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October 2, 2013

Ms. Shannon Aufman
North Carolina Department of Environment
and Natural Resources
Pre-Regulatory Landfill Unit
1601 Mail Service Center
Raleigh, North Carolina 27699-1601

Subject: Remedial Investigation - Landfill Gas Evaluation
Swannanoa Landfill
Swannanoa, Buncombe County, North Carolina
Site ID# NCD980557987
Task Order 7987DP-8

Dear Ms. Aufman:

CDM Smith Inc. (CDM Smith) is pleased to submit the Remedial Investigation – Landfill Gas Evaluation report for the Swannanoa Landfill (site) located adjacent to Mountain Crest Ridge Road, Swannanoa, North Carolina in accordance with Task Order 7987DP-8. This letter report presents the results of the landfill gas (LFG) probe evaluation and screening that was completed as part of Task Order 7987DP-7. This investigation was performed in accordance with the Work Plan approved by the Department of Environment and Natural Resources Division of Waste Management – Superfund Section – Inactive Hazardous Sites Branch – Pre-Regulatory Landfill Unit on June 10, 2013 and CDM Smith’s Standard Operating Procedures and Quality Assurance manual.

The purpose of this investigation was to abandon and reinstall LFG probes GP-6, -7, -9, -10, -13, and -16 and evaluate the remaining gas probes (i.e. GP-1, -2, -3, -4, -5, -8, -11, -12, -14, and -15) for a proper seal. Additionally, the reinstalled and existing probes were screened for oxygen, carbon dioxide, methane and total volatile organic compounds (VOCs). The LFG probe abandonment and reinstallation was completed by a drilling subcontractor using a Geoprobe® 6610 drill rig under the supervision of CDM Smith on July 9-10, 2013. A site map showing the LFG probe locations is provided on **Figure 1**. Field activities and screening results are discussed below. Note that variances to the Work Plan are discussed in each section.

Landfill Gas Probe Abandonment

LFG gas probes GP-6, -7, -9, -10, -13, and -16 were abandoned by removing the 1-inch diameter Schedule 40 polyvinyl chloride (PVC) riser and screen and tremie grouting the probe annulus with a Portland cement grout from the bottom of the annulus to ground surface. The above-grade protective



cover and 2' x 2' x 6" concrete pad that was installed for LFG probe GP-13 was removed and disposed of.

Landfill Gas Probe Evaluation

The seal integrity of the LFG probes that were not abandoned was evaluated by screening each probe for oxygen, carbon dioxide, and methane and comparing that reading to ambient atmospheric conditions. The probe seals were deemed sufficient if oxygen in the probe was less than ambient atmospheric conditions and carbon dioxide was higher than ambient atmospheric conditions. The assessment parameters were screened using a calibrated Landtec GEM 2000.

The seal integrity at LFG probes GP-1, -2, -3, -4, -8, -11, -12, -14, and -15 was determined to be sufficient based on the screening results. Positive pressure was observed in LFG probes GP-2, -3, and -12 during the seal evaluation and LFG screening. Positive pressure was also observed in GP-13 prior to abandonment. Field notes with the screening results for the seal evaluation are provided in **Appendix A**.

The PVC riser for LFG probe GP-5 was found broken from what appeared to have been the result of a tree limb falling on the probe. A 1-inch diameter coupling was installed to repair the riser. The initial oxygen and carbon dioxide measurement following the repair of GP-5 during the seal evaluation was 18.8 and 1.8 percent respectively, which is within the criteria for a sufficient seal.

Landfill Gas Probe Installation

The Work Plan stated that LFG probes GP-6, -7, -9, -10, -13, and -16 and any probe determined to have an improper seal would be abandoned and reinstalled adjacent to the original location. During the seal evaluation, groundwater levels were measured in each of the LFG probes using an electronic water level indicator with an accuracy of 0.01 feet. Groundwater levels were elevated in LFG probes GP-6, -7, -9, and -10. As a result, these probes were not replaced following abandonment because a 5-foot seal could not have been installed in the vadose zone to prevent short-circuiting of air from the surface. A summary of the groundwater levels measured in each LFG probe is provided in **Table 1**.

As stated in the Work Plan, LFG probe GP-13 was to be reinstalled and screened near the bottom of waste using direct-push drilling techniques. Perched groundwater was encountered from 6 to 17 feet below ground surface (bgs) while attempting to install GP-13. The boring was continued to 17 feet to determine the thickness of the perched groundwater zone and to assess if the boring could be completed without introducing potentially impacted perched groundwater deeper into the formation. Three attempts were made to install GP-13 by offsetting approximately 5 feet in different directions from the original boring location but were unsuccessful due to perched groundwater. Note that refusal was encountered at 16 and 17 feet bgs while attempting to install GP-13.

LFG probe GP-16 was reinstalled outside of the waste boundary using a hand-auger. The Geoprobe® could not access this location due to dense vegetation and steepness of the slope. The probe was constructed with 1-inch diameter Schedule 40 PVC riser flush-threaded to 5-feet of 0.010-inch machine slotted Schedule 40 PVC screen. A sand filter pack was installed 1-foot above the screen. A 2-foot thick bentonite seal was installed and hydrated above the sand filter pack. The remainder of the borehole annulus was completed with a Portland cement and bentonite grout mixture to land

surface. An identification placard was attached to the cement base of the probe and a locked expansion plug was installed. Boring logs for GP-13 and -16 are provided in **Appendix B**.

Landfill Gas Probe Screening

The LFG probes were screened on July 10-11, 2013 for oxygen, carbon dioxide, methane, and VOCs using a calibrated Landtec GEM 2000 (GEM 2000) and a MiniRae 2000. Additionally, barometric pressure, temperature, and humidity were recorded every hour during the screening process. The GEM 2000 was used to measure barometric pressure and a hygrometer was used to measure temperature and humidity. Note that LFG probe GP-16 was the only probe screened on July 11, 2013 to allow for 24-hours of stabilization after installation.

Each LFG probe was screened by installing a temporary 1-inch diameter slip cap fitted with a plastic quick connect for connecting Teflon®-lined tubing to the field instruments immediately upon removing the expansion plug. The assessment parameters were recorded in the site dedicated logbook after stabilization. The screening results are provided in the field notes in Appendix A.

Methane was detected above the lower explosive limit in all of the LFG probes with the exception of GP-5 and -16. VOCs were detected in LFG probes GP-1, -2, -3, -11, -12, -14, and -15. VOC concentrations ranged from 1.4 parts per million (ppm) in GP-11 and -15 to 11.3 ppm in GP-12. Oxygen was measured below ambient atmospheric conditions in all LFG probes. However, oxygen was measured slightly below ambient atmospheric conditions (20.9 percent) at 19.9 percent in GP-5. The elevated oxygen in GP-5 may have been a result of not allowing enough time for stabilization after repairing the damaged riser. Based on a discussion of the measurement with the Pre-Regulatory Landfill Unit during the investigation, it was determined that future screening results from GP-5 would be evaluated to determine if the probe should be abandoned. The LFG probe screening results are summarized in **Table 2** and on Figure 1.

Quality Assurance/Quality Control

The field instrumentation was calibrated each day prior to and after the seal evaluation and LFG screening in accordance with the manufacturer's directions. Based on previous methane readings from the site, the GEM 2000 was calibrated using a 35 percent carbon dioxide and 50 percent methane gas with an expiration date of October 31, 2013. The field instrumentation was bump tested during the seal evaluation and LFG screening to verify the calibration and instrument accuracy. Calibration and bump test results along with the field instrumentation serial numbers were recorded in the site dedicated logbook.

To ensure the validity of the seal evaluation and LFG screening results, changes in the weather, including barometric pressure, were monitored hourly. Weather conditions remained consistent during the seal evaluation and LFG screening and are provided in the field notes in Appendix A. Additionally, the assessment parameters did not fluctuate more than 2 percent during the seal evaluation and LFG screening.

All areas disturbed during this investigation were restored by the drilling subcontractor. Restoration activities included smoothing ruts generated by the drill rig and the installation of grass seed and hay.

Investigative-Derived Waste

Investigative-derived waste generated during this investigation consisted of well construction materials from the LFG probe abandonment, soil and waste cuttings from the attempts to install GP-13, and soil cuttings from the installation of GP-16. Well construction materials removed from the abandoned probes were disposed of offsite by the drilling subcontractor. Soil and waste cuttings generated during each attempt to install GP-13 were placed back in the borehole annulus and compacted by foot at land surface. Soil cuttings from LFG probe GP-16 were spread on the ground surface as this probe was installed outside of the waste limits.

Report Certification

The report certification as specified in the *Inactive Hazardous Sites Program, Guidelines for Addressing Pre-Regulatory Landfills & Dumps, August 2012* is provided in **Appendix C**.

If you have any questions or require further explanation, do not hesitate to call me at (919) 787-5620.

Very truly yours,



Mathew F. Colone, P.G.
CDM Smith Inc.

cc: Daniel Forbes, CDM Smith
Aaron Weispenning, CDM Smith

Table 1
Landfill Gas Probe Groundwater Levels
Swannanoa Landfill
Site Identification Number - NCD980557987

Gas Probe Code	Total Depth (feet btoc)	Depth to Water Below Ground Surface (feet)	Screen Interval (feet bgs)
GP-1	17.8	8.41	10-15
GP-2	18.9	14.10	10-15
GP-3	18.8	14.59	10-15
GP-4	18.9	9.49	10-15
GP-5	14.9	9.80	10-15
GP-6	9.2	6.06	2-7
GP-7	10.0	5.81	3-8
GP-8	16.7	7.91	9-14
GP-9	10.0	3.47	5-10
GP-10	10.0	1.83	5-10
GP-11	18.3	2.34	10-15
GP-12	18.8	13.85	10-15
GP-13	36.0	Dry	31-36
GP-14	18.8	Dry	10-15
GP-15	17.3	Dry	10-15
GP-16	10.7	Dry	3-8

Notes:

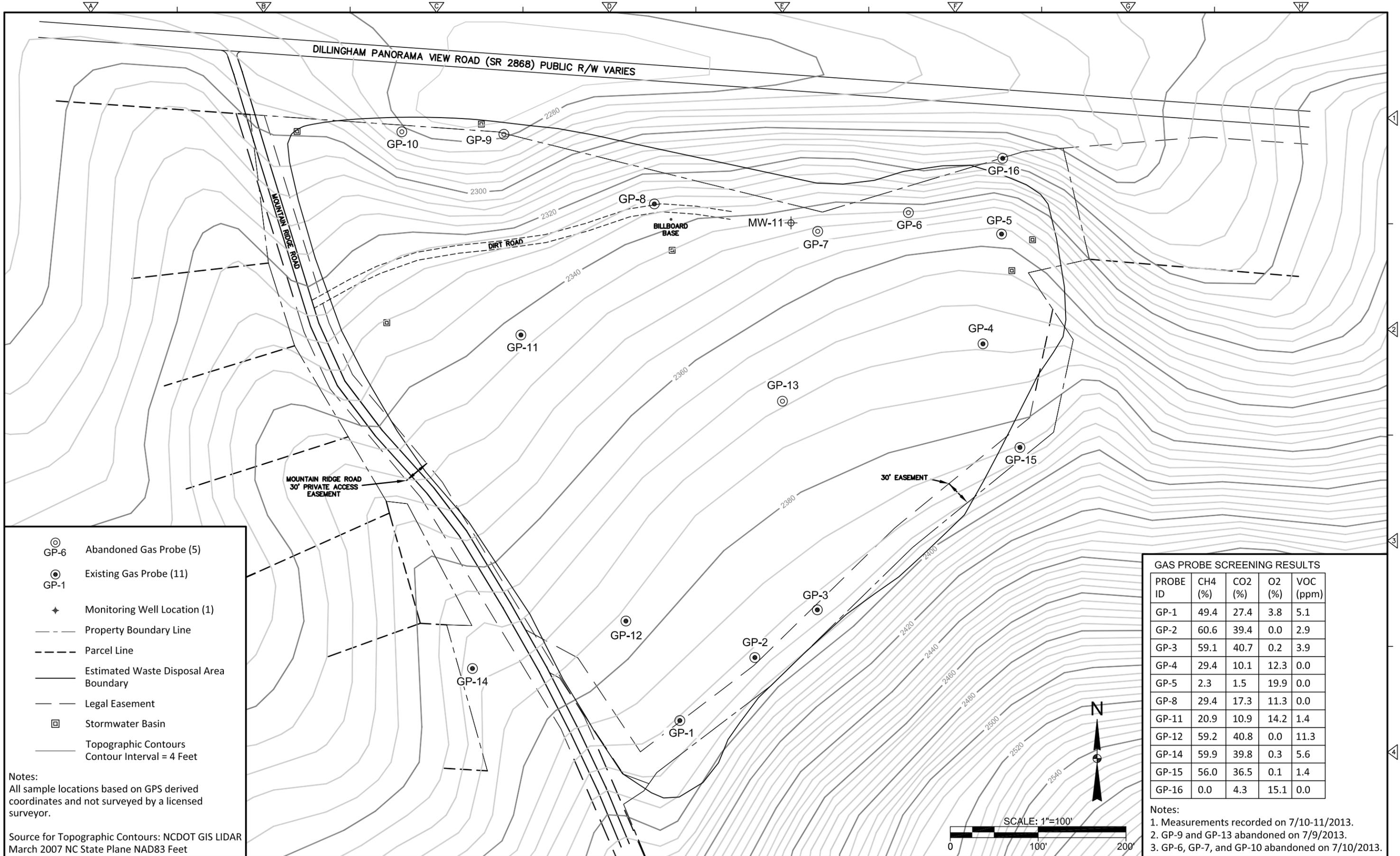
1. Groundwater levels were measured on 7/9/2013.
2. bgs -below ground surface
3. btoc - below top of casing
4. GP-9 and -13 were abandoned on 7/9/2013. GP-6, -7, and -10 were abandoned on 7/10/2013.
5. The measurement at GP-16 was recorded before the well was replaced on 7/9/2013.

Table 2
Landfill Gas Probe Screening Results
Swannanoa Landfill
Site Identification Number - NCD980557987

Gas Probe Code	Date	Time	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Balance (%)	LEL (%)	Total VOCs (ppm)
GP-1	7/10/13	1410	49.4	27.4	3.8	19.4	>100	5.1
GP-2	7/10/13	1422	60.6	39.4	0.0	0.0	>100	2.9
GP-3	7/10/13	1431	59.1	40.7	0.2	0.0	>100	3.9
GP-4	7/10/13	1451	29.4	10.1	12.3	48.2	>100	0.0
GP-5	7/10/13	1540	2.3	1.5	19.9	76.3	46	0.0
GP-8	7/10/13	1526	29.4	17.3	11.3	42.0	>100	0.0
GP-11	7/10/13	1603	20.9	10.9	14.2	54.0	>100	1.4
GP-12	7/10/13	1611	59.2	40.8	0.0	0.0	>100	11.3
GP-14	7/10/13	1554	59.9	39.8	0.3	0.0	>100	5.6
GP-15	7/10/13	1442	56.0	36.5	0.1	7.4	>100	1.4
GP-16	7/11/13	0815	0.0	4.3	15.1	80.6	0	0.0

Notes:

1. LEL - Lower Explosive Limit
2. VOCs - Volatile Organic Compounds
3. ppm - parts per million
4. 7/10/2013 Weather Conditions: Temperature = 80 °F, Barometric Pressure = 27.54" Hg, Humidity = 66%
5. 7/11/2013 Weather Conditions: Temperature = 66 °F, Barometric Pressure = 27.63" Hg, Humidity = 99%
6. The landfill gas was under positive pressure in GP-2, -3, and -12.
7. GP-9 and -13 were abandoned on 7/9/2013. GP-6, -7, and -10 were abandoned on 7/10/2013.
8. A calibrated Landtec GEM 2000 was used to record barometric pressure and a hygrometer was used to record temperature and humidity.



- ⊙ GP-6 Abandoned Gas Probe (5)
- ⊙ GP-1 Existing Gas Probe (11)
- ⊕ Monitoring Well Location (1)
- Property Boundary Line
- - - Parcel Line
- Estimated Waste Disposal Area Boundary
- Legal Easement
- ▣ Stormwater Basin
- Topographic Contours
Contour Interval = 4 Feet

Notes:
All sample locations based on GPS derived coordinates and not surveyed by a licensed surveyor.

Source for Topographic Contours: NCDOT GIS LIDAR
March 2007 NC State Plane NAD83 Feet

GAS PROBE SCREENING RESULTS				
PROBE ID	CH4 (%)	CO2 (%)	O2 (%)	VOC (ppm)
GP-1	49.4	27.4	3.8	5.1
GP-2	60.6	39.4	0.0	2.9
GP-3	59.1	40.7	0.2	3.9
GP-4	29.4	10.1	12.3	0.0
GP-5	2.3	1.5	19.9	0.0
GP-8	29.4	17.3	11.3	0.0
GP-11	20.9	10.9	14.2	1.4
GP-12	59.2	40.8	0.0	11.3
GP-14	59.9	39.8	0.3	5.6
GP-15	56.0	36.5	0.1	1.4
GP-16	0.0	4.3	15.1	0.0

Notes:
1. Measurements recorded on 7/10-11/2013.
2. GP-9 and GP-13 abandoned on 7/9/2013.
3. GP-6, GP-7, and GP-10 abandoned on 7/10/2013.

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: A. WEISPFENNING
 DRAWN BY: A. WEISPFENNING
 SHEET CHK'D BY: M. COLONE
 CROSS CHK'D BY: M. COLONE
 APPROVED BY: M. COLONE
 DATE: JULY 2013

CDM Smith
 Camp Dresser McKee & Smith
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 NC P-2412

SWANNANOVA, BUNCOMBE COUNTY, NORTH CAROLINA
 SWANNANOVA LANDFILL
 (NCD980557987)

SITE MAP WITH GAS PROBE SCREENING RESULTS

PROJECT NO. 127844-97867
 FILE NAME: GP 7-13.DWG
 FIGURE
1

Appendix A

Field Notes

7-9-13 70°F P. Cloudy

630 A. Weispening + M. Durwin ^{→ com Smith} arrive at office
to load up supplies + equipment

655 D. Forbes arrives at office

700 Depart for Swannanoa Landfill

1100 Arrive at gas station near landfill

Meet up with Dan Forbes (COM Smith) and

wait for probe tech

1115 Problem at gas station; proceed to
landfill and conduct walkthrough

* GP-5 was broken, will document with picture

1200 Complete Walkthrough and grab for GP-9

Dan Forbes + Mark Durwin will start drilling

while Amon Weispening starts screening

existing wells; complete HHS review after walkthrough

1230 calibrate GEM 2000

cal information from Pine:

Model: GEM 2000 Serial#: GM07409-04

cal date/time: 7/2/13 at 10:34 AM

Methane: 50.00%

CO₂: 35.00%

O₂: 20.90%

cal gas = 35/50 exp: 10/31/13

7-9-13 79°F P. Cloudy

1245 Complete calibration

initial readings

Final Reading

(after calibration)

CH₄ 49.8% 50.0%

CO₂ 35.3% 35.0%

O₂ 20.3% 20.9%

gas used = 35/50 exp: 03/20/16

1300 Start screening

Probes to be assessed

temp: 79°F

Barometric Pressure: 27.69" Hg

humidity: 58%

ID	Time	Probe	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	Bal	LEL
GP-8	1315	64	19.0	11.4	11.8	51.8	???
GP-5	1333	68	0.1	1.8	18.8	78.9	2
GP-4	1339	65	16.0	6.5	14.9	62.6	???
GP-15	1343	58	56.6	36.7	0.2	6.3	???
GP-3	1346	60	60.6	39.4	0.0	0.0	???
GP-2	1350	63	59.3	40.5	0.2	0.0	???
GP-1	1353	58	62.1	31.3	0.9	5.1	???
GP-12	1357	62	60.2	39.8	0.0	0.0	???
GP-14	1402	56	61.9	38.1	0.0	0.0	???
GP-11	1407	63	18.0	8.5	14.4	59.1	???
GP-6	1421	58	55.1	38.6	0.9	5.4	???
GP-13	1414	55	62.6	37.4	0.0	0.0	???
GP-7	1300	63	61.6	39.5	0.2	0.0	???
* GP-5 broken 2' above ground - can be repaired with a coupling ~ see photos 1+2; will reassess							
After cap has been in place overnight							
GP-16	1432	64	0.1	3.9	14.9	81.0	2

7-9-13 80°F P. Cloudy

1445 Bump Test GEM 2000

CH₄ = 50.0%

Pressure = 27.65 "Hg

CO₂ = 34.9%

Humidity = 50%

O₂ = 20.8%

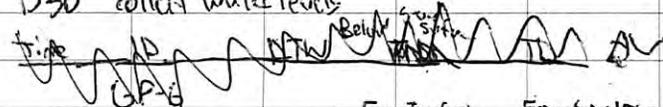
Temp = 80°F

1445- Dan Forbes spoke with Cheryl Marks,

Perched water was encountered at 6 feet at GP-13. Will offset location to see if we are outside of the perched zone. If water is encountered, the borings will be abandoned. The existing probe will also be abandoned. Additionally, GP-7 has water at 7 feet bgs. and was constructed improperly. A new probe will not be installed at this location because the shallow ground water prohibits proper well construction.

1500- 3rd offset attempt - H₂O at 6 feet / Refused at 16 ft.

1530 collect water levels



time	ID	TD	From Top casing DTW	From ground surface DTW	Below ground DTW
1541	GP-11	18.27	6.34	4.0	2.34
1548	GP-14	18.92	13.69	4.2	9.49
1550	GP-5	14.91	10.00	0.2	9.80
1555	GP-6	9.19	9.16	3.1	6.06
1558	GP-7	10.01	7.91	2.1	5.81
1603	GP-8	16.65	11.01	3.1	7.91
1608	GP-16	10.65	dry	3.0	3.47
1700	GP-9	18.00	6.19	-	1.83
1704	GP-10	10.00	4.59	-	

7-9-13 80°F P. Cloudy

1615 start hand augers at GP-16 to get to

11' GP-16 (hand auger)

Depth	Description
0-4"	silt, clay, sandy, organic; brown; soil - medium stiff; plastic; micaceous; moist Sand fine-grained
4"-3.5'	silt, sandy, trace clay, weathered rock light brown to brown, + orangish brown Sand fine-grained; loose to medium dense micaceous, moist
3.5'-11.0'	silt, sandy; trace weathered rock, brown to dark brown + orangish brown; loose to medium dense; micaceous; black mineralizing; moist

1730 Finish GP-16 Screen 11.0'-6.0'

well construction completed
concrete will be applied in casing along with
Bentonite
Grout
tapping off ground

1650 continue water levels

time	ID	TD	Top casing DTW	Stickup height	From ground DTW
1720	GP-15	17.30	dry	-	-
1717	GP-3	18.78	18.68	-	14.50
1715	GP-2	18.90	18.14	-	14.10
1712	GP-1	17.81	12.51	-	8.41
1710	GP-12	18.80	17.90	-	13.85
1707	GP-14	18.81	dry	-	-

7-9-13 80°F overcast

1200 - Forbes/Darwin / Drill crew mds to GP-9 location.

Drill Crew Specs

Company - Probe Technologies, Inc.

Driller - John Allen Helper - Cory Morgan

Drill Rig - Geoprobe @ 6610 Method - Direct-Push

1215 - Check H₂O in GP-9, DTW from TOC = 6.19

DTW from ground surface = 3.47

1225 - Check H₂O in GP-10, DTW from TOC = 4.59

DTW from ground surface = 1.83.

1240 - Call Shanna Auffman to discuss. Left message.

- Proceed to GP-13 location.

1250 - Property owner stops by staggings area (located by GP-14). Ms. Joyce said that she was not contacted about this week's work activities.

I explained to her that Shanna Auffman (DENR) called multiple times last week. Ms. Joyce said that she does not accept voice mail.

Ms. Joyce said to proceed with the work after explaining that we would not be installing new borings but would only be replacing existing wells.

1325 - Begin drilling GP-13. Check for H₂O in the existing probe. No H₂O but probe has positive pressure.

1335 - Offset to attempt to install GP-13. Refusal at 17 feet on second attempt. Note that each offset was backfilled with soil cores from 0-1 and bentonite in the remainder of the boring annulus.

7-9-13 80° F P. Cloudy

GP-13 Depth	(Feet) Recovery	Description
0-5	2	0-6" Clay, silty, trace fine-grained sand, brown, soft to medium stiff, plastic, organics, micaceous, moist 6"-4.75' Silty, sandy, trace weathered rock, brown, and light brown, sand fine-grained, loose to medium dense, micaceous, moist 4.75'-5' Waste (plastic/foam) silty, sandy, gray to dark gray, and brown, sand fine-grained, medium dense, micaceous, moist
5-10	2	5-10 Waste (Fabric, plastic, paper) Silty, sandy, trace clay and gravel, light to dark gray, and pale brown, micaceous, wet - Perched H ₂ O at 6 feet / will continue to attempt to get past the perched zone.
10-15	3	SAA, Foam from 10.5-11 feet, wet
15-17	0.5"	SAA, refusal at 17 feet
1340		Call Shanna Auffman to discuss perched water. Left message.
1400		Call Cathy Jacobs to discuss.
1420		Spoke with Shanna. Will abandon GP-9/10, and potentially GP-7 (H ₂ O at 7 feet bgs). Shanna will confirm with Cheryl Markus (DENR) about GP-7 and GP-13.
1430		Spoke with the property owner. Property owner was looking for Cathy Jacobs cell number.
1515		Drill crew offsite to get grant for abandonment
1545		Drill crew returns. Prepare to abandon GP-13 and GP-9
1700		Complete probe abandonment. Drill crew will dispose of protective covers, PVC piping, and concrete pads.

7-9-13 80°F overcast

1745 D. Russ and drillers offsite

1800 calibrate GEN 2000

	Initial	Final
CH4	49.8%	50.0%
CO2	34.9%	35.0%
O2	20.7%	20.9%

1820 type of progress email

1830 A. Weipfening + M. Durwin offsite



7-10-13 70°F overcast

700 A. Weipfening + M. Durwin depart hotel and head to lanes to get water + flassing to mark wells

745 Arrive onsite

800 Probe-tech onsite; mob to GP-16 to place concrete pad and tag unit as well as abandon old GP-16. Had to top off grout will remain tomorrow morning

850 mob to GP-10 and abandon

~~915 site restoration near access to GP-9 + 10~~

~~See pictures #4 - will restore after all wells abandoned~~

920 mob to abandon GP-6 and GP-7

950 abandonment of GP-6 and -7 complete

1005 Probe-tech offsite to get restoration supplies

1010 spoke with Shannon Auffman

- will not abandon any of the properly installed wells
- will take comprehensive round of readings and note any visual/audio clues regarding methane
- drillers will mob home after restoration complete
- will maintain GP-16 tomorrow morning and then head to Raley

7-10-13 75°F P. Sunny

1010 Shannon calls summary continued:

- report will summarize events and list water levels and screening results
- will touch base next week after Shannon talks to Cheryl to come up with a plan going forward

1040 Probotch back onsite to restore area near GP-9+10

See pictures #4-5

* rake ruts, put down grass seed, and straw

1130 restore area at entrance to access road that goes to GP-5 through -8

(see pictures #6-9)

* rake ruts, and put grass seed and straw down

1200 restore access road to landfill

* rake ruts, put grass seed down, and place straw; ground is very saturated (see pictures #10-14)

1250 restore area where trailer was stored

* rake ruts; put grass seed and straw down (see pictures #15-19)

7-10-13 80°F M. Sunny

1315 start calibrating equipment for probe screening while Probe-Tech loads equipment

1345 Probe-Tech offsite

GEM 2000 - calibrate using 35/50 gas

	Initial	Final
CH ₄	49.9 49.9	50.0
CO ₂	34.8	35.0
O ₂	0.1	0.0
(when connected to 35/50 mix)		
O ₂	20.5	20.9
(atmosphere)		

PID Information:

MiniAce 3000 model#: PGM-7320
Serial #: 592-905466

Calibrated by Pine on 7-8-13 at 10:02 AM
using Isobutylene at 100 ppm

Field calibration using Isobutylene (100 ppm)
Exp: 02/2016

	Initial	Final
Isobutylene	100.1 ppm	100.0 ppm

7-10-13 80°F P. Cloudy

1400 Start gas probe screening and gas data collection

weather conditions:

Temp = 78°F

Barometric Pressure = 27.54" Hg

Humidity = 73%

Wind 45 mph; P. cloudy

Time	ID	probe	CH4	CO2	O2	BAL	LFL	VOL ppm
1410	GP-1	64	49.4	27.4	3.8	19.4	>>>	5.1

No audio/visual notes

1422 GP-2 61 60.6 39.4 0.0 0.0 >>> 2.9

strong odor, can feel lfg coming out

1431 GP-3 58 59.1 40.7 0.2 0.0 >>> 3.9

strong odor and lfg is coming out ~~refusing~~ strong

1442 GP-15 63 56.0 36.5 0.1 7.4 >>> 1.4

1451 GP-4 58 29.4 10.1 12.3 48.2 >>> 0.0

1501 GPS GP-13 Abandonment and refill locations
(see picture #20)

1510 weather conditions: Temp = 80°F Humidity = 66%

Bar Pressure 27.54" Hg

M. Cloudy, 45 mph wind

1515 Bump Test

PID

100.4 ppm

GEM

CH4 50.1%

CO2 34.8%

O2 20.9%

7-10-13 80°F M. Cloudy

1519 continue gas data collection and well screenings

Time	ID	probe	CH4	CO2	O2	BAL	LFL	VOL
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1526	GP-8	64	29.4	17.3	11.3	42.0	>>>	0.0
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1534 GPS GP-7 Abandonment (photo #21)

1538 GPS GP-6 Abandonment (photo #22)

1540	GP-5	63	2.3	15	19.9	76.3	46	0.0
------	------	----	-----	----	------	------	----	-----

#light rain for 10 min - GP-14 had strong LFG odor

1554	GP-14	59	59.9	39.8	0.3	0.0	>>>	5.6
------	-------	----	------	------	-----	-----	-----	-----

1603	GP-11	58	20.9	10.9	14.2	54.0	>>>	1.4
------	-------	----	------	------	------	------	-----	-----

1611	GP-12	63	59.2	40.8	0.0	0.0	>>>	11.3
------	-------	----	------	------	-----	-----	-----	------

strong odor and LFG coming out fast

1620 screening complete

weather conditions: Temp = 76°F

Humidity = 73%

wind 45 mph; P. cloudy Barometric Pressure 27.50" Hg

1625 calibrate instruments

PID

Initial	Final
100.3	100.0

GEM 2000

Initial	Final
CH4 49.2	50.0
CO2 35.1	35.0
O2 20.7	20.9

7-10-13 80°F Overcast

1640 proceed to GP-9, -10, -16 abandonment locations to collect GPS readings

GP-9 Abandonment (photo #23)

GP-10 Abandonment (photo #24)

GP-16 Abandonment (photo #25)

GP-16 reinstall (photo #26)

1705 type of progress email

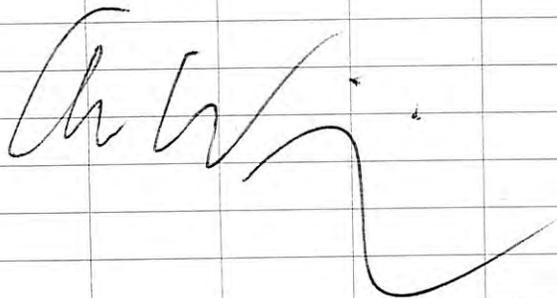
Daily summary

Abandon GP-16, -10, -6, -7 + top of -16 with gravel

Restore all areas

well screening

~~1730~~ 1730 offsite; will screen GP-16 in the morning



7-11-13 70°F Foggy

700 A. Weisfanning + M. Darwin depart hotel for site

720 Arrive onsite; investigate remediation area along site access road after heavy rain last night - straw is still in place (photo #27)

745 calibrate GEM 2000 + PID

(train M. Darwin on calibrating equipment)

GEM 2000

PID

	<u>initial</u>	<u>Final</u>		<u>initial</u>	<u>Final</u>
CH ₄	52.9%	50.0%	isobutylene	100.2 ppm	100.0 ppm
CO ₂	34.4%	35.0%			
O ₂	20.8%	20.9%			

Weather conditions:

Temp = 66°F

Barometric Pressure = 27.63" Hg

Humidity = 99%

No wind; foggy

<u>time</u>	<u>ID</u>	<u>puce</u>	<u>CH₄</u>	<u>CO₂</u>	<u>O₂</u>	<u>BAE</u>	<u>LEL</u>	<u>VOL</u>
815	GP-16	68	0.0	4.3	15.1	80.6	0	0

805 Bump Test

VOL = 100.3 ppm

CH₄ = 50.0%

CO₂ = 35.1%

O₂ = 20.9%

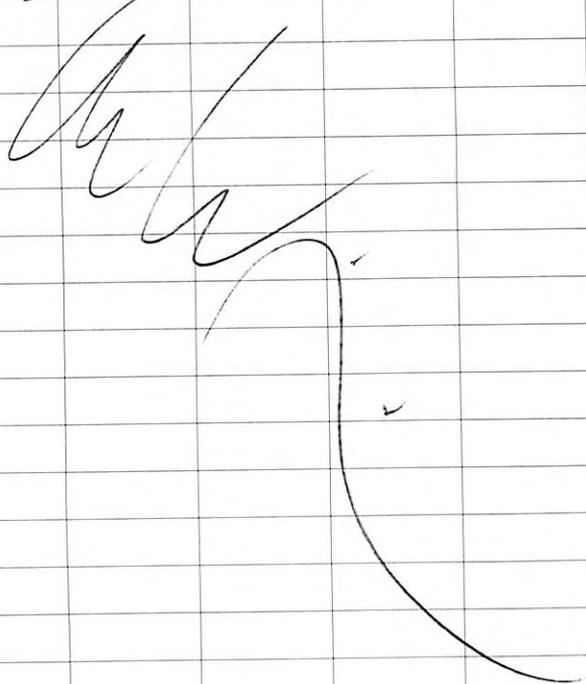
7-11-13 70°F Foggy

900 Finish downloading gps data, pictures,
and Summary email

905 offsite; will drop off equipment at

Pine on way home

1435 arrive at office



Appendix B

Boring Logs

GP-13 Boring Log

Project:	Swannanoa Landfill	Start Date:	7/9/2013	
Project No.:	127844-97867	End Date:	7/9/2013	
Logged/Checked By:	Dan Forbes/Mathew Colone	Total Depth:	17'	
Location Code:	GP-13	Surface Casing Dia./Depth:	None	
Location:	Swannanoa, Buncombe County, North Carolina		Well Casing Dia./Depth:	None
Driller:	Probe Technology, Inc.	Screen Dia./Depth/Slot:	None	

Drilling Method: Direct-Push, Geoprobe® 6610

Depth (feet)	Recovery (percent)	Formation Description	Probe Construction
1	40	CLAY, silty, trace sand, brown, soft to medium stiff, plastic, organics, micaceous, moist	No Probe Installed/Boring Abandoned Due to Perched Groundwater
2		SILT, sandy, trace weathered rock, brown and light brown, sand fine-grained, loose to medium dense, micaceous, moist	
3			
4			
5			
6	40	WASTE (fabric, plastic, paper), silt, sandy, trace clay and gravel, light to dark gray, and pale brown, sand fine-grained, medium dense, micaceous, wet (Perched groundwater present at 6 feet)	
7			
8			
9			
10			
11	60	WASTE (fabric, plastic, paper, some foam), silt, sandy, trace clay and gravel, light to dark gray, and pale brown, sand fine-grained, medium dense to dense, micaceous, wet	
12			
13			
14			
15			
16	25	WASTE (fabric, plastic, paper), silt, sandy, trace clay and gravel, light to dark gray, and pale brown, sand fine-grained, dense, micaceous, wet	
17			
18		Direct-Push refusal at 17 feet.	

GP-16 Boring Log

Project:	Swannanoa Landfill	Start Date:	7/9/2013	
Project No.:	127844-97867	End Date:	7/9/2013	
Logged/Checked By:	Aaron Weispfenning/Mathew Colone	Total Depth:	11'	
Location Code:	GP-16	Surface Casing Dia./Depth:	None	
Location:	Swannanoa, Buncombe County, North Carolina		Well Casing Dia./Depth:	1" PVC to 6'
Driller:	Probe Technology, Inc.	Screen Dia./Depth/Slot:	1" PVC: 6'-11', 0.01"	

Drilling Method: Hand-Auger

Depth (feet)	Formation Description	Probe Construction Above-Grade Completion
1	SILT, clayey, sandy, organics, brown, sand fine-grained, soft to medium stiff, plastic, micaceous, moist	<p>The diagram illustrates the probe construction. It features a central 1" Schedule 40 PVC Riser. The riser is surrounded by Portland Cement at the top and bottom. Below the cement are Bentonite Seals. A #2 Sand Filter Pack is located between the Bentonite Seals. A 1" Schedule 40 PVC Screen is positioned within the filter pack. At the bottom of the riser is a 1" PVC End Cap.</p>
2	SILT, sandy, trace clay and weathered rock, light brown to brown, and orangish brown, sand fine-grained, loose to medium dense, micaceous, moist	
3		
4		
5	SILT, sandy, trace weathered rock, brown to dark brown, and orangish brown, sand fine-grained, loose to medium dense, micaceous, black mineralization, moist	
6		
7		
8		
9		
10		
11		
12	Boring terminated at 11 feet.	

Appendix C

Report Certification

REPORT CERTIFICATION

Document Name: Remedial Investigation - Landfill Gas Evaluation
Site Name: Swannanoa Landfill
Site ID: NCD980557987
Task Order: Task Order 7987DP-8

I certify that, to the best of my knowledge, after thorough investigation, the information contained in or accompanying this certification is true, accurate, and complete.

Mathew F. Colone, P.G.
Project Manager

Mathew F. Colone
Signature

9/5/2013
Date

Before me personally appeared Mathew F. Colone to me known and known to me to be the person described in and who executed the foregoing instrument, and acknowledged to and before me that Mathew F. Colone executed said instrument for the purposes therein expressed.

Witness my hand and official seal this 5th day of SEPTEMBER, 2013.

Andrea S. Wiley
Notary Public

North Carolina
State of

February 1, 2016
My Commission Expires On

Mecklenburg
County of

