

**Landfill Gas Collection and Control System Expansion
Phase One – Upfit Modification 2014
Update Report**

**Avery County Closed MSW Landfill
Permit No. 06-91**

Prepared for:

**Avery County Solid Waste
P.O. Box 640
Newland, NC 28657**



August 2015

Prepared by:

SMITH+GARDNER

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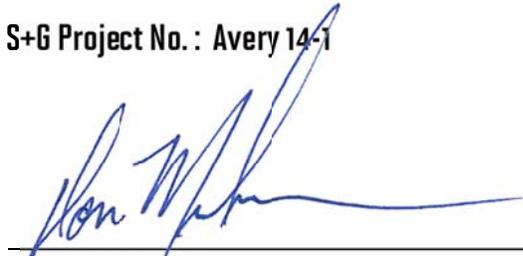
Avery County Solid Waste

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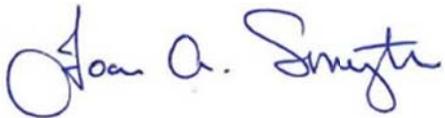
Newland, NC 28657



S+G Project No. : Avery 14-1



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1.0 INTRODUCTION

The Avery County Closed MSW Landfill is located on approximately 4.5 acres on Brushy Creek Road in Spruce Pine, North Carolina. During 2012, monitoring data indicated several issues with the existing landfill gas collection and control system (LFGCCS) due to low landfill gas quality. In response to these issues, the Phase One expansion of the LFGCCS was proposed in the *Annual Landfill Gas Monitoring Report*¹. The proposed changes were approved² by the division of Waste Management, and were subsequently implemented by Avery County (County). A Phase One Evaluation 2014 Report was submitted³ to NCDENR following the system evaluation period and recommended modification of the LFG Extraction System including the following:

- Temporary Connection of LFG Monitoring Well P3 to Collection System;
- Determining Liquid Recharge Rates (W9 and W10); and
- Preparation of a System Modification Summary report;

The above system modification was completed on September 11th and 12th, 2014. The purpose of the modification was to evaluate an additional extraction option for intercepting LFG migration away from the site. An Upfit Modification 2014 Report, summarizing the installation and initial effectiveness of the upfit was submitted to NCDENR in January 2015.

This Update Report is provided to further evaluate the effectiveness of the 2014 Upfit, as well as, to present additional system modifications for approval. A site map is provided as **Figure 1**.

2.0 PHASE ONE – 2014 SYSTEM UPFIT MODIFICATION SUMMARY

2.1 Connection of LFG Monitoring Well P3 to Collection System

On September 11, 2014 S+G made a temporary connection from landfill gas (LFG) monitoring well P3 to the LFG extraction well W9 vacuum riser. The system modification was installed entirely aboveground. Connection to monitoring well P3 was made by modifying the steel casing to allow the installation of a 1" SCH40 PVC tee connection to the 1" riser of P3. A 2" to 1" PVC reducer was also installed.

The connection to the extraction well W9 vacuum riser (HDPE 4") was performed using a mechanical HDPE to PVC coupling (4" to 2"). Additionally, ball valves, sample ports, and flex hose were installed on both the P3 and W9 sides of the connection. Independent operation of P3 and W9 were maintained as a result to the above connection method.

¹ *Annual Landfill Gas Monitoring Report*, Closed Avery County MSW Landfill. Submitted by Smith Gardner, November 2012.

² Approval response letter, Closed Avery County MSW Landfill (Annual Landfill Gas Monitoring Report). Sent by Jaclynn Drummond, Solid Waste Section, November 15, 2012.

³ Landfill Gas Collection and Control System Expansion - Phase One Evaluation 2014, Submitted by Smith Gardner, Inc., July 2014.

2.2 2014 System Upfit Modification Effectiveness

Previous to the system modification, CH₄ concentrations in off-site monitoring well P11 (installed in 2011) had historically shown concentrations from 26.8 to 59.9 % CH₄ by volume. Within one month of installation, CH₄ concentrations in P3 and P11 were brought under the 5% (CH₄ by volume) threshold and concentrations have been zero for eight (8) consecutive months (as shown on the **attached Table and Graph**).

It is S+G's opinion that the current reduction in CH₄ concentrations in P3 and P11 are directly correlated with the 2014 System Upfit modification. Based on the success of this modification, we propose the following additional modifications.

3.0 ADDITIONAL MODIFICATION PLAN

3.1 Connection of LFG Monitoring Wells P1 and P7 to Collection System

As can be seen in the attached graph of monthly monitoring data, monitoring wells P1 and P7 continue to exhibit LFG concentrations above the LEL. To address the continuing exceedances, S+G proposes to connect LFG monitoring wells P1 and P7 to the extraction system to mitigate migration issues in these areas. The connections to the system will be performed similarly to the previous upfit at P3 (detail provided as **Figure 2**). All connections will be made above ground, using 2" SCH 40 PVC pipe, to the vacuum riser associated with extraction wells W10 and W8.

As shown on **Figure 2**, LFG monitoring wells P1 and P7 will maintain their current steel casings (though modified) and monitoring port. Vacuum at monitoring wells will be controlled by two (2) ball valves, one in close proximity to the monitoring wells and another close to extraction well vacuum risers. The new connections will operate independently from the extraction wells.

3.2 Continuing Evaluation

Preliminary evaluation of these modifications will occur over a six-month period after which time, S+G will send an update report. Further modifications may be presented at that time if warranted.

FIGURES

**Phase One - Upfit Modification 2014 – Update Report
Landfill Gas Collection and Control System Expansion
Avery County Closed MSW Landfill**

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LEGEND

- EXISTING LANDFILL GAS PROBE
- ④ OFFSITE STRUCTURE TO BE MONITORED

REFERENCES

1. ADJACENT PROPERTIES ARE FROM AVERY COUNTY GIS MAPPING DEPARTMENT.
2. MONITORING WELL LOCATIONS FROM FIELD SURVEY DATED 1/14/08, BY SURVEYING SOLUTIONS, P.C.
3. PROPERTY LINE FROM FIELD SURVEY DATED APRIL 9, 2010, BY APPALACHIAN PROFESSIONAL LAND SURVEYORS & CONSULTANTS.
4. LFG PROBES LOCATIONS FROM FIELD SURVEY DATED APRIL 9, 2010, BY APPALACHIAN PROFESSIONAL LAND SURVEYORS & CONSULTANTS. PROBE P-2, P-3, AND P-9 THROUGH P-13 LOCATIONS WERE NOT SURVEYED AND ARE APPROXIMATE.



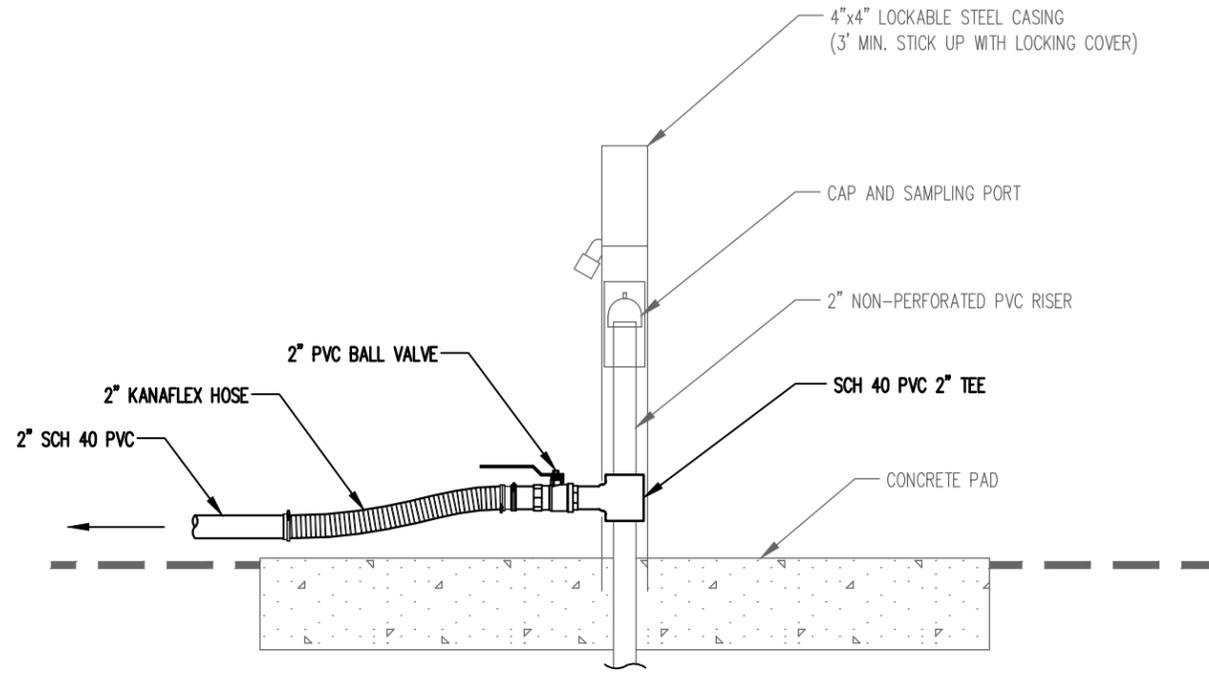
PREPARED BY: _____ NC LIC. NO. C-0828 (ENGINEERING)
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DRAWN:	K.C.B.	APPROVED:	D.M.M.
DATE:	Dec 2013	SCALE:	AS SHOWN
PROJECT NO.:	AVERY 13-6	FIGURE NO.:	1
FILENAME:	AVERY-B0216		

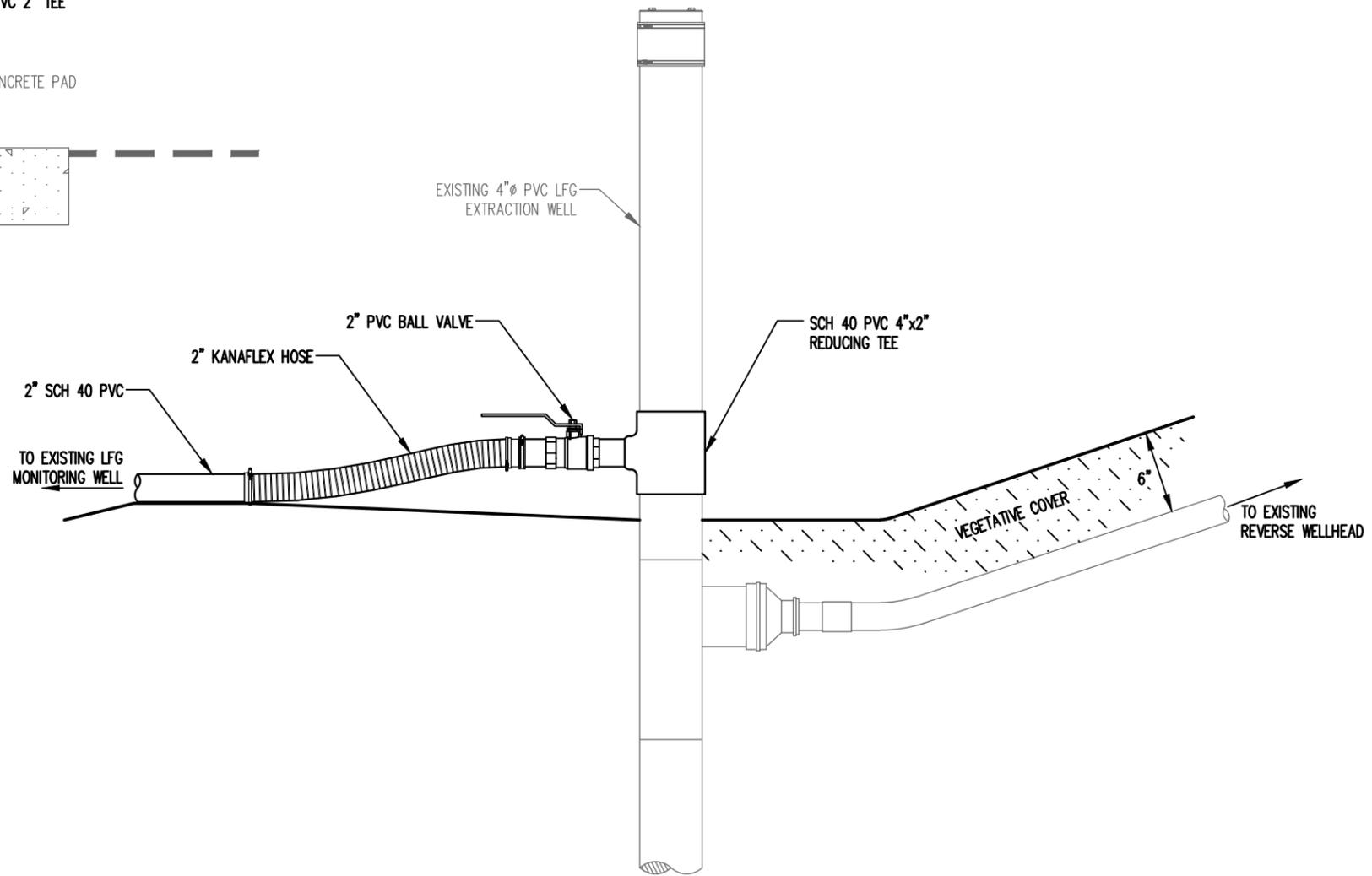
LANDFILL GAS
 MONITORING SYSTEM
 AVERY COUNTY CLOSED MSWLF
 SPRUCE PINE, NORTH CAROLINA

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LANDFILL GAS MONITORING WELL



LANDFILL GAS EXTRACTION WELL

PREPARED BY: _____ NC LIC. NO. C-0828 (ENGINEERING)

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FIGURE NO.	1
SCALE:	AS SHOWN
APPROVED:	D.D.M.
DRAWN:	J.A.L.
PROJECT NO.:	AVERY 13-6
DATE:	Jun 2014
FILENAME:	AVERY-B0227

PREPARED FOR:
**LANDFILL GAS
 WELLHEAD MODIFICATIONS
 AVERY COUNTY CLOSED MSWLF
 SPRUCE PINE, NORTH CAROLINA**

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TABLE

**Phase One - Upfit Modification 2014 – Update Report
Landfill Gas Collection and Control System Expansion
Avery County Closed MSW Landfill**

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TABLE 2
Avery County Closed MSW Landfill
Landfill Gas Collection and Control System Monitoring
May 2011 - July 2015

DATE	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13
May-11	21.8	0	54.8	0	0	0	31.8	0	NA	NA	NA	NA	NA
Jun-11	61.6	0	66.7	0	0	0	32.2	0	NA	NA	NA	NA	NA
Jul-11	56	0	64.8	0	0	0	34.9	0	NA	NA	NA	NA	NA
Aug-11	36.8	0	44.5	0	0	0	32.5	0	NA	NA	NA	NA	NA
Sep-11	29.9	0	45.5	0	0	0	33.4	0	NA	NA	NA	NA	NA
Oct-11	30	0	50.4	0	0	0	35	0	NA	NA	NA	NA	NA
Nov-11	43.8	0	54.2	0	0	0	42.3	0	0	0	36.2	0	0
Dec-11	36.8	0	44.1	0	0	0	36.7	0	0	0	39.3	0.2	1.6
Jan-12	49.4	0	0	0	0	0	36.6	0	0	0	26.8	0	2.1
Feb-12	27.3	0	36.4	0	0	0	34.4	0	0	0	41.4	0	0.6
Mar-12	65.7	0	62.9	0	0	0	35.6	0	0	0	38.2	0	1.7
Apr-12	58.1	0	51.1	0	0	0	34.2	0	0	0	45.1	0	1.9
May-12	54.5	0	2.8	0	0	0	33.1	0	0	0	34.2	0	2.3
Jun-12	56.3	0	2.3	0	0	0	36.9	0	0	0	34.9	0	1.3
Oct-12	55.1	0	63.6	0	0	0	34.2	0	0	0	47.5	0	2.4
Nov-12	56.2	0	66.3	0	0	0	37	0	0	0	41.7	0	0.1
Dec-12	52.6	0	59.7	0	0	0	42.9	0	0	0	45.7	0	0.3
Jan-13	45.9	0	49.8	0	0	0	42.7	0	0	0	39.6	0	0
Feb-13	65.6	0	64.1	0	0	0	32.3	0	0	0	53.8	0	0
Mar-13	33.6	0	58.9	0	0	0	32	0	0	0	58.4	0	1.8
Apr-13	36.7	0	59.9	0	0	0	31.4	0	0	0	59.9	0	0
May-13	28.1	0	56.2	0	0	0	24.9	0	0	0	49.1	0	0
Jun-13	17.7	0	51.9	0	0	0	28.2	0	0	0	41	0	6.5
Jul-13	27.4	0	55	0	0	0	24.2	0	0	0	46.2	0	0
Aug-13	9	0	60.8	0	0	0	26.1	0	0	0	41.7	0	0
Sep-13	7.3	0	63.7	0	0	0	33.3	0	0	0	58.2	0	0
Oct-13	8.1	0	50.4	0	0	0	32.1	0	0	0	54.2	0	0
Nov-13	4.1	0	19.2	0	0	0	33.1	0	0	0	41.4	0	0.8
Dec-13	34.8	0	47.7	0	0	0	32.2	0	0	0	39.7	0	1.8
Jan-14	36.2	0	48	0	0	0	39.9	0	0	0	44.7	0	0
Feb-14	58.4	0	62.6	0	0	0	33	0	0	0	53.3	0	3.2
Mar-14	61.3	0	0	0	0	0	29.3	0	0	0	43.1	0	1.8
Apr-14	59.4	0	40.2	0	0	0	30.1	0	0	0	52.7	0	0
May-14	66.2	0	52.8	0	0	0	29.3	0	0	0	50.3	0	3.9
Jun-14	61.8	0	54.7	0	0	0	28	0	0	0	50.2	0	2.9
Jul-14	63.2	0	61.1	0	0	0	27.9	0	0	0	50.6	0	3.1
Aug-14	38.3	0	45.9	0	0	0	26.7	0	NA	0	47.2	0	3.1
Sep-14	47.5	0	36.6	0	0	0	29.3	0	0	0	15.9	0	3.4
Oct-14	37.4	0	1.3	0	0	0	29.8	0	0	0	0.1	0	2.3
Nov-14	26	0	0	0	0	0	30.1	0	0	0	1.1	0	2.7
Dec-14	43.4	0	0	0	0	0	29.2	0	0	0	0	0.9	3
Jan-15	42	0	0	0	0	0	32.5	0	0	0	0	0.6	3.6
Feb-15	40.3	0	0	0	0	0	31.4	0	0	0	0	0.5	4.2
Mar-15	31.2	0	0	0	0	0	25.4	0	0	0	0	0	0
Apr-15	35.1	0	0	0	0	0	26.5	0	0	0	0	0	0
May-15	43.8	0	0	0	0	0	28.9	0	0	0	0	0	0
Jun-15	39.9	0	0	0	0	0	27.4	0	0	0	0	0	0
Jul-15	36.6	0	0	0	0	0	24.6	0	0	0	0	0	2.1

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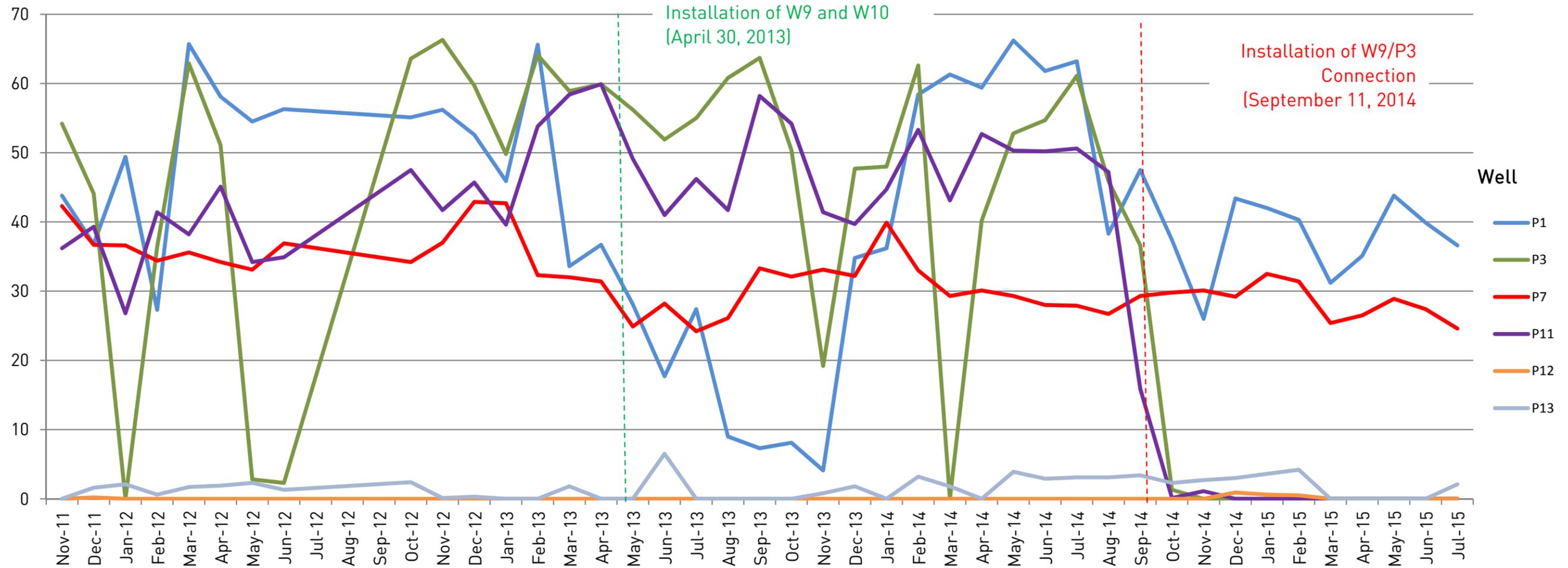
GRAPH

**Phase One - Upfit Modification 2014 – Upfit Report
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Avery County MSW Landfill Landfill Gas Monitoring Well Network Methane Concentrations Between May 2011 and July 2015

% CH4 by
 Volume



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