topographic map w/2 foot contour interval, not a surveyed elevation
Depth of well data as measured by S&ME Inc. personnel on date of sampling
DTGW = Depth to Groundwater
Elevation = calculated groundwater elevation (rounded to nearest 0.1 foot)
feet BTOC = Feet below top of casing

Groundwater is relatively shallow in the vicinity of the unnamed tributary to Bear Branch as indicated by water levels observed at groundwater monitoring wells MW-3, MW-5, and MW-6. Groundwater occurrence is relatively deeper in the upland landscape positions represented by groundwater monitoring well MW-1, MW-2, and MW-4. ***Figure 3, Groundwater Contour Map*** depicts the estimated groundwater flow direction in the vicinity of the landfill based on the December 2013. The December 13, 2013, estimated groundwater flow direction is generally consistent with flow directions observed by S&ME since 2007.

3. METHANE MONITORING PROGRAM

The following sections detail general requirements, procedures, and frequency of the monitoring program.

3.1 General Requirements

The general requirements of the methane monitoring program are to establish methane gas monitoring locations and protocols that assess methane concentrations at the property boundaries, on-site structures, and off site residences and structures adjacent to the landfill. The methane monitoring program is designed to address the following facility requirements:

- The concentration of methane gas or other explosive gases generated by the facility does not exceed 25 percent of the lower explosive limit (LEL) in on-site facility structures (excluding gas control or recovery system components);
- The concentration of methane gas or other explosive gases does not exceed the LEL for methane or other explosive gases at the facility property boundary; and
- The facility does not release methane gas or other explosive gases in any concentration that can be detected in off-site structures.

3.2 Monitoring Locations

As mentioned previously, there are three monitoring wells used to monitor methane gas for the facility. The methane gas monitor wells are positioned to detect methane gas that may migrate into the structures located at the landfill or beyond the landfill property boundary. The wells are located between the waste boundary and the property boundary and between the waste boundary and facility structures that are occupied or used regularly by County personnel. Monitoring for methane in the former scale house building began on December 13, 2013.

The following table provides a description of each location and its function:

Monitoring Well ID	Location and Function	Currently Monitored?
LFG-1	Monitors between the edge of waste and the eastern property boundary	Yes
LFG-2	Monitors between the edge of waste and the northern property boundary	Yes
MW-1	Monitors between the edge of waste and the western property boundary	Yes

The former landfill scale house utilized by Caswell County for the solid waste convenience site shall also be monitored quarterly. A continuous methane gas monitor with alarm will not be utilized. However, ambient conditions inside the building will be monitored utilizing the same field instrument used to obtain field measurements from the landfill gas monitoring wells. Based on the approximate 20 years that have passed since waste was last placed in the closed MSW landfill, the existence of the unnamed tributary

to Bear Branch between the edge of waste and the scale house building, and the approximate 1200 feet which separate the limits of the closed MSW landfill edge of waste and the scale house building, continuous monitoring should not be necessary. However, if methane concentrations are measured along the property boundaries in LFG-1, LFG-2, or MW-1 that exceed the lower explosive limit then the structure will be monitored in accordance with the Contingency Plan detailed in Section 4.

3.3 Monitoring Frequency and Procedures

Monitoring of the methane monitoring wells will be conducted quarterly unless directed otherwise by the NCDENR. Methane monitoring within the former scale house building will be performed quarterly.

Monitoring of the headspace gas in the methane monitoring wells will be performed by trained personnel using a GEM portable gas analyzer fitted with a Swagelock quick connect assembly or a stopcock type valve. The GEM portable gas analyzer will be calibrated prior to field measurements in general accordance with the manufacture's recommendations. The following procedures will be used to collect landfill gas measurements in the methane monitoring wells:

1. Record the ambient temperature, barometric pressure, and general weather conditions at the facility on the day of data collection.

2. Unlock the protective casing for the methane well and open the protective casing lid to expose the methane well.

3. Connect the GEM portable gas meter to the methane well using the quick connections or stopcock valve. If quick connections are used, make sure the quick connections are seated properly, the user should hear and feel the male and female connections click into place.

4. Record the time of sample tube purging and the time (seconds) pumped for each sample location.

5. Monitor percent methane (%CH_4) in each well until the reading on the meter stabilizes.

6. Record initial and stabilized % LEL readings for each sample location. (LEL for methane is 5% CH_4).

7. The time of measurement, percent carbon dioxide (%CO_2), and percent oxygen (%O_2) will also be recorded.

The gas in the facility structures will be measured by recording detected concentration until reading stabilize, generally after approximately 3 to 5 minutes in each structure.

The Landfill Gas Monitoring Data Form presented in ***Appendix II*** will be used to record the readings from the methane monitoring wells, structures, and additional details associated with each monitoring event.

3.4 Reporting

The measurements collected from the methane monitoring wells will be recorded for each well for each sampling event and a copy of the quarterly landfill gas monitoring results shall be placed in the Operating Record of the facility and be readily available for review during landfill audits and inspection. The results do not need to be reported to the NCDENR Solid Waste Section **unless:**

- there is an explosive gas exceedance of the LEL at the facility property boundary as measured in the landfill gas monitoring wells, or
- there is an explosive gas exceedance of 25% LEL in facility structures.

Under either of these circumstances, an Environmental Monitoring Reporting Form together with the Landfill Gas Monitoring Data Form, must be completed and submitted to the NCDENR Solid Waste Section. Copies of both forms are contained in Appendix II.

4. CONTINGENCY PLAN

North Carolina regulations require that explosive gases be controlled such that concentrations of gases will be less than 25 percent of the LEL in on-site structures and less than 100 percent of the LEL at the facility property boundary.

If methane gas levels exceeding the maximum LEL are detected, the County will perform the following:

- Immediately take steps necessary to ensure protection of human health and notify the Division;
- Within seven days of detection, place in the landfill record the methane or explosive gas levels detected and a description of the steps taken to protect human health; and
- Within 60 days of detection, implement a remediation plan for the methane or explosive gas releases, place a copy of the plan in the operating record, and notify the Division that the plan has been implemented. The plan would describe the nature and extent of the problem and the proposed remedy.

Figure 4 presents a flow chart summarizing methane monitoring requirements, and the necessary steps the owner/operator must take if methane gas concentrations exceed the action levels in methane gas monitoring wells or facility structures.

As a step to address the protection of human health, in the event that methane concentrations in LFG-1, LFG-2, or MW-1 exceed the LEL for methane, Caswell County will begin methane monitoring of the off site residential structures adjacent to the well/wells. Procedures for residential monitoring are as follows:

1. Notify the adjacent property owners in writing of the potential for entrapped methane gas beneath their dwellings and request permission to monitor for the presence of methane gas within and around their home;

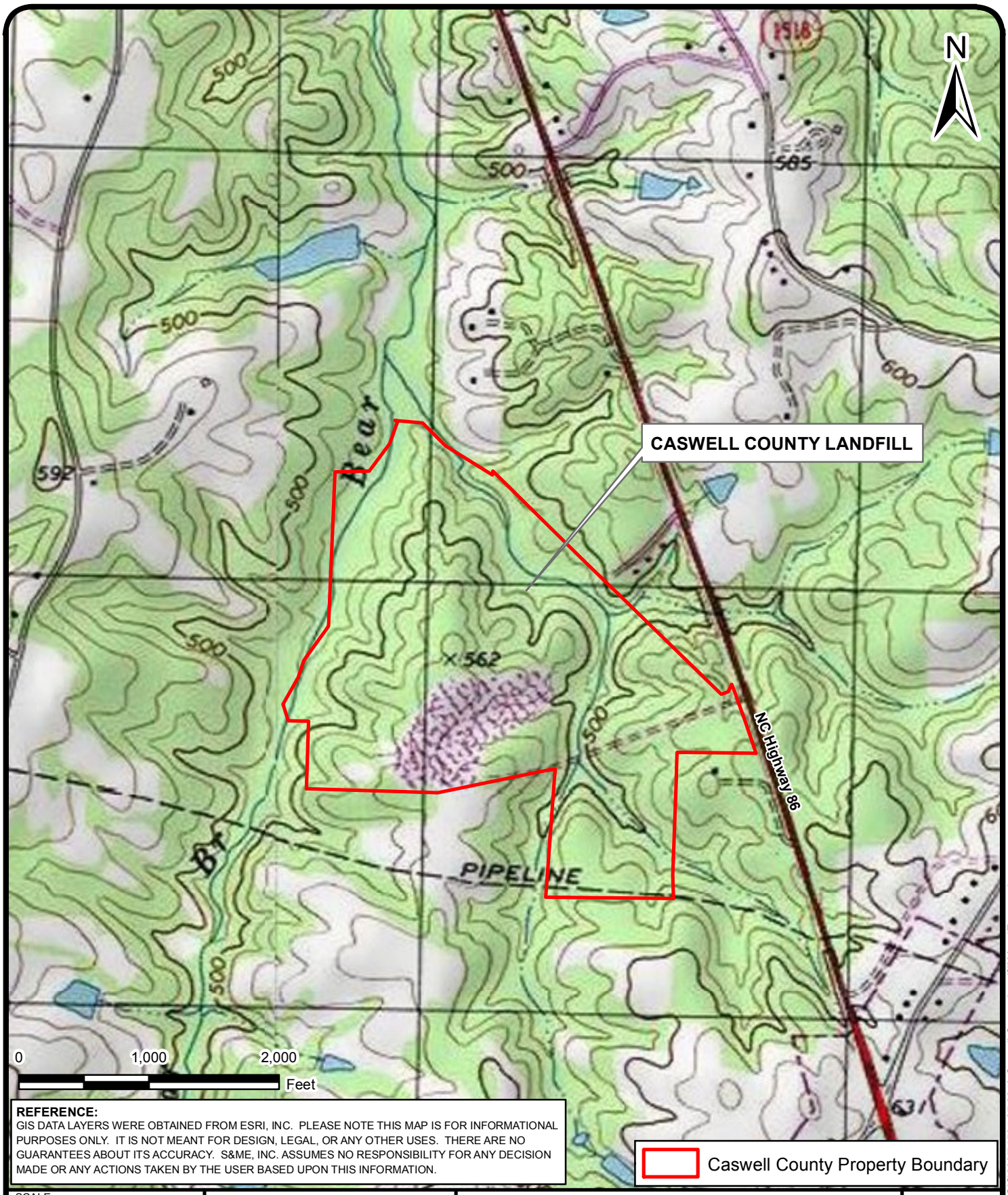
2. Once permission has been granted for monitoring, visually observe the home both inside and out for potential areas where methane gas may become trapped (i.e. crawl spaces, basements, closets, etc.); then

3. Monitor ambient methane concentrations inside and outside of the home, documenting locations and measurements.

The Landfill Gas Monitoring Date Form presented in ***Appendix II*** shall be used to record the readings from the residential monitoring.

If detectable concentrations of methane gas are measured within the residence, Caswell County will immediately take steps necessary to ensure protection of human health and notify the Division.

FIGURES



REFERENCE:
GIS DATA LAYERS WERE OBTAINED FROM ESRI, INC. PLEASE NOTE THIS MAP IS FOR INFORMATIONAL PURPOSES ONLY. IT IS NOT MEANT FOR DESIGN, LEGAL, OR ANY OTHER USES. THERE ARE NO GUARANTEES ABOUT ITS ACCURACY. S&ME, INC. ASSUMES NO RESPONSIBILITY FOR ANY DECISION MADE OR ANY ACTIONS TAKEN BY THE USER BASED UPON THIS INFORMATION.

SCALE: 1 " = 1,000 '	S&ME WWW.SMEINC.COM	**USGS TOPOGRAPHIC MAP**	FIGURE NO.
DATE: 05-08-14		CASWELL COUNTY LANDFILL CASWELL COUNTY, NC	**1**
DRAWN BY: MEM			
PROJECT NO: 1584-07-034A	ENGINEERING LICENSE NO: F-0176		

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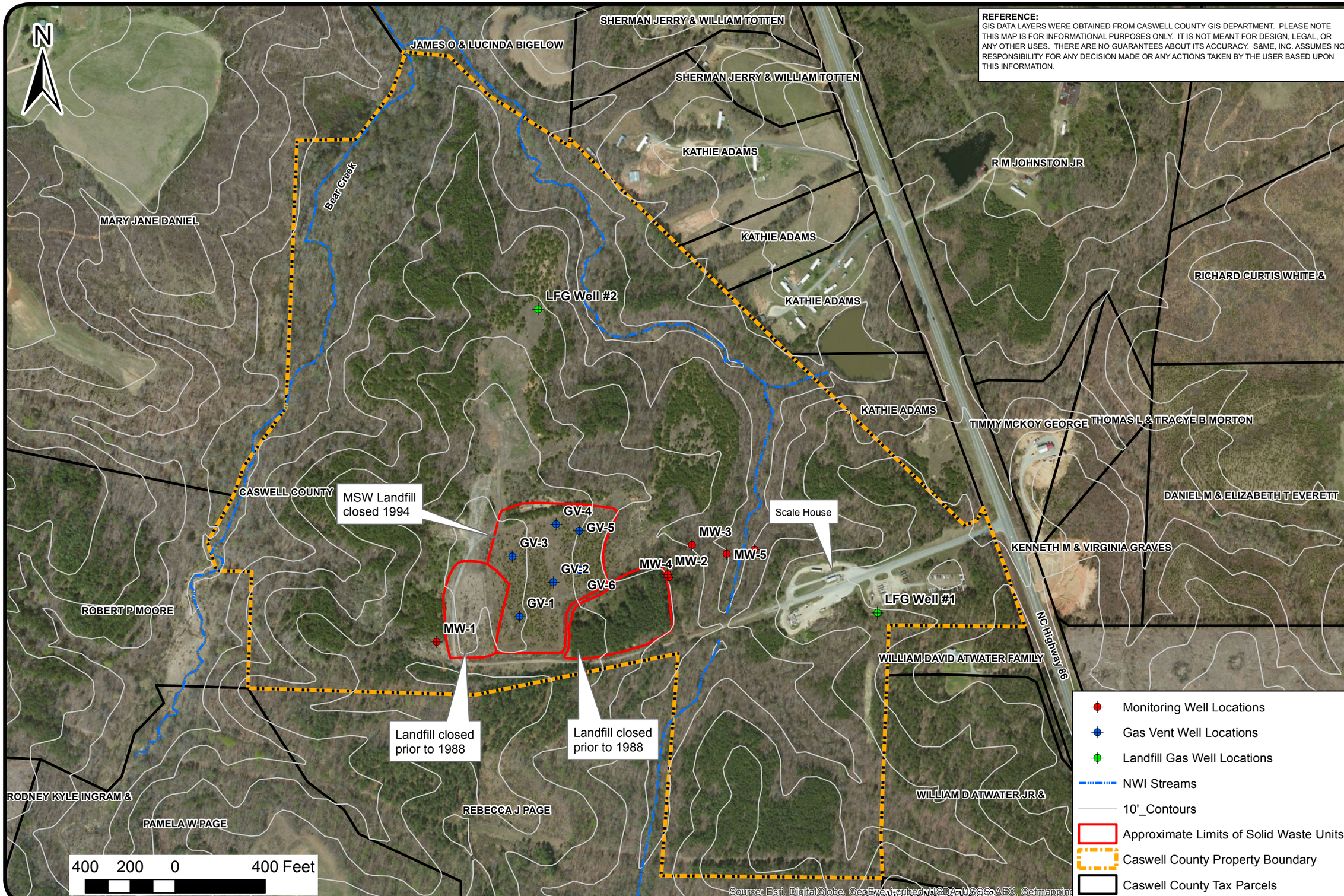

REFERENCE:
GIS DATA LAYERS WERE OBTAINED FROM CASWELL COUNTY GIS DEPARTMENT. PLEASE NOTE THIS MAP IS FOR INFORMATIONAL PURPOSES ONLY. IT IS NOT MEANT FOR DESIGN, LEGAL, OR ANY OTHER USES. THERE ARE NO GUARANTEES ABOUT ITS ACCURACY. S&ME, INC. ASSUMES NO RESPONSIBILITY FOR ANY DECISION MADE OR ANY ACTIONS TAKEN BY THE USER BASED UPON THIS INFORMATION.

DATE: 05.19.2014	DRAWN BY: MEM
SCALE: 1 " = 400 '	PROJECT NO. 1584-07-034A
	ENGINEERING LICENSE NO.
	CHECKED BY: EQBH

S&ME
WWW.SMEINC.COM

EXISTING SITE CONDITIONS

CASWELL COUNTY LANDFILL
CASWELL COUNTY, NORTH CAROLINA

FIGURE NO.
2

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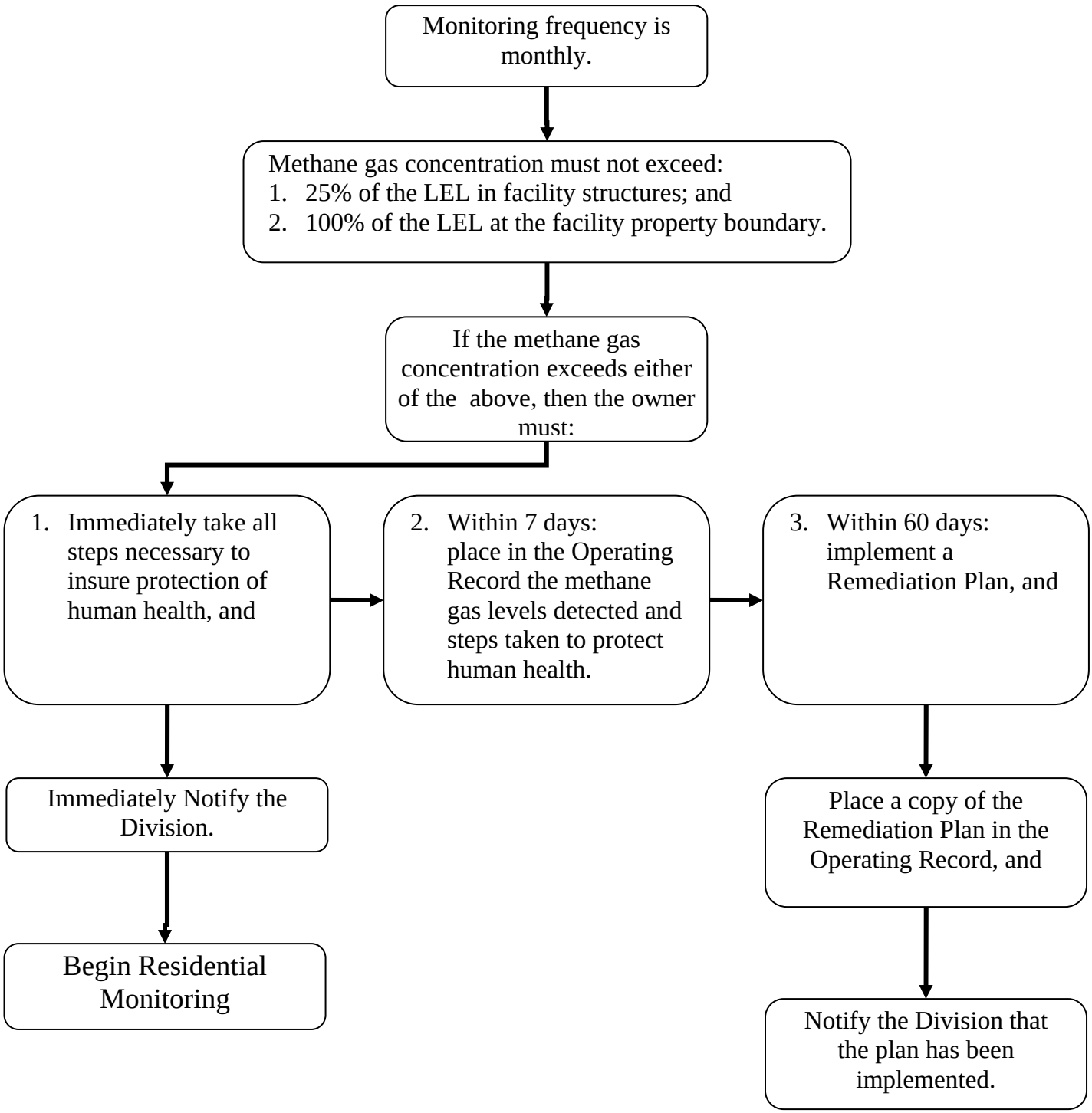
KEY
- MONITORING WELL LOCATION
- GROUNDWATER CONTOUR
(505.2) - GROUNDWATER ELEVATION MEASURED IN MONITORING WELL
- GROUNDWATER FLOW DIRECTION

GRAPHIC SCALE
120 60 0 120
SCALE: 1" = 120'

GROUNDWATER CONTOUR MAP
CASWELL COUNTY LANDFILL
YANCEYVILLE, NORTH CAROLINA

SCALE: AS SHOWN
DRAWN BY: RDM
CHECKED BY: EQBH
JOB NO. 1584-07-034
DATE: OCTOBER 2013
FIGURE NO. 3

S&ME
3718 OLD BATTLEGROUND ROAD
GREENSBORO, NC. 27410
PH. 336-288-7180
FAX. 336-288-8980
WWW.SMEINC.COM



SCALE: NTS	S&ME WWW.SMEINC.COM	**METHANE MONITORING REQUIREMENTS**
CHECKED BY:		MONITORING PLAN FOR LANDFILL GAS CASWELL COUNTY LANDFILL YANCEYVILLE, NORTH CAROLINA S&ME PROJECT NO. 1584-07-034
DRAWN BY: EQBH		Figure No. 4
DATE: MAY 2014		

APPENDIX I

(Methane Monitoring Well Construction Records)

SMITH+GARDNER
ENGINEERS

ADDRESS
14 N. Boylan Avenue, Raleigh NC 27603

TEL
919.828.0577

WEB
www.smithgardnerinc.com

May 24, 2013

Ms. Christine Ritter
NCDENR DWM Solid Waste Section
1646 Mail Service Center
Raleigh, North Carolina 27699-1646

RE: Landfill Gas Well Installation
Caswell County Closed MSW Landfill
Yanceyville, North Carolina

Dear Ms. Ritter:

Smith Gardner, Inc. (S+G) was recently contracted by Caswell County to install landfill gas monitoring wells at the Caswell County Closed MSW Landfill. The installation of two landfill gas monitoring wells was completed on April 22, 2013.

Geologic Explorations, Inc. performed the landfill gas monitoring well installation with oversight provided by S+G personnel. Two landfill gas monitoring wells (LFG-1 and LFG-2) were installed near the facility boundary. Both wells were drilled to auger refusal and no water was encountered during drilling. Well construction is summarized below:

Well No.	Total Depth	Screened Interval
LFG-1	14 feet	5' to 14'
LFG-2	24 feet	6' to 24'

Both wells were completed with solid PVC riser pipe to approximately 3 feet above grade. Each was outfitted with locking steel outer casings and landfill gas monitoring well caps. Well tags and large identifying numbers were affixed to the outer casing of each well. Well boring logs and construction detail sheets are **attached** for your review and records. The approximate well locations are shown on the attached **Figure 1**.

S+G previously submitted the results from the May 2013 monitoring event which indicated that the newly installed landfill gas monitoring wells, as well as groundwater monitoring well (MW-1) on-site had no detectable concentrations of methane.

If you have any questions or require any additional information, please contact us at 919-828-0577 or by e-mail (below).

Sincerely,
SMITH GARDNER, INC.

Madeline M. German, P.G.
Project Geologist
madeline@smithgardnerinc.com

Joan A. Smyth, P.G.
Senior Hydrogeologist
joan@smithgardnerinc.com

Attachments: Figure 1
LFG-1 and LFG2 construction records and boring logs

Cc: Kevin Howard, Caswell County
Tim Smith, Caswell County
File

0 250 500 750 1,000 Feet

NOTE: LFG WELL LOCATIONS ARE APPROXIMATE.

LFG WELL LOCATIONS ARE APPROXIMATE TO THIS FIGURE.

LANDFILL GAS MONITORING LOCATIONS
CASWELL COUNTY LANDFILL
YANCEYVILLE, NORTH CAROLINA

NC LIC. NO. C-0828 (ENGINEERING)

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

DRAWN:	APPROVED:	SCALE:	DATE:	PROJECT NO.:	FIGURE NO.:
C.T.J.	J.A.S.	AS SHOWN	May. 2013	CASWELL 13-1	1

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NON RESIDENTIAL WELL CONSTRUCTION RECORD

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

WELL CONTRACTOR CERTIFICATION # 2581

1. WELL CONTRACTOR:

BRIAN THOMAS
Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC
Well Contractor Company Name

176 COMMERCE BLVD
Street Address

STATESVILLE NC 28625
City or Town State Zip Code

(704) 872-7686
Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT#

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) LSG-1

3. WELL USE (Check One Box) Monitoring ☐ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☑ (list use) LANDFILL GAS

DATE DRILLED 04/22/13

4. WELL LOCATION:

162 LANDFILL ROAD 27379
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: YANCEYVILLE COUNTY CASWELL

TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☐ Valley ☑ Flat ☐ Ridge ☐ Other

LATITUDE 36 ° 26 ' 20.8400 " DMS **OR** DD

LONGITUDE 79 ° 21 ' 52.4600 " DMS **OR** DD

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.)

CASWELL COUNTY LANDFILL N/A
Facility Name Facility ID# (if applicable)

162 LANDFILL ROAD
Street Address

YANCEYVILLE NC 27379
City or Town State Zip Code

CASWELL COUNTY
Contact Name

PO BOX 98
Mailing Address

YANCEYVILLE NC 27379
City or Town State Zip Code

( )
Area code Phone number

6. WELL DETAILS:

a. **TOTAL DEPTH:** 24.0 FEET

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

c. **WATER LEVEL** Below Top of Casing: DRY 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/A **METHOD OF TEST** N/A

f. **DISINFECTION: Type** N/A **Amount** N/A

g. **WATER ZONES** (depth):

Top	Bottom	Top	Bottom
Top	Bottom	Top	Bottom
Top	Bottom	Top	Bottom

7. CASING:

Depth		Diameter	Thickness/ Weight	Material
Top 0.0	Bottom 6.0 Ft.	2 INCH	SCH 40	PVC
Top	Bottom Ft.			
Top	Bottom Ft.			

8. GROUT:

Depth		Material	Method
Top 0.0	Bottom 3.0 Ft.	PORTLAND BENTONITE	SLURRY
Top	Bottom Ft.		
Top	Bottom Ft.		

9. SCREEN:

Depth		Diameter	Slot Size	Material
Top 6.0	Bottom 24.0 Ft.	2.0 in.	.010 in.	PVC
Top	Bottom Ft.	in.	in.	
Top	Bottom Ft.	in.	in.	

10. SAND/GRAVEL PACK:

Depth		Size	Material
Top 4.0	Bottom 24.0 Ft.	20-40	FINE SILICA SAND
Top	Bottom Ft.		
Top	Bottom Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description
0.0	6.0	RED SILTY CLAY
6.0	18.0	BROWN SILTY SAND
18.0	24.0	TAN SILTY SAND

12. REMARKS:

BENTONITE SEAL FROM 3.0 TO 4.0 FEET

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

SIGNATURE OF CERTIFIED WELL CONTRACTOR 04/30/13 DATE

BRIAN THOMAS
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

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

Form GW-1b
Rev. 2/09

NON RESIDENTIAL WELL CONSTRUCTION RECORD

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

WELL CONTRACTOR CERTIFICATION # 2581

1. WELL CONTRACTOR:

BRIAN THOMAS
Well Contractor (Individual) Name

GEOLOGIC EXPLORATION, INC
Well Contractor Company Name

176 COMMERCE BLVD
Street Address

STATESVILLE | NC | 28625
City or Town | State | Zip Code

(704) 872-7686
Area code Phone number

2. WELL INFORMATION:

WELL CONSTRUCTION PERMIT#

OTHER ASSOCIATED PERMIT#(if applicable)

SITE WELL ID #(if applicable) LSG-2

3. WELL USE (Check One Box) Monitoring ☐ Municipal/Public ☐
Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐
Irrigation ☐ Other ☑ (list use) LANDFILL GAS

DATE DRILLED 04/22/13

4. WELL LOCATION:

162 LANDFILL ROAD 27379
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

CITY: YANCEYVILLE COUNTY CASWELL

TOPOGRAPHIC / LAND SETTING: (check appropriate box)
☐ Slope ☑ Valley ☐ Flat ☐ Ridge ☐ Other

LATITUDE 36 ° 26 ' 32.4300 " DMS **OR** DD

LONGITUDE 79 ° 22 ' 10.5000 " DMS **OR** DD

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.)

CASWELL COUNTY LANDFILL | N/A
Facility Name | Facility ID# (if applicable)

162 LANDFILL ROAD
Street Address

YANCEYVILLE | NC | 27379
City or Town | State | Zip Code

CASWELL COUNTY
Contact Name

PO BOX 98
Mailing Address

YANCEYVILLE | NC | 27379
City or Town | State | Zip Code

( )
Area code Phone number

6. WELL DETAILS:

a. **TOTAL DEPTH:** 14.0 FEET

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

c. **WATER LEVEL** Below Top of Casing: DRY 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/A **METHOD OF TEST** N/A

f. **DISINFECTION: Type** N/A **Amount** N/A

g. **WATER ZONES** (depth):

Top	Bottom	Top	Bottom
Top	Bottom	Top	Bottom
Top	Bottom	Top	Bottom

7. CASING:

Depth		Diameter	Thickness/ Weight	Material
Top 0.0	Bottom 5.0 Ft.	2 INCH	SCH 40	PVC
Top	Bottom Ft.			
Top	Bottom Ft.			

8. GROUT:

Depth		Material	Method
Top 0.0	Bottom 3.0 Ft.	PORTLAND BENTONITE	SLURRY
Top	Bottom Ft.		
Top	Bottom Ft.		

9. SCREEN:

Depth		Diameter	Slot Size	Material
Top 5.0	Bottom 14.0 Ft.	2.0 in.	.010 in.	PVC
Top	Bottom Ft.	in.	in.	
Top	Bottom Ft.	in.	in.	

10. SAND/GRAVEL PACK:

Depth		Size	Material
Top 4.0	Bottom 14.0 Ft.	20-40	FINE SILICA SAND
Top	Bottom Ft.		
Top	Bottom Ft.		

11. DRILLING LOG

Top	Bottom	Formation Description
0.0	5.0	BROWN SILTY SAND
5.0	14.0	PARTIALLY WEATHERED ROCK

12. REMARKS:

BENTONITE SEAL FROM 3.0 TO 4.0 FEET

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

SIGNATURE OF CERTIFIED WELL CONTRACTOR | 04/30/13 DATE

BRIAN THOMAS
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

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

Form GW-1b
Rev. 2/09

Smith Gardner, Inc.

14 North Boylan Avenue, Raleigh NC 27603

(919) 828-0577

FIELD BOREHOLE LOG

BOREHOLE NUMBER **LFG-1**

PROJECT NAME: **Caswell County Closed MSW**

LOCATION: **Yancyville, NC**

DRILLING CO: **Geologic Explorations**

DRILLING METHOD: **HOLLOW STEM AUGER**

FIELD PARTY: **B. Thomas**

GEOLOGIST: **M. German**

DATE BEGUN: **4/22/13** COMPLETED: **4/22/13**

TOTAL DEPTH: **24**

TOP OF CASING ELEV.: GROUND ELEV.:

NORTHING: **0** EASTING: **0**

STATIC WATER LEVEL (from TOC)		
Depth (ft)	Not Encountered	
Time		
Date		

DEPTH Feet	BLOW COUNT Per 6"	SAMPLING METHOD	RECOVERY Inches	DRILL METHOD	DESCRIPTION	LITHOLOGY	DEPTH Feet	WELL INSTALLATION
0.0					SILT: dark brown, fine grained, silt, soft		0.0	
5.0							5.0	
10.0					CLAY: gray clay, moist		10.0	
15.0					SANDY CLAY: dark yellow fine grained, silty with clay		15.0	
20.0					SILT: light brown yellow tan, fine grained, silt, slight moisture. Auger refusal 24 ft bgs		20.0	

Smith Gardner, Inc.

14 North Boylan Avenue, Raleigh NC 27603

(919) 828-0577

FIELD BOREHOLE LOG

BOREHOLE NUMBER **LFG-2**

PROJECT NAME: **Caswell County Closed MSW**

LOCATION: **Yancyville, NC**

DRILLING CO: **Geologic Explorations**

DRILLING METHOD: **HOLLOW STEM AUGER**

FIELD PARTY: **B. Thomas**

GEOLOGIST: **M. German**

DATE BEGUN: **4/22/13** COMPLETED: **4/22/13**

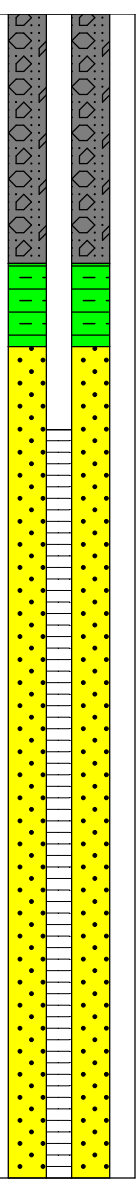
TOTAL DEPTH: **14**

TOP OF CASING ELEV.: GROUND ELEV.:

NORTHING: **0** EASTING: **0**

STATIC WATER LEVEL (from TOC)		
Depth (ft)	Not Encountered	
Time		
Date		

DEPTH Feet	BLOW COUNT Per 6"	SAMPLING METHOD	RECOVERY Inches	DRILL METHOD	DESCRIPTION	LITHOLOGY	DEPTH Feet	WELL INSTALLATION
0.0					SILTY SAND: light yellow orange brown, fine grained, silty sand, some clumping, hard		0.0	
5.0					SILTY SAND: light yellow orange brown, fine grained, silty sand, hard		5.0	
10.0					SILTY SAND: light brown tan, silty sand, hard, few rock fragments. Auger Refusal 14 ft bgs		10.0	



APPENDIX II

(Landfill Gas Monitoring Data Form & Environmental Monitoring Reporting Form)

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
☐ 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.

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)

NC Division of Waste Management - Solid Waste Section

Landfill Gas Monitoring Data 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).

Facility Name: _____ Permit Number: _____

Date of Sampling: _____ NC Landfill Rule (.0500 or .1600): _____

Name and Position of Sample Collector: _____

Type and Serial Number of Gas Meter: _____ Calibration Date of Gas Meter: _____

Date and Time of Field Calibration: _____

Type of Field Calibration Gas (15/15 or 35/50): _____ Expiration Date of Field Calibration Gas Canister: _____

Pump Rate of Gas Meter: _____

Ambient Air Temperature: _____ Barometric Pressure: _____ General Weather Conditions: _____

Instructions: Under "Location or LFG Well" identify the monitoring wells or describe the location for other tests (e.g., inside buildings). A drawing showing the location of test must be attached. Report methane readings in both % LEL and % methane by volume. A reading in percent methane by volume can be converted to % LEL as follows: % methane by volume = % LEL/20

Location or LFG Well ID	Sample Tube Purge	Time	Time Pumped (s)	Initial %LEL	Stabilized %LEL	%CH4 by Volume	%O2	%CO2	Notes

If your facility has more gas monitoring locations than there is room on this form, please attach additional sheets listing the same information as contained on this form.

Certification

To the best of my knowledge, the information reported and statements made on this data submittal and attachments are true and correct. I am aware that there are significant penalties for making any false statement, representation, or certification including the possibility of a fine and imprisonment.

_____ _____

SIGNATURE TITLE