



Client: **Bridgeton Landfill LLC**
 Project Location: **Bridgeton, MO**
 Project Name: **Soil Gas Probes CQA**
 FEI Project Number: **BT-209**
 FEI Inspector: **Bill Abernathy**
 Drilling Contractor: **Bulldog Drilling**
 Driller: **Josh Edwards**
 Helper(s): **Shawn Guy**

Drilling/Sampling Method: **AMS PowerProbe 9500-VTR**

1012S	1012D
Easting: 515220.4	Easting: 515221.3
Northing: 1066917.3	Northing: 1066917.1
GS Elev: 455.03	GS Elev: 455.13
Drill Date: 5/11/20	Drill Date: 4/28/20
Sampled Depth: N/A	Sampled Depth: 31.6'

Probe Location: **1012**

Depth in Feet	Sample Run / Recovery (inches)	Soil Type	Soil Description	Probe Completion Details
0				0.75-in Sch40 PVC threaded solid riser and 10-slot screen
2	not sampled			
4	CH4 = 0.0%			
6	not sampled			Halliburton Casing-Seal bentonite granules
8	CH4 = 0.0%			
10	not sampled			
12	CH4 = 0.0%			
14	1 39 / 48		SILTY CLAY (CL), dry, 10YR 4/2 (dark grayish brown)	13.5 ft
16	CH4 = 0.0%		SILT (MH), clayey, dry with moist to wet zone 6 inches above base, 10GY 3/1 (very dark greenish gray)	silt interval 16.5 ft
18	2 39 / 48		CLAY (CH), dry to moist, stiff to very stiff, high plasticity, occasional organic debris/inclusions, 10GY 4/1 (dark greenish gray)	installed 5/11/20
20	CH4 = 0.0%			
22	3 48 / 48		SILT (ML), moist with wet lenses, root structures at upper contact, rapid dilatancy, abundant CH lenses	
24	CH4 = 0.0%		SAND (SM), fine grained, well sorted, medium dense, moist to wet, homogenous, slight chemical odor	
26	4 28 / 48		CLAY (CH), moist, stiff, 10GY 4/1 (dark greenish gray)	Unimin #1 (14/30) silica sandpack
28	CH4 = not measured below water level		SAND (SM), wet, fine grained, laminated, silty lenses throughout with rapid dilatancy, dense, coarsens downward	10.0 ft screen sand interval
30	5 31 / 43		CLAY (CH) as above	
			SAND (SM) as above with iron stained GVL at base	
			LIMESTONE, weathered fragments in catcher	
32			Bottom of Hole = 31.6 feet	Refusal at 31.6 ft
34				installed 5/11/20



Client: **Bridgeton Landfill LLC**
 Project Location: **Bridgeton, MO**
 Project Name: **Soil Gas Probes CQA**
 FEI Project Number: **BT-209**
 FEI Inspector: **Bill Abernathy**
 Drilling Contractor: **Bulldog Drilling**
 Driller: **Josh Edwards**
 Helper(s): **Shawn Guy**

Drilling/Sampling Method: **AMS PowerProbe 9500-VTR**

1013UM	1013LM	1013S	1013D
East: 515108.9	East: 515108.0	East: 515109.5	East: 515108.4
North: 1066933.8	North: 1066934.5	North: 1066934.5	North: 1066935.3
GS Elev: 454.18	GS Elev: 454.15	GS Elev: 454.23	GS Elev: 454.03
Drill Date: 5/5/20	Drill Date: 5/5/20	Drill Date: 5/5/20	Drill Date: 4/28/20
Sampled To: N/A	Sampled To: N/A	Sampled To: N/A	Sampled To: 41.8'

Probe Location: **1013**

Depth in Feet	Sample Run / Recovery (inches)	Soil Type	Soil Description	Probe Completion Details
0				0.75-in Sch40 PVC threaded solid riser and 10-slot screen
2	20 / 48			
4	CH4 = 0.0%			
6	21 / 48		GRAVEL, with moist to dry, soft to medium stiff CL bands, coarse, angular fill, topsoil, organic matter	
8	CH4 = 0.0%			
10	19 / 48		SILTY CLAY (CL), soft, moist, 5GY 4/1 (dark greenish gray), slow dilatancy minor gravel	
12	CH4 = 0.0%			
14	29 / 48		SILT (ML), medium stiff, moist, slow dilatancy	13.6 ft silt interval
16	CH4 = 0.8%		CLAY (CH), medium stiff, moist, silty base, high plasticity, homogenous	15.5 ft silt interval
18	36 / 48			installed 5/5/20
20	CH4 = 0.0%		SILT (ML), medium stiff, moist to wet, slow to rapid dilatancy, CH bands throughout	18.3 ft silt interval
22	35 / 48		CLAY (CH)	
24	CH4 = 0.0%		SILT (ML) as above	9.0 ft screen
26	38 / 48		CLAY/SILT/CLAY, soft, moist, gradational contacts	
28	CH4 = 0.0%		SILT (ML), moist with wet pockets with rapid dilatancy, weak, clayey	
30	48 / 48		CLAY (CH), stiff, moist, high plasticity, silty/sandy	installed 5/5/20
32	CH4 = 0.0%		SAND (SM), moist to wet, fine grained, well sorted, silty, 5GY 4/1 (dark greenish gray)	Unimin #1 (14/30) silica sandpack
34	29 / 48		CLAY (CH), soft, moist, high plasticity	6.0 ft screen
			SAND (SM), wet, fine grained, well sorted, dense, micaceous, 10GY 5/1 to 10GY 4/1 (greenish gray to dark greenish gray)	Pel-Plug TR-30 1/4" coated bentonite pellets
			CLAY (CH), soft to medium stiff, moist, high plasticity	installed 5/5/20
				2.5 ft screen
				Halliburton Casing-Seal bentonite granules
				27.2 ft sand interval
				28.0 ft sand interval
				33.9 ft sand interval



Client: **Bridgeton Landfill LLC**
 Project Location: **Bridgeton, MO**
 Project Name: **Soil Gas Probes CQA**
 FEI Project Number: **BT-209**
 FEI Inspector: **Bill Abernathy**
 Drilling Contractor: **Bulldog Drilling**
 Driller: **Josh Edwards**
 Helper(s): **Shawn Guy**

Drilling/Sampling Method: **AMS PowerProbe 9500-VTR**

<u>1013UM</u>	<u>1013LM</u>	<u>1013S</u>	<u>1013D</u>
East: 515108.9	East: 515108.0	East: 515109.5	East: 515108.4
North: 1066933.8	North: 1066934.5	North: 1066934.5	North: 1066935.3
GS Elev: 454.18	GS Elev: 454.15	GS Elev: 454.23	GS Elev: 454.03
Drill Date: 5/5/20	Drill Date: 5/5/20	Drill Date: 5/5/20	Drill Date: 4/28/20
Sampled To: N/A	Sampled To: N/A	Sampled To: N/A	Sampled To: 41.8'

Probe Location: **1013**

Depth in Feet	Sample Run / Recovery (inches)	Soil Type	Soil Description	Probe Completion Details
36	CH4 = not measured below water level	SAND	SAND (SM) as above minor coarse sand and fine angular gravel at base	<p>35.2 ft 4.1 ft screen sand interval installed 5/4/20 Refusal at 41.8 ft</p>
38	10 20 / 48			
40	11 22 / 22			
42		Bottom of Hole = 41.8 feet		



Client: **Bridgeton Landfill LLC**
 Project Location: **Bridgeton, MO**
 Project Name: **Soil Gas Probes CQA**
 FEI Project Number: **BT-209**
 FEI Inspector: **Bill Abernathy**
 Drilling Contractor: **Bulldog Drilling**
 Driller: **Josh Edwards**
 Helper(s): **Shawn Guy**

Drilling/Sampling Method: **AMS PowerProbe 9500-VTR**

1014S	1014D
Easting: 515190.2	Easting: 515189.7
Northing: 1066875.2	Northing: 1066874.3
GS Elev: 453.19	GS Elev: 453.13
Drill Date: 5/11/20	Drill Date: 4/28/20
Sampled Depth: N/A	Sampled Depth: 31.3'

Probe Location: **1014**

Depth in Feet	Sample Run / Recovery (inches)	Soil Type	Soil Description	Probe Completion Details
0				0.75-in Sch40 PVC threaded solid riser and 10-slot screen
2	not sampled			Halliburton Casing-Seal bentonite granules
4	CH4 = 0.0%			
6	not sampled			
8	CH4 = 0.0%			5.0 ft screen
10	not sampled			
12	CH4 = 0.0%			9.9 ft
14	1 29 / 48		SILT (ML), soft, moist with wet zones of rapid dilatancy	silt interval
16	CH4 = 0.0%			14.9 ft
18	2 48 / 48		CLAY (CH), dry to moist, stiff, high plasticity, 10GY 3/1 (very dark greenish gray)	installed 5/11/20
20	CH4 = 0.0%			10.7 ft screen
22	3 48 / 48		SILT (ML), as above, rapid dilatancy, weak	
24	CH4 = 0.0%			19.2 ft
26	4 27 / 48		SAND (SM), silty upper half, moist to wet, fine grained, micaceous, well sorted, medium dense, occasional CH lenses, 5G 3/1 (very dark greenish gray)	Unimin #1 (14/30) silica sandpack
28	CH4 = 0.0%			installed 5/11/20
30	5 28 / 40		CLAY (CH), moist to wet, medium stiff	
	CH4 = not measured below water level		SAND, fine to medium grained, wet, dense	Refusal at 31.3 ft
			LIMESTONE, weathered fragments w/ SM, ML, CH	
32			Bottom of Hole = 31.3 feet	
34				

AQUATERRA Environmental Solutions, Inc.						LOG OF BORING NO.: TMP-1		SHEET NUMBER 1 of 2				
13 Executive Dr. Suite 1 Fairview Heights IL 62208						DRILLING CONTRACTOR: Roberts Environmental Drilling		WELL CONSTRUCTION DETAILS				
CLIENT: Republic Services, Inc.						DRILLER: Patrick		MATERIAL: PVC		PVC	PVC	
PROJECT NAME: Bridgeton Landfill						DRILLING RIG: Track Mounted CME-75		CASING DIAMETER: 1"		1"	1"	
PROJECT NUMBER: 4788.10						DRILLING METHOD: 10" ID HSA, 8" Air Rotary		WELL TOTAL DEPTH: 66.5'		53.5'	35.3'	
PROJECT LOCATION: Maryland Heights, MO						SAMPLING METHOD: Split Spoon, Cuttings		SCREEN LENGTH: 10'		15'	30'	
BORING LOCATION: N: 1066895 E: 515160						BORING DIAMETER: 12" / 8"		RISER LENGTH: 59.5'		41.5'	9'	
AES PROJECT NO: 4788.10						WELL DIAMETER: 3x 1"		TOP OF SCREEN: 56.3'		35.3'	5.1'	
AES GEOLOGIST: T.Pool, C. Joyce						WELL COMPLETION: Stick-Up		BOTTOM OF SCREEN: 66.3'		53.3'	35.1'	
START DATE: 05/20/12 FINISH DATE: 09/29/12						SURFACE ELEVATION: 456.5		SCREEN SLOT: 0.010 IN		0.010 IN	0.010 IN	
START TIME: FINISH TIME:						TOC ELEVATION: S-456.47; M-456.43; C-456.41		TOP OF FILTER PACK: 55.5'		37.3'	4.1'	
DATE: -						WATER LEVEL: -		TOP OF SEAL: 53.5'		35.3'	2.1'	
DATE: -						WATER ELEVATION: -		TYPE OF SEAL: 3/8" Bentonite Chips		→		
DATE: -						DATE: -		TYPE OF FILTER PACK: 12/20 Grice		TMP-1D	TMP-1M	TMP-1S
SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	SOIL DESCRIPTION AND DRILLING CONDITIONS			NOTES AND WELL CONSTRUCTION			
HSA-1				2	ML	Parking lot fill, gravel			Top of Upper Seal 2.1'			
SS-1	SS		2.0	4		Brown sandy, clayey SILT, dry			Top of Gravel Pack 4.1'			
HSA-2	CU			6		Trace Gravel at 8'			Top of 1S Screen 5.1'			
SS-2	SS		2.0	8	SM	Brown silty SAND, dry						
HSA-3	CU			10		Dark brown, silty CLAY, moist						
SS-3	SS		0.0	12	CL	No recovery spoon empty						
HSA-4	CU			14								
SS-4	SS		2.0	16		Dark brown silty CLAY, moist						
HSA-5	CU			18								
SS-5	SS		2.0	20		Gray silty CLAY, wet						
HSA-6	CU			22	SM	Gray silty fine SAND, saturated						
SS-6	SS		2.0	24		Gray fine-med SAND, saturated						
HSA-7	CU			26	SP	Gray fine-med SAND, saturated						
SS-7	SS		1.0	28		Gray fine-med SAND, saturated						
AR	CU			30	LMS	BEDROCK @ 36' trace sand			Bottom of 1S Screen 35.1'			
				32		TP ends logging here on 8/20/12 resumed by CJ on 8/29/12			Top of Middle Seal 35.3'			
				34					Top of Middle Gravel Pack 37.3'			
				36					Top of 1M Screen 38.3'			

LEGEND:
 PID - Photoionization Detector
 SS - Split Spoon
 CU - Cuttings Sample
 ST - Shelby Tube
 PP - Pocket Penetrometer
 HSA - Hollow Stem Augers
 AR - Air Rotary

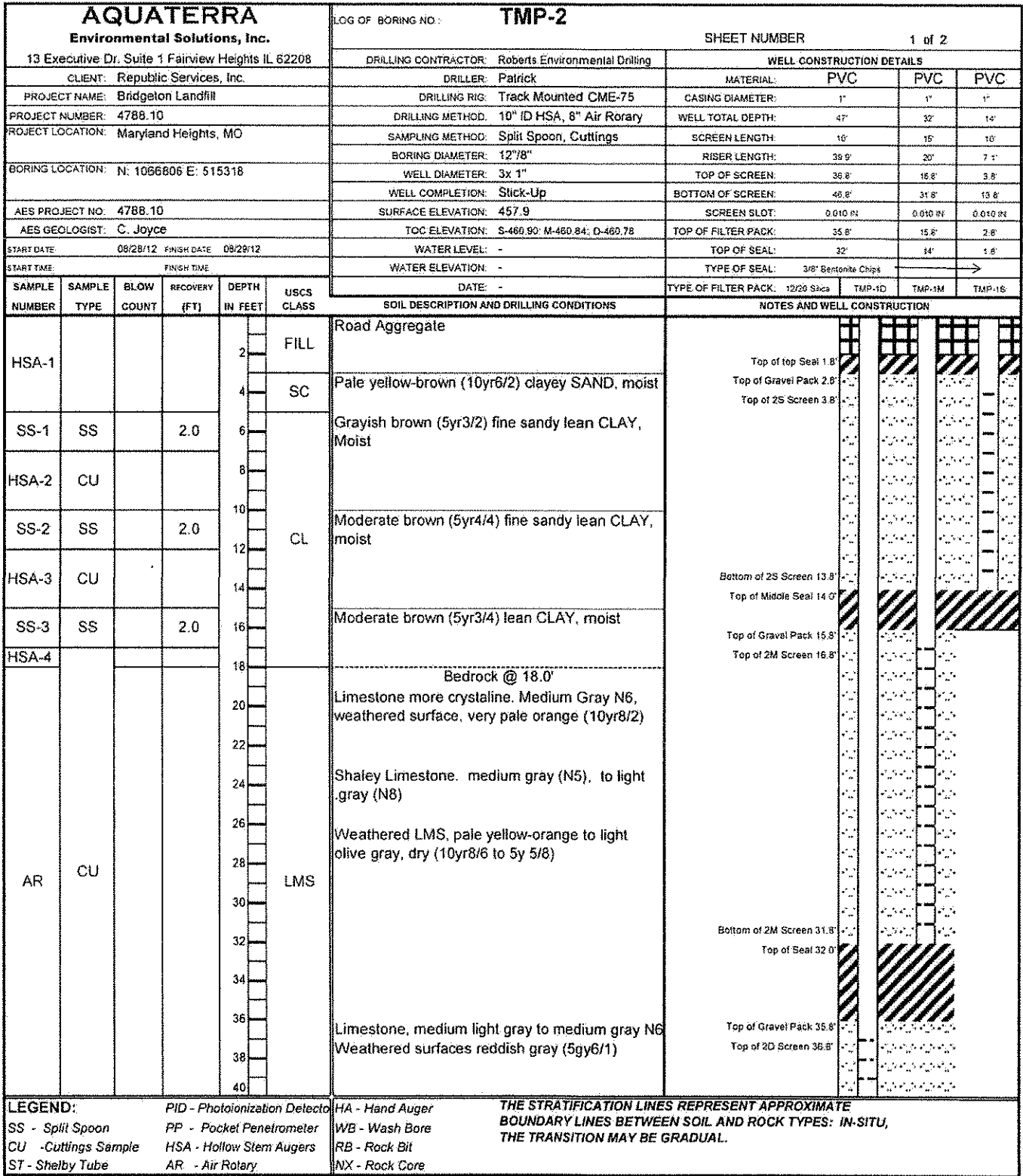
HA - Hand Auger
 WB - Wash Bore
 RB - Rock Bit
 NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

AQUATERRA Environmental Solutions, Inc. 13 Executive Dr. Suite 1 Fairview Heights IL 62208						LOG OF BORING NO:	SHEET NUMBER				
CLIENT: Republic Services, Inc.						GEOLOGIST: T.Pool, C. Joyce					
PROJECT NAME: Bridgeton Landfill						DATE: 08/20/12					
						PROJECT NUMBER: 4788.1					
SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:	TMP-1D	TMP-1M	TMP-1S	
AR	CU			42	LMS	Fine clayey sand infiltrated through cracks in the limestone or beneath augers at RX interface overnight. Medium Bluish Gray (SB5/1)					
				44							
				46							
				48							
				50							
				52							
				54							
				56							Unweathered LIMESTONE at 55.0'
				58							
				60							
				62							
				64							
				66							Boring Terminated @ 66.5'
		68									
		70									
		72									
		74									
		76									
		78									
		80									
		82									
		84									
		86									
		88									
		90									

LEGEND: PID - Photoionization Detector HA - Hand Auger
 SS - Split Spoon PP - Pocket Penetrometer WB - Wash Bore
 CS - 5 foot CME Sampler HSA - Hollow Stem Augers RB - Rock Bit
 ST - Shelby Tube AR - Air Rotary NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.



AQUATERRA Environmental Solutions, Inc. 13 Executive Dr. Suite 1 Fairview Heights IL 62208						LOG OF BORING NO.: TMP-2	SHEET NUMBER 2 of 2				
CLIENT: Republic Services, Inc.						GEOLOGIST: C. Joyce					
PROJECT NAME: Bridgeton Landfill						DATE: 08/28/12					
						PROJECT NUMBER: 4788.1					
SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:	TMP-1D	TMP-1M	TMP-1S	
AR	CU			42	LMS	Limestone med gray N6. Weathered Surfaces dusky yellow	Bottom of 2D Screen 46.8'	[Diagrammatic representation of soil/rock layers]			
				44							
				46							
				48		Boring Terminated @ 47' BGS					
				50							
				52							
				54							
				56							
				58							
				60							
				62							
				64							
				66							
				68							
				70							
				72							
				74							
				76							
				78							
				80							
				82							
				84							
				86							
				88							
				90							
LEGEND: SS - Split Spoon PID - Photoionization Detector CS - 5 foot CME Sampler PP - Pocket Penetrometer ST - Shelby Tube HSA - Hollow Stem Augers AR - Air Rotary						HA - Hand Auger WB - Wash Bore RB - Rock Bit NX - Rock Core		THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.			

AQUATERRA Environmental Solutions, Inc. 13 Executive Dr. Suite 1 Fairview Heights IL 62208						LOG OF BORING NO. TMP-3				SHEET NUMBER 1 of 2							
CLIENT: Republic Services, Inc.						DRILLING CONTRACTOR: Roberts Environmental Drilling				WELL CONSTRUCTION DETAILS							
PROJECT NAME: Bridgeton Landfill						DRILLER: Patrick				MATERIAL: PVC		PVC		PVC			
PROJECT NUMBER: 4788.10						DRILLING RIG: Track Mounted CME-75				DIAMETER: 1"		1"		1"			
PROJECT LOCATION: Maryland Heights, MO						DRILLING METHOD: 8" HAS, 8" Air Rotary				WELL TOTAL DEPTH: 61'		48'		28.5'			
BORING LOCATION: N: 1066895 E: 515160						SAMPLING METHOD: Split Spoon, Cuttings				SCREEN LENGTH: 10'		15'		20'			
AES PROJECT NO: 4788.10						BORING DIAMETER: 10 7/8"				RISER LENGTH: 53.6'		35.7'		11.3'			
AES GEOLOGIST: T.Pool, C. Joyce						WELL DIAMETER: 3x 1"				TOP OF SCREEN: 50.8		32.8		8.3			
START DATE: 08/23/12 FINISH DATE: 08/28/12						WELL COMPLETION: Stick-Up				BOTTOM OF SCREEN: 60.8		47.6		28.3'			
WATER LEVEL: -						SURFACE ELEVATION: 456.1				SCREEN SLOT: 0.010 IN		0.010 IN		0.010 IN			
WATER ELEVATION: -						TOC ELEVATION: S-458.82; M-458.777; D-458.812				TOP OF FILTER PACK: 49.8		30.5		7.3			
DATE: -						WATER LEVEL: -				TOP OF SEAL: 45		29		3.5			
TYPE OF SEAL: 3/8" Bentonite Chips						DATE: -				TYPE OF SEAL: 3/8" Bentonite Chips		-		-			
TYPE OF FILTER PACK: 12/20 S#4						DATE: -				TYPE OF FILTER PACK: 12/20 S#4		TMP-30		TMP-3M		TMP-3S	
SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	SOIL DESCRIPTION AND DRILLING CONDITIONS				NOTES AND WELL CONSTRUCTION							
HSA-1				2		Grass with Gravel											
				4	ML					Top of Upper Seal 2.5'							
SS-1	SS		2.0	6		Brown with gray clayey SILT, dry				Top of Gravel Pack 4.3'							
				8		Brown silty CLAY, dry				Top of 1S Screen 5.3'							
HSA-2	CU			10		Trace Gravel at 8'				Top of 3S Screen 8.3'							
SS-2	SS		2.0	12		Brown silty CLAY, dry											
HSA-3	CU			14	CL												
SS-3	SS		2.0	16		Dark brown silty CLAY, wet											
HSA-4	CU			18													
SS-4	SS		2.0	20		Gray silty CLAY, moist											
				22		Gray sandy, clayey SILT saturated											
HSA-5	CU			24													
SS-5	SS		2.0	26	ML	Gray sandy SILT, moist				Bottom of 3S Screen 28.3							
HSA-6	CU			28						Top of Middle Seal 28.5							
SS-6	SS		2.0	30		Bit Refusal				Top of Gravel Pack 30.5							
				32		Bedrock @ 31.0'											
AR	CU			34	LMS	Gray weathered LIMESTONE, wet				Top of 3M Screen 32.8							
				36													
				38													
				40		End of TP Log, CJ resumes on 8/28/2012											

LEGEND:
 PID - Photoionization Detector
 SS - Split Spoon
 CU - Cuttings Sample
 ST - Shelby Tube
 PP - Pocket Penetrometer
 HSA - Hollow Stem Augers
 AR - Air Rotary
 HA - Hand Auger
 WB - Wash Bore
 RB - Rock Bit
 NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

AQUATERRA Environmental Solutions, Inc. 13 Executive Dr. Suite 1 Fairview Heights IL 62208						LOG OF BORING NO.	SHEET NUMBER				
CLIENT: Republic Services, Inc.						GEOLOGIST:	T.Pool, C. Joyce				
PROJECT NAME: Bridgeton Landfill						DATE:	08/23/12				
						PROJECT NUMBER:	4788.1				
SAMPLER TYPE	LEL %	H2S (PPM)	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:	TMP-3D	TMP-3M	TMP-3S	
AR	CU			42	LMS	Gray weathered LIMESTONE, wet					
				44							
				46							
				48							
				50							Bottom of 3M Screen 47.8'
				52							Top of Bottom Seal 48'
				54							Top of Gravel Pack 49.8'
				56							Top of 3D Screen 50.8'
				58							
				60							Bottom of 3D Screen 60.8'
			64								
			66								
			68								
			70								
			72								
			74								
			76								
			78								
			80								
			82								
			84								
			86								
			88								
			90								

LEGEND: PID - Photoionization Detector HA - Hand Auger
 SS - Split Spoon PP - Pocket Penetrometer WB - Wash Bore
 CS - 5 foot CME Sampler HSA - Hollow Stem Augers RB - Rock Bit
 ST - Shelby Tube AR - Air Rotary NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

APPENDIX 5

MONITORING EQUIPMENT

Envision™ Technical Specifications

Operating Temperature Range

Unit	Minimum	Maximum	Comments
Envision	-4°F (-20°C)	122°F (50°C)	Heater option recommended below 14°F (-10°C)

Gas Sensor Accuracy

Sensor	Range	Linearity	Resolution	T90
CH ₄	0 - 100%	± < 2.0% absolute	0.1%	<30s
CO ₂	0 - 100%	± < 2.0% absolute	0.1%	<30s
O ₂	0 - 2% 2 - 25%	± < 0.1% absolute ± < 5% relative	0.1%	<5s

Pressure Sensors

Static	Range -5 to +5 (" H ₂ O)	Range -130 to +130 ("H ₂ O)	Comments
Accuracy	±0.14"H ₂ O	±2% of reading	According to sensor manufacture specs.
Resolution	0.01"H ₂ O	0.01"H ₂ O	
T90	<1 ms	<10 ms	
Differential	Range -5 to +5 (" H ₂ O)	Range -30 to +30 ("H ₂ O)	
Accuracy	±0.14"H ₂ O	±0.6"H ₂ O	According to sensor manufacture specs.
Resolution	0.001"H ₂ O	0.01"H ₂ O	
T90	<1 ms	<10 ms	
Available		Range -130 to +130 ("H ₂ O)	
Accuracy	NA	±2% of reading	According to sensor manufacture specs.
Resolution	NA	0.01"H ₂ O	
T90	NA	<10 ms	
Barometric (Absolute Pressure Only)		Range 22 to 31 ("Hg)	
Accuracy	NA	±0.24"Hg (±8 mBar)	According to sensor manufacture specs.
Resolution	NA	0.1"Hg	
Wired Thermistor Accuracy	±1.8°F (±1.0°C)	Wired Thermistor Range	-22 to +212°F (-30 to +100°C)
Battery Life (cycles)	up to 1000 full charge cycles		Temperature (°F) Battery Life (hours)
Battery Construction	NiMH (no memory)		77 10.6
Charge Time	4 hours from complete discharge		50 10.1
Pump Inches H ₂ O	-138		32 8.1
Flow (cc/min)	260		14 5.1

Note: All statements about sensor accuracy and product specifications are subject to change without notice.



150 Smokerise Drive
Wadsworth, OH 44281
330-725-7766

www.ElkinsEarthworks.com



Envision™ Landfill Gas Analyzer



865 West Liberty, Suite 220, Medina, Ohio

April 2018



1	INTRODUCTION	5
2	THE ENVISION® SYSTEM	5
2.1	HANDHELD COMPUTER	5
2.1.1	<i>Trimble® Nomad</i>	6
2.1.2	<i>Xplore Bobcat</i>	6
2.1.3	<i>Juniper Archer 2</i>	7
2.1.4	<i>Juniper Mesa 2</i>	7
2.1.5	<i>Envision® Gas Analyzer</i>	8
3	SAFETY	11
4	CERTIFICATION	11
5	TRIMBLE® HANDHELD COMPUTER PREPARATION	12
5.1	TURNING ON THE TRIMBLE HANDHELD COMPUTER	12
5.2	TURNING OFF THE TRIMBLE HANDHELD COMPUTER	13
5.3	BACKLIGHT AND POWER SETTINGS.....	13
5.4	ENABLE BLUETOOTH®	19
5.5	ENABLE GPS	21
6	ENVISION® GAS ANALYZER APPLICATION	24
6.1	SOFTWARE SCREEN PROPERTIES	25
6.2	“LOGIN SCREEN” - LOGGING TO THE ELKINS GAS ANALYZER SOFTWARE	26
6.3	CONNECTING AND DISCONNECTING THE ENVISION® GAS ANALYZER.....	30
6.3.1	<i>Connecting to the Envision® Gas Analyzer</i>	30
6.3.2	<i>Bluetooth Connection</i>	30
6.3.3	<i>Serial Connection (if desired)</i>	34
6.3.4	<i>Disconnecting from the Envision®</i>	35
6.3.5	<i>Resetting Bluetooth</i>	37
6.4	MAIN MENU	37
6.5	CALIBRATION	37
6.5.1	<i>Zero Gas Calibration</i>	39
6.5.2	<i>Span Gas Calibration</i>	43
6.5.3	<i>Pressure Sensor Calibration</i>	47
6.5.4	<i>Storing a Calibration File</i>	52
6.6	ANALYZE.....	55
6.6.1	<i>Select ID</i>	55
6.6.2	<i>Analyze</i>	65
6.6.3	<i>Read Pressures (ENV100/200)</i>	78
6.6.4	<i>Read Pressures (ENVAUS)</i>	83
6.7	COMMENTS.....	88
6.8	VIEW AND STORE DATA	90
6.9	UTILITIES	92
6.9.1	<i>Well ID Maintenance</i>	93



6.9.2	View Missing Well Report	114
6.9.3	Meter Status.....	116
6.9.4	License Manager.....	118
6.9.5	Set Options.....	120
6.9.6	Restore All Factory Cal	122
6.10	STORED DATA.....	123
6.11	O&M MANUAL.....	124
6.12	EXITING THE GAS ANALYZER SOFTWARE.....	125
6.13	SOFTWARE OPTIONS.....	126
7	THE ENVISION® GAS ANALYZER CONFIGURATION EDITOR SOFTWARE	128
7.1	LOADING THE APPLICATION.....	128
7.2	OPENING THE GAS ANALYZER CONFIGURATION EDITOR FOR THE FIRST TIME	128
7.3	ADD A SITE, TECHNICIAN, VALVE ADJUSTMENT, WELL CONDITION AND/OR WELL REPAIR.....	130
7.4	ADD A MONITORING POINT.....	132
7.5	CLONING WELLS	137
7.6	DELETE WELLS.....	140
7.7	COMBINING WELLS FROM ANOTHER ID SET.....	142
7.8	SAVE FILE.....	144
7.9	ID SET STORED LOCATION ON PC.....	145
7.10	TRANSFERRING ID SETS BETWEEN HANDHELD AND DESKTOP PC	146
7.11	IMPORTING GEM CONFIGURATION FILES.....	150
7.12	PRINT PREVIEW.....	151
8	CONNECTING THE HANDHELD COMPUTER TO A DESKTOP PC.....	152
8.1	WINDOWS MOBILE DEVICE CENTER.....	152
8.2	WINDOWS XP MACHINES.....	156
8.2.1	Download Active sync	156
8.3	TRANSFERRING FILES.....	162
8.3.1	Directory Structure.....	162
8.3.2	Copy Files from PC to Handheld Device.....	166
8.3.3	Copy File from Handheld Device to PC.....	169
9	ERRORS AND TROUBLESHOOTING	172
9.1	ENVISION® ERROR CONDITIONS:.....	172
9.2	OTHER ERROR CODES	173
10	ENVISION® MAINTENANCE.....	175
10.1	FACTORY MAINTENANCE	175
10.2	FIELD MAINTENANCE	175
11	WARRANTY.....	177
11.1	ENVISION® WARRANTY	177
11.2	TRIMBLE HANDHELD WARRANTY.....	177



11.2.1	Hardware Warranty.....	177
11.2.2	Hardware Warranty Exclusions	178
11.2.3	Software/Firmware Extended Limited Warranty.....	178
11.2.4	Software/Firmware Warranty Exclusions	178
12	PROBLEMS AND POTENTIAL SOLUTIONS FOR ENVISION AND HANDHELD DEVICE	179
13	SPECIFICATIONS	180
13.1	ENV100 & ENV200 SPECIFICATIONS	180
13.2	ENVAUS SPECIFICATIONS	181
14	CONTACT INFORMATION – SERVICE AND SALES	182



1 Introduction

Elkins Earthworks® would like to welcome you to the Envision® gas analyzer system. The Envision® gas analyzer, designed by Elkins Earthworks® is manufactured in the United States. The equipment was designed for the field technician as well as project managers. The Envision® gas analyzer is a two-part system, the sensor unit (Envision®) and the handheld computer. This unique pairing makes field activities more productive by giving the user the ability to expand functionality by using GPS, bar-coding, and other features that the Windows® operating system can offer.

There are currently 4 models of Envision gas analyzer:

ENV100 – has internal heating pads and is not certified intrinsically safe

ENV200 – does not have internal heating pads and is certified intrinsically safe

ENV200 “B” – same as ENV200 with added capability to measure barometric pressure

ENVAUS – does not have internal heating pads, is not certified intrinsically safe, and has borehole flow measurement capability

2 The Envision® System

The Envision® gas meter is a unique field instrument utilized primarily for the measurement of CH₄, CO₂, O₂, pressure, temperature, and flow within landfill gas and bio-gas collection systems. The Envision® gas analyzer package is comprised of two components: the handheld computer and the sensor unit (Envision®).

2.1 Handheld Computer

Elkins Earthworks® currently offers 4 models of handheld computers that can run the Gas Analyzer proprietary software to operate the Envision® sensor unit. The handheld computers typically communicate with Envision® via Bluetooth® wireless technology.

2.1.1 Trimble® Nomad



The Nomad is a highly ruggedized field computer from Trimble. The Trimble series handhelds are all-in-one field computers for GIS (Geographic Information System) data collection and mobile GIS applications, combining a handheld computer powered by the Windows Mobile 6 or 6.1 operating system. The Trimble series handhelds connect to the Envision® via Bluetooth® or via serial cable. They come standard with Bluetooth and 802.11 (Wi-Fi). Optional features may also be selected such as GPS, barcode scanner, and/or an internal camera.

2.1.2 Xplore Bobcat



Xplore's Bobcat ruggedized tablet is IP65 rated, runs Windows 7, 8.1, or 10 and has a bright 10" touch screen. It has a battery life of 8 hours (standard) or 14 hours (optional dual battery). Wi-Fi, GPS, Bluetooth, and Ethernet communications are standard with optional 4G LTE. The Bobcat has a variety of pluggable ports, cameras in the front and back and optional barcode scanner, fingerprint scanner, and near-field communication. It can survive multiple drops at a height of 4 feet onto plywood over concrete.

2.1.3 Juniper Archer 2



The Archer 2 is an IP68 rugged handheld unit from Juniper Systems. It runs the Windows Embedded Handheld 6.5.3 operating system (includes Windows Office Mobile) and has a 4.3" high visibility touch screen. It can operate up to 20 hours on a single charge.

2.1.4 Juniper Mesa 2



Juniper's Mesa 2, 8.5" x 5.5", IP68 ruggedized tablet comes with the Windows 10 operating system and runs 8 – 10 hours on a single charge. It has options for Bluetooth, Wi-Fi, 4G LTE, camera, GPS, barcode scanner, RFID, and hot-swappable batteries.

2.1.5 Envision® Gas Analyzer



The Envision® gas analyzer houses the gas and pressure sensors. The gas analyzer utilizes infrared sensors to measure CH₄ and CO₂. The Envision® uses an electrochemical cell to measure O₂ concentration and an accurate thermistor temperature probe to measure wellhead gas temperatures. Data generated by the Envision® gas analyzer is relayed to the handheld PC via Bluetooth or serial cable several times per second.

2.1.5.1 Gas Ports

The Envision® gas analyzer ENV100 and ENV200 models have four (4) ports located on the front of the unit.



Figure 1 ENV100 and ENV200 Port Labels

Port listing from right to left:

Calibrate/Static/Sample port – This port is used to calibrate the unit with calibration gas, to measure static wellhead pressure, and to sample for gas quality.

Impact Port – This port is used to generate a differential pressure for calculating flow. **Do not connect pressurized calibration gasses to this port.**

Available – This port is used to acquire an available (system) vacuum at the monitoring port. **Do not connect pressurized calibration gasses to this port.**

Exhaust – This port is used to exhaust the gasses that are pumped through the sample train for measurement. Only connect an exhaust hose to this port. **Do not apply pressure to the exhaust port.**

The Envision® gas analyzer ENVAUS model is slightly different in that the yellow “Available” port is now labeled “Borehole Flow” (see photo below). Instead of measuring available (system) vacuum at this port, it is used to measure low-level borehole flow instead. The “Calibrate/Static/Sample” port is then used to measure available (system) vacuum.

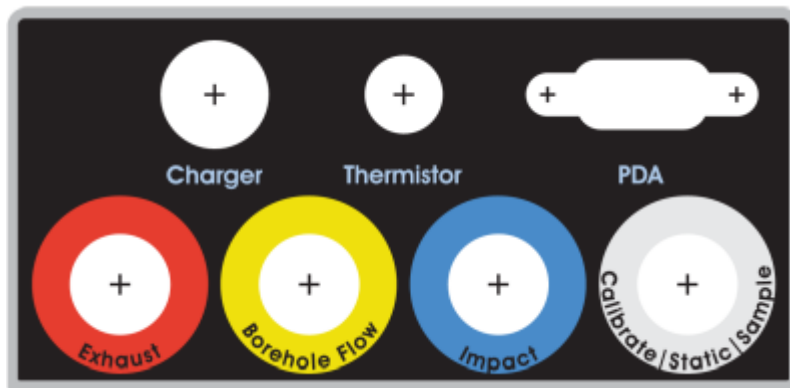


Figure 2 ENVAUS Port Labels

2.1.5.2 Cable Ports

Charger port – This port is used to charge the unit with the supplied wall charger. The Envision should run a full, normal working day without needing to be recharged. Plug the charger in overnight to charge the unit. It usually takes about 4 hours to fully charge an Envision. The charging circuit will turn off automatically when the unit has reached a full charge. **Do not plug the charger into the unit in an explosive environment.**

Thermistor Port – The wired thermistor plugs in to this port. If you have purchased a wireless (Bluetooth) thermometer from Elkins Earthworks, it may be used in place of the wired thermistor.

PDA Port – The PDA port may be used to directly connect the Envision to a handheld device (with a serial port) if Bluetooth is unavailable or not working correctly. A standard 9 pin serial cable may be used.

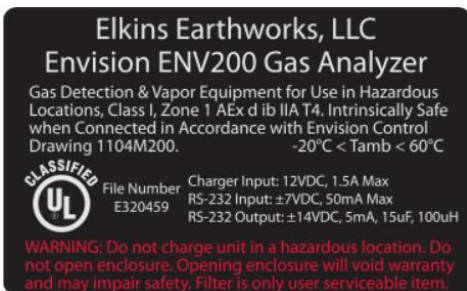


3 Safety

Landfill gas is normally safely extracted from landfills and conveyed to appropriate control devices. However, during the course of monitoring each extraction point, exposure may occur. As such, it is important to follow all site-specific safety protocols when monitoring. Working at a landfill typically requires site specific health and safety plans. While performing monitoring at a landfill, the user should be aware of the items included in the site specific health and safety plan. It is important to know that all personal protection equipment and safety protocols as appropriate must be used when using this instrument. All vents on the meter are designed to exhaust to the atmosphere. Since landfill gas contains methane, no smoking is permitted while using the instrument. Calibration gases must be handled with utmost care and with adequate ventilation.

It is the sole responsibility of the user of the Envision® sensor unit and handheld PC to determine the appropriate location that either unit can be utilized within as monitoring conditions may change. The Envision® sensor unit handheld PC are not intended for use in confined space entries but for the continuous monitoring of gasses within a landfill gas collection system.

4 Certification



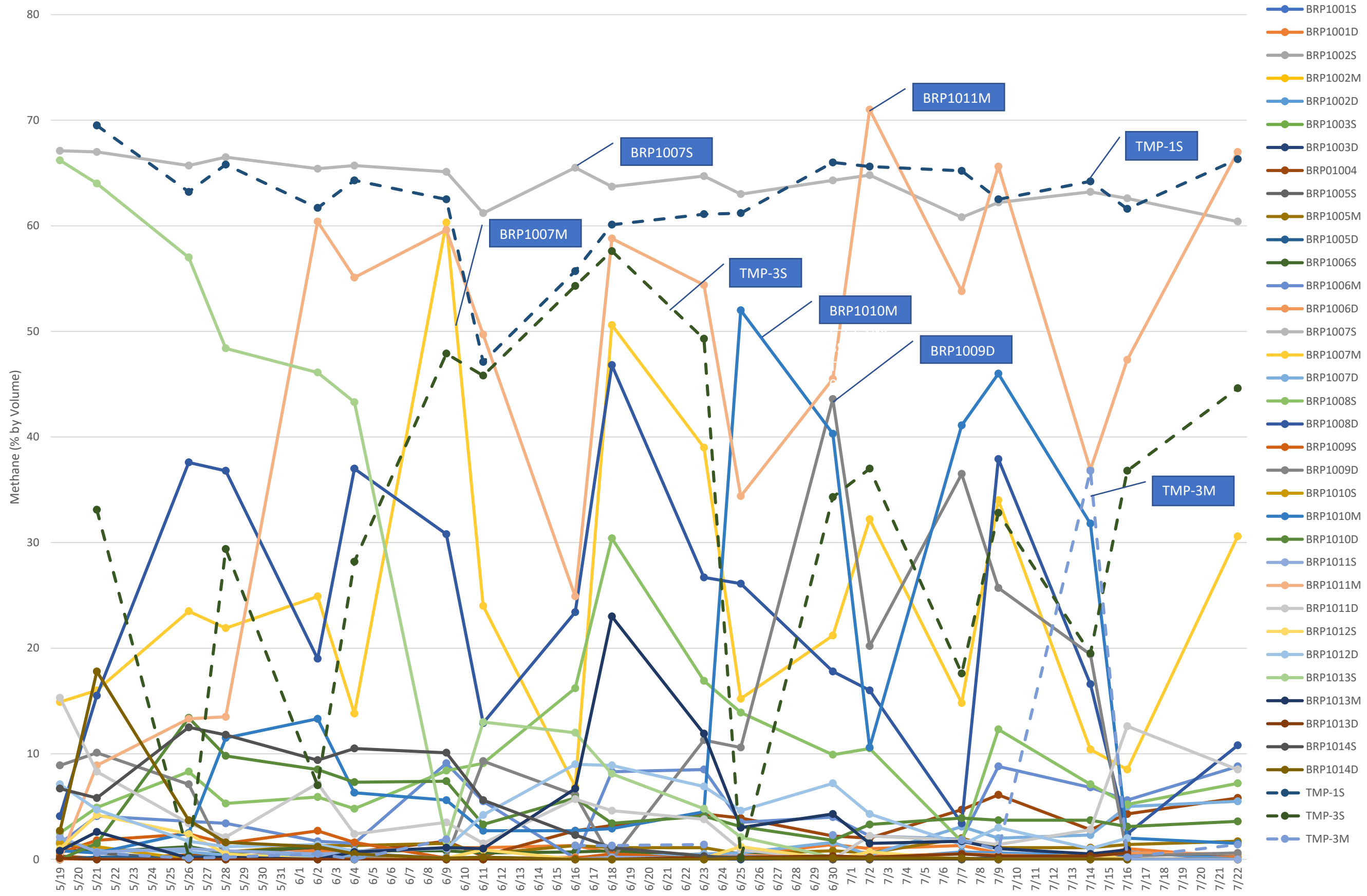
Envision® model ENV200 has been UL certified for use in hazardous locations (Class 1, Zone 1, AEx d ib IIA T4) when connected in accordance with control drawing 1104M200. Although models ENV100 and ENVAUS are based on a similar design, these models have not been certified for use in explosive atmospheres. It is important that this manual be followed closely and that any repair to the Envision® gas analyzer is made at the approved Elkins Earthworks® repair facility. Opening the Envision® gas analyzer and breaking the housing warranty seals may result in voiding the unit's warranty as well as compromising the unit's safety. The charger should not be connected when an explosive atmosphere is present.

The Envision® sensor unit also meets FCC regulations for a Class A Digital Device Part 15, Subpart B, Sections 15.107b & 15.109b

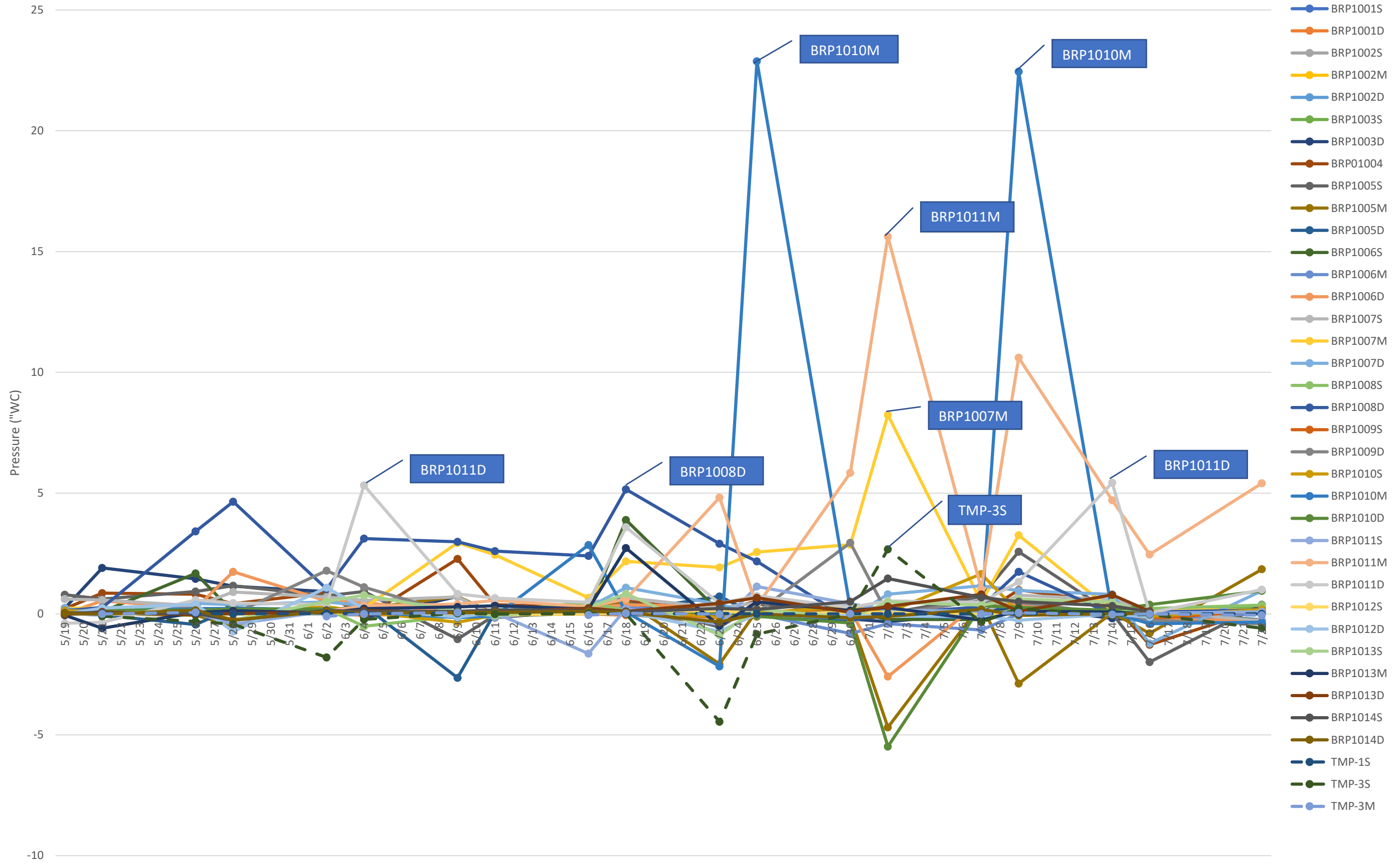
APPENDIX 6

SUMMARY OF MONITORING DATA

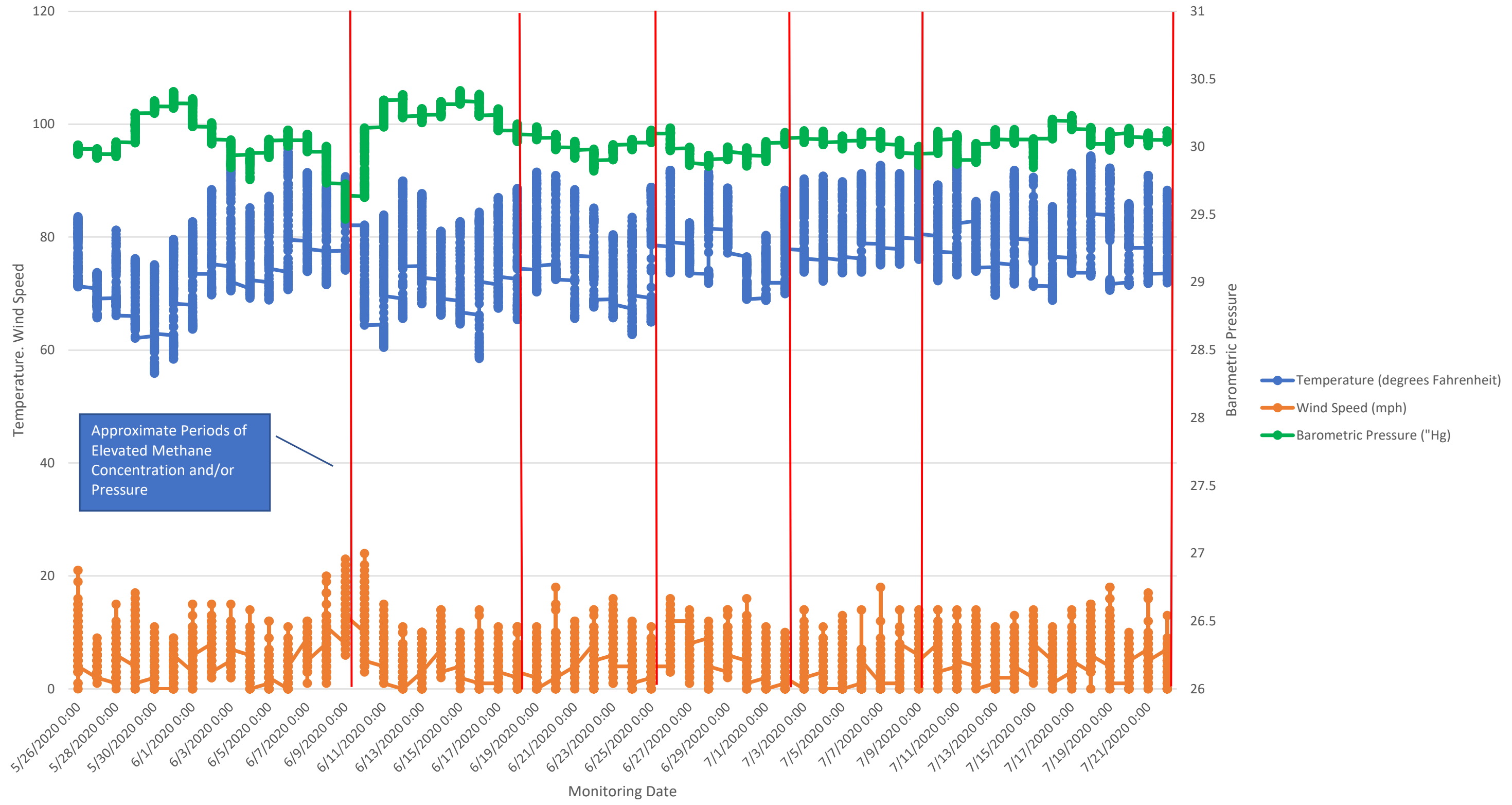
Interim Monitoring Points - Methane Data



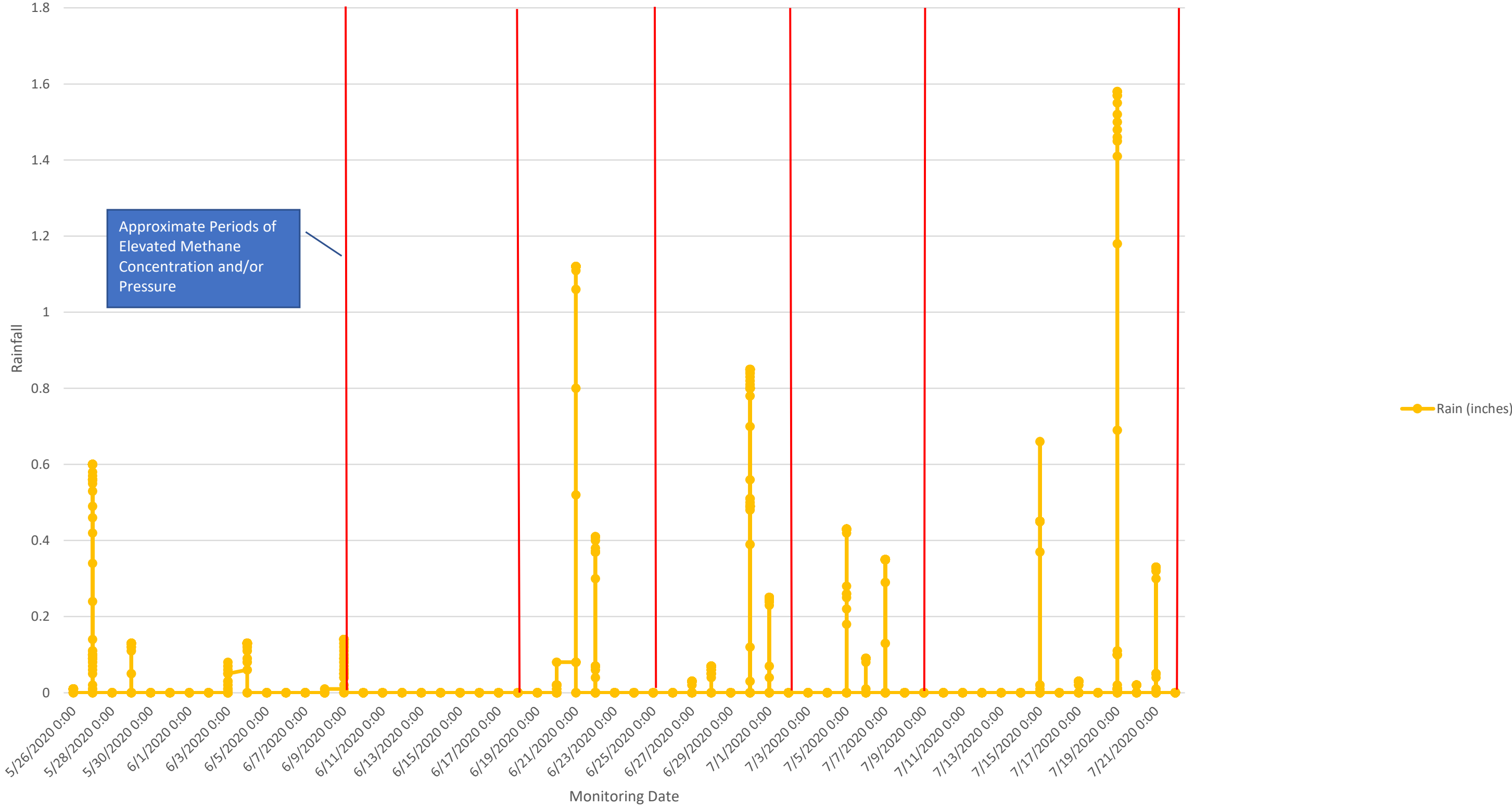
Interim Monitoring Points - Pressure Data



Weather Data - 1

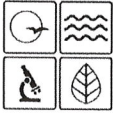


Weather Data - 2



APPENDIX 7

INTERIM MONITORING POINT DECOMMISSIONING



MISSOURI DEPARTMENT OF NATURAL RESOURCES
 GEOLOGICAL SURVEY PROGRAM
**MONITORING WELL/TEST HOLE/SOIL AND GEOTECHNICAL
 BORING PLUGGING REGISTRATION REPORT**

FOR OFFICE USE ONLY	
REF NO.	DATE RECEIVED
CR NO.	CHECK NO.
STATE CERT NO.	REVENUE NO.

ROUTE / /	APPROVED	DATE	ENTERED
--------------	----------	------	---------

OWNER AND SITE INFORMATION			
PROPERTY OWNER NAME WHERE WELL IS LOCATED Republic Services, LLC (Bridgeton Landfill, LLC)		PRIMARY PHONE NUMBER WITH AREA CODE (209) 227-9531 (Erin Fanning)	
PROPERTY OWNER MAILING ADDRESS 13570 St. Charles Rock Rd	CITY Bridgeton	STATE MO	ZIP CODE 63044
PHYSICAL ADDRESS OF PROPERTY WHERE WELL IS LOCATED 13570 St. Charles Rock Rd		CITY Bridgeton	
NAME OF SITE, BUSINESS, OR CLEANUP PROJECT Bridgeton LF - Vapor Points	DNR/EPA PROJECT NUMBER OR REGULATORY SITE ID NUMBER (IF APPLICABLE) MDNR Permit # 0118912	VARIANCE NUMBER (IF ISSUED) 6668	
PRIMARY CONTRACTOR NAME (PLEASE PRINT) Bill Abernathy	PERMIT NUMBER 003662-PM	Section 256.607(3), RSMo, requires all primary contractors to comply with all rules and regulations promulgated pursuant to Sections 256.600 to 256.640 RSMo.	

LOCATION INFORMATION			
Latitude 38 ° 45 ' 50.6 "	COUNTY	_____ ¼ _____ ¼ _____ ¼	
Longitude 90 ° 26 ' 48.1 "	St Louis CO	Section _____ Township _____ N Range _____ <input type="checkbox"/> E <input type="checkbox"/> W	

MONITORING WELL INFORMATION						
DATE WELL PLUGGED		ORIGINAL DRILLER (IF KNOWN)		DATE ORIGINALLY DRILLED (IF KNOWN)		REFERENCE NUMBER (IF KNOWN)
DEPTH OF WELL ft.	STATIC WATER LEVEL ft.	LENGTH OF RISER AND SCREEN ft.	DIAMETER OF RISER AND SCREEN in.	RISER AND SCREEN PLUGGED IN PLACE <input type="checkbox"/> Yes <input type="checkbox"/> No (Removed)	PUMP OR SAMPLING EQUIPMENT REMOVED <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	CASING REMOVED <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A

TEMPORARY MONITORING WELL/SOIL BORING/GEOTECHNICAL BORING INFORMATION				
Quantity	Depth of Well or Boring (ft.)	Diameter (in.)	Total Depth (Linear Feet) of All Wells or Borings	TOTAL NUMBER OF WELLS/BORINGS 35
See Attached List	see attached			AVERAGE DEPTH OF ALL WELLS/BORINGS
				DATE FIRST WELL/BORING WAS PLUGGED 4/24/2020
				DATE LAST WELL/BORING WAS PLUGGED 7/24/2020
TOTAL 943.2 LF				

TEST HOLE INFORMATION						
DATE TEST HOLE PLUGGED	DEPTH OF WELL ft.	LENGTH OF GROUT PLUG Bottom _____ ft. Top _____ ft.	DAVIS FORMATION REACHED <input type="checkbox"/> Yes <input type="checkbox"/> No	MECHANICAL PACKER (IF USED) <input type="checkbox"/> Yes, Depth _____ ft. <input type="checkbox"/> No	AMOUNT OF CLEAN FILL (IF USED) _____ Tons or _____ Cubic Yards	CASING REMOVED (CHOOSE ONE) <input type="checkbox"/> Yes, Diameter of Remaining Borehole _____ in. <input type="checkbox"/> No, Diameter of Casing _____ in.

PLUGGING INFORMATION (This section is required in addition to one of the well, soil boring or test hole sections above.)						
WELL REMOVED BY EXCAVATION <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	GROUT INSTALLATION METHOD <input type="checkbox"/> Gravity <input checked="" type="checkbox"/> Tremie <input type="checkbox"/> Pressure	GROUT MATERIAL USED CEMENT <input type="checkbox"/> Type I <input type="checkbox"/> Type III BENTONITE <input type="checkbox"/> Chips <input type="checkbox"/> Pellets <input checked="" type="checkbox"/> Slurry <input type="checkbox"/> Other	NUMBER OF SACKS OF GROUT USED 4 LBS PER SACK 50	NUMBER OF GALLONS OF WATER USED PER SACK 10	GROUT HYDRATED TO SATURATION <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
FINISHED SURFACE MATERIAL <input type="checkbox"/> Asphalt <input type="checkbox"/> Concrete <input type="checkbox"/> Soil <input checked="" type="checkbox"/> Other	SURFACE MATERIAL DEPTH _____ ft. _____ in.	DRILLER NOTES Vapor Monitoring				

I hereby certify that the monitoring well herein described was plugged in accordance with the Department of Natural Resources requirements.

MONITORING WELL INSTALLATION CONTRACTOR	PERMIT NUMBER 003662-PM	DATE 7/24/2020
MONITORING WELL INSTALLATION CONTRACTOR APPRENTICE (IF APPLICABLE)	PERMIT NUMBER	DATE

Location	Depth
1001 S	23.0
1001 D	29.2
1002 S	20.0
1002 M	26.7
1002 D	29.5
1003 S	14.7
1003 D	20.0
1004 D	35.2
1005 S	22.8
1005 M	30.0
1005 D	33.9
1006 s	18.6
1006 M	9.8
1006 D	33.0
1007 S	18.9
1007 M	30.1
1007 D	34.2
1008 S	30.0
1008 D	39.1
1009 S	19.0
1009 D	30.0
1010 S	19.4
1010 M	30.1
1010 D	31.5
1011 S	25.7
1011 M	36.4
1011 D	41.5
1012 S	16.5
1012 D	31.6
1013 S	16.0
1013 UM	27.0
1013 LM	33.6
1013 D	41.8
1014 S	14.9
1014 D	29.5
TOTAL LF	943.2