



**BRIDGETON LANDFILL, LLC.**

**CONSTRUCTION QUALITY ASSURANCE  
ACCEPTANCE REPORT**

**NORTH QUARRY SURFACE COLLECTOR**

**BRIDGETON, ST. LOUIS COUNTY, MISSOURI**

**Prepared For:  
Bridgeton Landfill, LLC.  
13570 ST. Charles Rock Road  
Bridgeton, MO 63044**

**APRIL 2019**

**Project No.: BT-133-19**

**Prepared By:**

**Feezor Engineering, Inc.  
3377 Hollenberg Drive  
Bridgeton, MO 63044**



**CONSTRUCTION QUALITY ASSURANCE  
ACCEPTANCE REPORT**

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**BRIDGETON LANDFILL, LLC**

**BRIDGETON, SAINT LOUIS COUNTY, MISSOURI**

Prepared for

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April 2019

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# 1 INTRODUCTION

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## 1.1 Overview of Project

Bridgeton Landfill, LLC is a closed municipal solid waste facility located at 13570 St. Charles Rock Road, Bridgeton, St. Louis County, Missouri. The facility is owned and operated by Bridgeton Landfill, LLC (BL) who operate the facility pursuant to Permit No 118912. (and subsequent modifications), issued by the Missouri Department of Natural Resources (MDNR).

GMP-08 exhibited first-time measurements of greater than 2.5% methane on March 12, 2019. Subsequent to the March 12, 2019 detection, GMP-08 has been monitored more frequently. GMP-08 has exhibited methane concentrations over 2.5% intermittently throughout the remainder of the quarterly monitoring period. A separate Landfill Gas Corrective Action Plan (LGCAP) for GMP-08 was submitted to the MDNR and to the St. Louis County Department of Public Health Air Pollution Control Program (SLCDPH-APCP) on March 26, 2019. The SLCDPH-APCP approved the GMP-08 LGCAP on March 27, 2019 (under the auspices of a GCCS Design Plan Addendum) and the MDNR approved the GMP-08 LGCAP in correspondence dated April 9, 2019 (verbal approval to install Option 1 was received from MDNR on March 27, 2019).

The LGCAP approved the installation of a surface collector adjacent to GMP-8 in the northeast corner of the North Quarry of the Bridgeton Landfill. This surface collector was installed to mitigate the GMP-08 methane concentrations over 2.5%.

The installation of the surface collector began on March 26, 2019 and was concluded April 23, 2019. Fusion Solutions Inc. (Fusion) of Carlinville, Illinois and Mid-America Liner (Mid-America) of Springfield, Missouri were selected to install the necessary components of the surface collector. Feezor Engineering, Inc. of Bridgeton, Missouri was selected to perform Construction Quality Assurance (CQA) services and record surveying. Daniel R. Feezor, P.E. of FEI was the Construction Quality Assurance Officer (CQAO). Mr. Feezor selected Brad Vits and Dane Hale to be the CQA technicians.

## 2 SURFACE COLLECTOR INSTALLATION

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The installation of the surface collector consisted cutting the previously installed EVOH cap and placing collector piping directly on the underlying subgrade. The surface collector consisted of a 4" perforated HDPE SDR 11 pipe with adjacent perforated rectangular collectors to provide a pathway for gas collection once vacuum was applied. The perforation pattern of the collector pipe was installed as depicted on **Drawing #1 of Appendix D**.

The perforated collector was fitted with risers at both ends and the midpoint. A two-inch Landtec Accu-Flow gas extraction wellhead was installed at the midpoint riser and may be installed on the ends in the future if deemed beneficial. The gas extraction wellhead was then connected to the existing site gas collection and control system for conveyance to the onsite utility flare servicing the North Quarry.

## **3 GEOMEMBRANE REPAIR**

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Upon completion of the installation of the surface collector, the existing EVOH geomembrane was repaired to seal the cut that was made.

### **3.1 Flexible Membrane Liner Properties**

The installed material consists of 50-mil Ethylene Vinyl Alcohol (EVOH) geomembrane. Raven Industries (Raven) provided manufacturer's certifications and test results for the 50-mil geomembrane which are included in **Appendix B**.

#### **3.1.1 Quality Control Testing**

All rolls of EVOH geomembrane supplied for this project by Raven were CQA tested in the manufacturing facility. The rolls were evaluated for tensile characteristics that included stress at break and elongation at break. Additional testing performed included average thickness and asperity height along with tear and puncture resistance. Lastly, material was tested at a frequency of once per every 200,000 pounds for standard oxidative induction time. The reported values of each roll tested exceed the requirements of the CQA Plan. The test methods, minimum values and testing frequency conform with those established in the CQA Plan included within the project work plan.

### **3.2 Installation Procedures**

#### **3.2.1 Deployment**

Fusion and Mid-America installed a repair strip of geomembrane by hand over the installed surface collector. The orientation of the geomembrane repair is depicted on **Drawing #2 of Appendix D**.

#### **3.2.2 Seaming Procedures**

##### **3.2.2.1 Trial Welds**

It was determined that a trial weld would be made and sent to TRI/Environmental Laboratory for analysis. Trial weld samples were made from excess EVOH liner and were prepared using the same procedures and under the same conditions the welder expected during field welding. The minimum strength criterion required for peel testing was 52 ppi for extrusion welds. For shear testing, the minimum strength criterion was 80 ppi for extrusion welds. The failure mode was required to be a film tear bond, or a partial adhesion failure as described in section 6.1 and Table 1(a) of The Geosynthetics Research Institute specification GM-19 and the welds were to show no more than 25% delamination into the weld. A failure mode of Separation in Plane

(SIP) is also deemed acceptable in accordance with literature from the Manufacturer and the CQA Plan contained within the work plan.

Results of trial weld testing are presented in **Appendix C.2 and C.4.**

### 3.2.2.2 Extrusion Welding Procedures

Geomembrane repair work associated with the surface collector cap strip was performed with an extrusion welder. The unit introduced a bead of molten resin along the edge of the seam of the two FML sheets to be welded. The top sheet was heat-tacked down to the bottom sheet and was ground with an abrasive disk immediately prior to the extrusion process. The continuity of the extrusion welds were non-destructively verified by vacuum testing at all locations except where the liner was welded to penetrations. At those locations, welds were inspected visually.

### 3.2.3 Testing

#### 3.2.3.1 Non-Destructive testing

Extrusion welded repairs were vacuum tested.

Results of non-destructive testing of FML seams are presented in **Appendix C.5.**

#### 3.2.3.2 Destructive testing

Destructive geomembrane seam samples were obtained at a minimum frequency of one per 500 linear feet of seam. Destructive seam testing was performed at TRI/Environmental Laboratory. The pass / fail criteria were as follows:

#### **Peel Adhesion (ASTM D6392)**

- Five out of the five-test specimens meet the strength requirements discussed in section 3.2.2.1.
- Failure mode is a film-tear bond or partial adhesion failure as described in section 6.1 and Table 1(a) of the GRI specification GM-19 and the welds were to show no more than 25% separation into the weld. A failure mode of Separation in Plane (SIP) is also deemed acceptable in accordance with literature from the Manufacturer and the CQA Plan contained within the work plan.

#### **Shear Strength (ASTM D 6392)**

- Five out of the five-test specimens meet the strength requirements discussed in section 3.2.2.1.

- Failure mode is a film-tear bond or partial adhesion failure as described in section 6.1 and Table 1(a) of the GRI specification GM-19 and the welds were to show no more than 25% separation into the weld.

Destructive samples were obtained and were labeled. A summary log of destructive samples is presented in **Appendix C.3**. Results of laboratory testing of destructive seam samples are included as **Appendix C.4**.

### **3.2.4 Defects and Repairs**

The installation required one destructive sample to be obtained and pass due to the length of welding performed. The initial destructive sample (DS-1) failed to meet the requirements of Section 3.2.3.2. In accordance with the CQA Plan, attempts were made to find passing samples on both sides of the failing sample. A successful before sample (DS-1B) was obtained but no passing after samples (DS-1A) were able to be obtained. At this point it was determined to reconstruct the initial cap strip with a new cap strip. In accordance with the CQA Plan, due to recreating over 250' of seam, another destructive sample was taken (DS-1R). This sample also demonstrated failing results along with the trial weld that was tested for work performed on April 19, 2019.

To resolve, the failing destructive sample, Mid-America capped the entirety of work completed on April 19, 2019 and a final destructive sample was obtained (DS-1R2) which received passing results at the laboratory. Essentially, work performed on April 16<sup>th</sup> and 23<sup>rd</sup> of 2019 successfully bound the initial and subsequent failing samples.

A summary of repair activity for the project are presented in **Appendix C.5** and **Drawing #2 of Appendix D**.

## 4 SURVEY CONTROL

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### **4.1 Construction Surveying**

Feezor Engineering Inc. of Bridgeton, Missouri, provided surveying as the Project Surveyor.

### **4.2 Final As-built Surveying**

Feezor Engineering Inc. of Bridgeton, Missouri provided the final certification survey for the as-built coordinates and elevations of key points and features of the North Quarry Surface Collector.

## 5 CERTIFICATION

---

I, Daniel R. Feezor, P.E., do hereby certify to my best knowledge and belief, that the North Quarry Surface Collector at the Bridgeton Landfill was constructed in accordance with the approved Temporary Cap and Cap Integrity System Construction Quality Assurance Plan (last revised 9-30-16).

## Appendix A

### Daily Field Summaries

Feezor Engineering, Inc.  
406 E. Walnut St.  
Chatham, IL 62629  
(217) 483-3118



Page: 1 of 1

### Daily Field Summary Report

<b>Client:</b> <u>Bridgeton Landfill, LLC</u>	<b>Job No.:</b> <u>BT-133</u>
<b>Project:</b> <u>LFG Corrective Action Assistance</u>	<b>Task No.:</b> <u>-</u>
<b>Location:</b> <u>Bridgeton, MO</u>	<b>Date:</b> <u>3/26/2019</u>
<b>Contractor(s):</b> <u>Fusion Solutions Inc. (Fusion)</u>	<b>Report No.:</b> <u>1</u>
<b>Weather:</b> AM <u>Sunny</u> PM <u>M. Cloudy</u>	
<b>Temperature:</b> AM <u>36 F</u> PM <u>55 F</u>	

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0700 – I arrive on site  
0715 – Fusion Solutions opened the existing liner.  
0745 – Fusion Solutions begins fabricate the pipe  
0930 – Fusion begins to perforate pipe to design spec.  
1200 – Lunch  
1230 – Return from lunch. Fusion Solutions starts on liner repair  
1815 – Repairs are finished on the liner. Destruct was taken from the extrusion weld  
1830 – I leave the site

Copies To: Erin Fanning, Dan Feezor

FEI Representative:

Feezor Engineering, Inc.  
406 E. Walnut St.  
Chatham, IL 62629  
(217) 483-3118



Page: 1 of 1

### Daily Field Summary Report

<b>Client:</b> <u>Bridgeton Landfill, LLC</u>	<b>Job No.:</b> <u>BT-133</u>
<b>Project:</b> <u>LFG Corrective Action Assistance</u>	<b>Task No.:</b> <u>-</u>
<b>Location:</b> <u>Bridgeton, MO</u>	<b>Date:</b> <u>3/27/2019</u>
<b>Contractor(s):</b> <u>Fusion Solutions Inc. (Fusion)</u>	<b>Report No.:</b> <u>2</u>
<b>Weather:</b> AM <u>Sunny</u> PM <u>Sunny</u>	
<b>Temperature:</b> AM <u>39 F</u> PM <u>64 F</u>	

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

0700 – I arrive on site.

0715 – Fusion Solutions installs extra patch welds on repair where wedge seams meet the repair weld.

1015 – I observe and document vacuum box test being performed on all welds.

1200 – Work on liner is complete and Fusion Solutions leaves for lunch.

Copies To: Erin Fanning, Dan Feezor

FEI Representative: Dane C. Hale

Feezor Engineering, Inc.  
406 E. Walnut St.  
Chatham, IL 62629  
(217) 483-3118



Page: 1 of 1

### Daily Field Summary Report

<b>Client:</b> <u>Bridgeton Landfill, LLC</u>	<b>Job No.:</b> <u>BT-133</u>
<b>Project:</b> <u>LFG Corrective Action Assistance</u>	<b>Task No.:</b> <u>-</u>
<b>Location:</b> <u>Bridgeton, MO</u>	<b>Date:</b> <u>4/16/2019</u>
<b>Contractor(s):</b> <u>Fusion Solutions Inc. (Fusion)</u>	<b>Report No.:</b> <u>3</u>
<b>Weather:</b> AM <u>M Sunny</u> PM <u>M Sunny</u>	
<b>Temperature:</b> AM <u>40 F</u> PM <u>65 F</u>	

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

- 0730 – I arrive on site. Fusion Solutions and I begin tracking failure of DS-1 by moving both directions of failing sample and re-sampling. It is determined approximately half of the initial cap needs to be covered with a new cap. DS-1A and DS-1B are obtained for shipment to TRI Environmental.
- 0800 – Fusion Solutions begins process of capping portions of failing seams.
- 1200 – Fusion Solutions performs vacuum box testing of completed welds for non-destructive testing. Destructive test samples and trial welds are shipped to TRI for evaluation.

Copies To: Erin Fanning, Dan Feezor

FEI Representative:

*Bradley Jts*

Feezor Engineering, Inc.  
406 E. Walnut St.  
Chatham, IL 62629  
(217) 483-3118



Page: 1 of 1

### Daily Field Summary Report

<b>Client:</b> <u>Bridgeton Landfill, LLC</u>	<b>Job No.:</b> <u>BT-133</u>
<b>Project:</b> <u>LFG Corrective Action Assistance</u>	<b>Task No.:</b> <u>-</u>
<b>Location:</b> <u>Bridgeton, MO</u>	<b>Date:</b> <u>4/19/2019</u>
<b>Contractor(s):</b> <u>Fusion Solutions Inc. (Fusion)</u>	<b>Report No.:</b> <u>4</u>
<b>Weather:</b> AM <u>Cloudy</u> PM <u>Cloudy</u>	
<b>Temperature:</b> AM <u>50 F</u> PM <u>58 F</u>	

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

- 0730 – I arrive on site. DS-1A was still determined to be a failure in the lab. It was decided that the initial cap would be re-done since half was done on 4/16. Then a new destructive sample will be obtained (DS-1R).
- 0900 – Fusion Solutions begins process of capping the remainder of the original cap strip.
- 1200 – Fusion Solutions performs vacuum box testing of completed welds for non-destructive testing. Destructive test sample and trial welds are shipped to TRI for evaluation.

Copies To: Erin Fanning, Dan Feezor

FEI Representative: Bradley

Feezor Engineering, Inc.  
406 E. Walnut St.  
Chatham, IL 62629  
(217) 483-3118



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### Daily Field Summary Report

<b>Client:</b> <u>Bridgeton Landfill, LLC</u>	<b>Job No.:</b> <u>BT-133</u>
<b>Project:</b> <u>LFG Corrective Action Assistance</u>	<b>Task No.:</b> <u>-</u>
<b>Location:</b> <u>Bridgeton, MO</u>	<b>Date:</b> <u>4/23/2019</u>
<b>Contractor(s):</b> <u>Fusion Solutions Inc.; Mid-America Lining Co.</u>	<b>Report No.:</b> <u>5</u>
<b>Weather:</b> AM <u>P Cloudy</u> PM <u>P Cloudy</u>	
<b>Temperature:</b> AM <u>60 F</u> PM <u>68 F</u>	

Description of field activities (include labor, equipment, site conditions, sampling, etc.)

- 1000 – I arrive on site. Trial weld and DS-1R from 4/19 were both determined to be failures at the testing laboratory. Mid-America Lining Co. is onsite to cap seaming that was performed on 4/19 and resample will be obtained for laboratory testing (DS-1R2).
- 1030 – Mid-America performs trial weld testing and begins to cap seaming that was performed on 4/19. Fusion Solutions laborers are assisting.
- 1530 – Vacuum box testing is performed on all welding activities performed today. I obtain DS-1R2 and ship to the lab for analysis.

Copies To: Erin Fanning, Dan Feezor

FEI Representative: Bradley Utis

## Appendix B

### Geomembrane MQC Data

# PRODUCT CERTIFICATION

**Product Name: X60FC1      Sales Order # 255344      Size of product: 16 x 550**

Absolute Barrier™ X-Series X60FC1 are a seven layer, co-extruded membrane consisting of high density polyethylene (HDPE) with an effective barrier core-layer to provide superior resistance to gas transmission. HDPE provides excellent chemical resistance and durability for long term applications.

Roll #	Thickness	Asperity GM 12	Dumbbell Tensile	Elongation (%) MD/TD	Graves Tear (lbs.)	Puncture (lbs.)	OIT Oxidative Induction Time
	ASTM D5994		ASTM D 6693 MD/TD		ASTM D1004	ASTM D4833	ASTM D3895
10165408	64	G 11.7 B 11.2	183	551	51	132	230
10165525	59	G 15.7 B 11.9	183	551	51	132	230
10165667	59	G 14.2 B 10.9	183	551	51	132	230
10165838	60	G 18.8 B 12.5	183	551	51	132	230
10165861	59	G 16.9 B 12.9	183	551	51	132	230
10166978	55	G 17.5 B 24.8	183	551	51	132	230
10167263	56	G 17.0 B 23.5	183	551	51	132	230
10167467	56	G 16.6 B 24.5	183	551	51	132	230
10167949	56	G 18.5 B 23.6	150	386	51	132	230
10168157	56	G 17.9 B 22.0	150	386	51	132	230
10168382	57	G 18.3 B 23.6	150	386	51	132	230
10168407	59	G 15.3 B 20.6	150	386	51	132	230
10168467	59	G 17.1 B 21.5	150	386	51	132	230
10168547	59	G 16.0 B 24.3	150	373	46	126	230
10167709	57	G 18.6 B 24.9	150	386	51	132	230
10166855	57	G 18.0 B 23.1	183	551	51	132	230

Note: Any resins used to make this product have met suppliers' certifications.

**Customer: Republic Services**

**PO # 761517**

**Date: October 20, 2018**



Cheryl J Raymond

Quality Assurance Technician II

Raven Industries – Engineered Films Division



Raven Engineered Films  
PO Box 5107, Sioux Falls, SD 57117-5107  
[www.ravenefd.com](http://www.ravenefd.com)

## Appendix C

### Geomembrane Installation Data

## Appendix C.1

### Field Tensiometer Calibration

# DEMTECH<sup>®</sup> Services Inc.

## CALIBRATION CERTIFICATE

Tensiometer Model:  
 Device Calibrated:  
 Range:  
 Model No:  
 Serial No:

Pro-Tester [T-0100/A or T-0100SE/A]

S-Type load cell  
 0 - 750 lbs. Tension

Calibration Apparatus:

Pro-Cal unit, model TC-0100/A

M2405-750#
<b>1808</b>

A/D Module Model No:  
 A/D Module Serial No:  
 Channel No:

T-029
<b>119051808</b>
N/A

Dead Weight:

Reference Cell:

W1	2
W2	152
W3	302

R1	2
R2	152
R3	302

Indicator reading with no load:

0
---

Offset: **-6.029389**

Scale: **3.332150**

Applied Force lbs.

2
52
102
152
202
252
302

Cell Response:

2
52
102
152
202
252
302

Deviation Error:

0.00
0.00
0.00
0.00
0.00
0.00
0.00

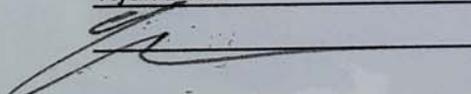
Total Deviation Error (%): **0.00%**

Temperature at time of calibration: 73 degrees F

Excitation Voltage: **5** V DC

This calibration conforms to the standards set by ASTM E4 and is traceable to NIST standards

Note: A/D Module and load cell above have been systems calibrated and are considered a matched pair. In general, calibrated A/D Modules and load cells are not interchangeable.

Calibration Technician: Ryan Beck  
 Signature: 

Date: 04/22/19

## Appendix C.2

### Trial Weld Log

# Trial Weld Log

Date	Time	Material Type	Tech	Type	Mach	Amb Temp	Fusion Speed	Fusion Temp	Extr. Preheat	Extr. Barrel	Peel 1 (In/Out)	Peel 2 (In/Out)	Peel 3 (In/Out)	Shear 1	Shear 2	Shear 3	QA ID	Pass / Fail	Comments
3/26/2019	1:00 PM	TT	TG	X	1	50	-	-	445	475	SEE APPENDIX C.4 - TRIAL WELD-1						DH	P	PERFORMED BY TRI
3/27/2019	8:00 AM	TT	TG	X	1	35	-	-	445	475	SEE APPENDIX C.4 - TRIAL WELD-2						DH	P	PERFORMED BY TRI
4/16/2019	8:00 AM	TT	CP	X	1	40	-	-	445	475	SEE APPENDIX C.4 - TW-3						BJV	P	PERFORMED BY TRI
4/19/2019	9:00 AM	TT	CP	X	1	50	-	-	445	475	SEE APPENDIX C.4 - TW-4						BJV	F	PEEL / PERFORMED BY TRI
4/23/2019	11:30 AM	TT	HV	X	3	55	-	-	500	500	144	169	111	143	165	150	BJV	P	
											-	-	-						

## Appendix C.3

### Destructive Sampling Log

# Destructive Log

Destruct Number	From	To	Technician	Machine	Station	Field Test Date	Field P/F	Lab P/F	QA ID	Reason / Comments
DS-1	R1	EX	TG	1	SEE SURVEY	-	-	F	DH	NO TENSIO METER ONSITE
DS-1A	R1	EX	TG	1	SEE SURVEY	-	-	F	BJV	NO TENSIO METER ONSITE
DS-1B	R1	EX	TG	1	SEE SURVEY	-	-	P	BJV	NO TENSIO METER ONSITE
DS-1R	R4	EX	CP	1	SEE SURVEY	-	-	F	BJV	NO TENSIO METER ONSITE
DS-1R2	R6	EX	HV	3	SEE SURVEY	4/23/2019	P	P	BJV	

## Appendix C.4

### Destructive Sampling Laboratory Test Results



Date: 2019-04-01

**Mail To:**  
**Brad Vitts**  
**Feezor Engineering. Inc.**  
**406 E. Walnut St**  
**Chatham , IL , 62629**

**Bill To:**  
**Feezor Engineering. Inc.**  
**BT-133-19**

e-mail:bvits@fezorengineering.com

Dear Mr. Vitts,

Thank you for consulting with TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

**Project:** 2019 LFG Corrective Action  
**TRI Job Reference Number:** 45475  
**Material(s) Tested:** (3) Single Extrusion Weld Seam(s)  
**Test(s) Requested:** SAME DAY Peel and Shear  
(ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

Codes:	
AD	Adhesion Failure (100% Peel)
BRK	Break in sheeting away from Seam edge.
SE	Break in sheeting at edge of seam.
AD-BRK	Break in sheeting after some adhesion failure - partial peel.
SIP	Separation in the plane of the sheet (leaving the bond intact).
FTB	Film tearing bond (all non "AD" failures).
NON-FTB	100% peel.

If you have any questions or require any additional information, please call us at 1-800-880-8378.

Sincerely,

Brian Anderson  
Project Manager  
Geosynthetic Services Division  
<http://www.geosyntheticstestinc.com>

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.



**DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS - SINGLE TRACK**

**TRI Client: Feezor Engineering. Inc.**

**Project: 2019 LFG Corrective Action**

**Material: 60 mil. HDPE**

**SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)**

**TRI Log#: 45475**

PARAMETER	TEST REPLICATE NUMBER					MEAN
	1	2	3	4	5	
<b>Sample ID: TRIAL WELD-1   Weld: Single Extrusion</b>						
<b>Side: Peel</b>						<b>Peel</b>
Peel Strength (ppi)	151	144	147	145	145	<b>146</b>
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
<b>Shear</b>						<b>Shear</b>
Shear Strength (ppi)	159	157	157	157	156	<b>157</b>
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
<b>Sample ID: TRIAL WELD-2   Weld: Single Extrusion</b>						
<b>Side: Peel</b>						<b>Peel</b>
Peel Strength (ppi)	140	122	112	125	123	<b>124</b>
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
<b>Shear</b>						<b>Shear</b>
Shear Strength (ppi)	154	150	155	151	152	<b>152</b>
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
<b>Sample ID: DS-1   Weld: Single Extrusion</b>						
<b>Side: Peel</b>						<b>Peel</b>
Peel Strength (ppi)	84	118	141	133	94	<b>114</b>
Peel Incursion (%)	100	100	80	100	100	
Peel Locus Of Failure Code	AD	AD	AD-BRK	AD	AD	
Peel NSF Failure Code	NON-FTB	NON-FTB	FTB	NON-FTB	NON-FTB	
<b>Shear</b>						<b>Shear</b>
Shear Strength (ppi)	166	150	159	163	156	<b>159</b>
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.



Date: 2019-04-17

**Mail To:**  
**Andrew Roberts**  
**Feezor Engineering. Inc.**  
**406 East Walnut**  
**Chatham , IL , 62629**

**Bill To:**  
**Feezor Engineering. Inc.**

e-mail:aroberts@fezorengineering.com

Dear Mr. Roberts,

Thank you for consulting with TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

**Project:** **Bridgeton Landfill - N. Quarry Surface Collector**

TRI Job Reference Number: **45946**

Material(s) Tested: (3) Single Extrusion Weld Seam(s)

Test(s) Requested: SAME DAY Peel and Shear  
(ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

Codes:

AD	Adhesion Failure (100% Peel)
BRK	Break in sheeting away from Seam edge.
SE	Break in sheeting at edge of seam.
AD-BRK	Break in sheeting after some adhesion failure - partial peel.
SIP	Separation in the plane of the sheet (leaving the bond intact).
FTB	Film tearing bond (all non "AD" failures).
NON-FTB	100% peel.

If you have any questions or require any additional information, please call us at 1-800-880-8378.

Sincerely,

Brian Anderson  
Project Manager  
Geosynthetic Services Division  
<http://www.geosyntheticstestinc.com>

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS - SINGLE TRACK

TRI Client: Feezor Engineering. Inc.

Project: Bridgeton Landfill - N. Quarry Surface Collector

Material: 60 mil. HDPE

SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

TRI Log#: 45946

TEST REPLICATE NUMBER

PARAMETER	1	2	3	4	5	MEAN
-----------	---	---	---	---	---	------

Sample ID: DS-1A | Weld: Single Extrusion

Side: Peel						Peel
Peel Strength (ppi)	112	74	85	70	90	86
Peel Incursion (%)	100	100	100	100	100	
Peel Locus Of Failure Code	AD	AD	AD	AD	AD	
Peel NSF Failure Code	NON-FTB	NON-FTB	NON-FTB	NON-FTB	NON-FTB	
Shear						Shear
Shear Strength (ppi)	154	118	159	134	156	144
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

Sample ID: DS-1B | Weld: Single Extrusion

Side: Peel						Peel
Peel Strength (ppi)	111	124	123	135	121	123
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SIP	SE	SIP	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						Shear
Shear Strength (ppi)	141	147	142	142	152	145
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

Sample ID: TW-3 | Weld: Single Extrusion

Side: Peel						Peel
Peel Strength (ppi)	148	145	143	147	146	146
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						Shear
Shear Strength (ppi)	145	143	141	153	153	147
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.



Date: 2019-04-22

**Mail To:**  
**Andrew Roberts**  
**Feezor Engineering. Inc.**  
**406 East Walnut**  
**Chatham , IL , 62629**

**Bill To:**  
**Feezor Engineering. Inc.**

e-mail:aroberts@fezorengineering.com

Dear Mr. Roberts,

Thank you for consulting with TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

**Project: Bridgeton Landfill - N. Quarry Surface Collector**

TRI Job Reference Number: **46062**

Material(s) Tested: (2) Single Extrusion Weld Seam(s)

Test(s) Requested: SAME DAY Peel and Shear  
(ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

Codes:

AD	Adhesion Failure (100% Peel)
BRK	Break in sheeting away from Seam edge.
SE	Break in sheeting at edge of seam.
AD-BRK	Break in sheeting after some adhesion failure - partial peel.
SIP	Separation in the plane of the sheet (leaving the bond intact).
FTB	Film tearing bond (all non "AD" failures).
NON-FTB	100% peel.

If you have any questions or require any additional information, please call us at 1-800-880-8378.

Sincerely,

Brian Anderson  
Project Manager  
Geosynthetic Services Division  
<http://www.geosyntheticstestinc.com>

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS - SINGLE TRACK

TRI Client: Feezor Engineering. Inc.

Project: Bridgeton Landfill - N. Quarry Surface Collector

Material: 60 mil. HDPE

SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

TRI Log#: 46062

TEST REPLICATE NUMBER

PARAMETER	1	2	3	4	5	MEAN
-----------	---	---	---	---	---	------

Sample ID: DS-1R | Weld: Single Extrusion

<b>Side: Peel</b>						<b>Peel</b>
Peel Strength (ppi)	23	20	22	25	22	<b>22</b>
Peel Incursion (%)	100	100	100	100	100	
Peel Locus Of Failure Code	AD	AD	AD	AD	AD	
Peel NSF Failure Code	NON-FTB	NON-FTB	NON-FTB	NON-FTB	NON-FTB	
<b>Shear</b>						<b>Shear</b>
Shear Strength (ppi)	154	157	153	151	150	<b>153</b>
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

Sample ID: TW-4 | Weld: Single Extrusion

<b>Side: Peel</b>						<b>Peel</b>
Peel Strength (ppi)	117	135	92	116	136	<b>119</b>
Peel Incursion (%)	<5	50	80	70	<5	
Peel Locus Of Failure Code	SE	AD-BRK	AD-BRK	AD-BRK	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
<b>Shear</b>						<b>Shear</b>
Shear Strength (ppi)	153	158	154	148	147	<b>152</b>
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.





DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS - SINGLE TRACK

TRI Client: Feezor Engineering. Inc.

Project: Bridgeton Landfill - N. Quarry Surface Collector

Material: 60 mil. HDPE

SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

TRI Log#: 46118

PARAMETER	TEST REPLICATE NUMBER					MEAN
	1	2	3	4	5	
<b>Sample ID: DS-1R2   Weld: Single Extrusion</b>						
<b>Side: Peel</b>						<b>Peel</b>
Peel Strength (ppi)	120	143	143	136	139	<b>136</b>
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
<b>Shear</b>						<b>Shear</b>
Shear Strength (ppi)	152	142	137	150	149	<b>146</b>
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

## Appendix C.5

### Repair Log

# Geomembrane Repair Log

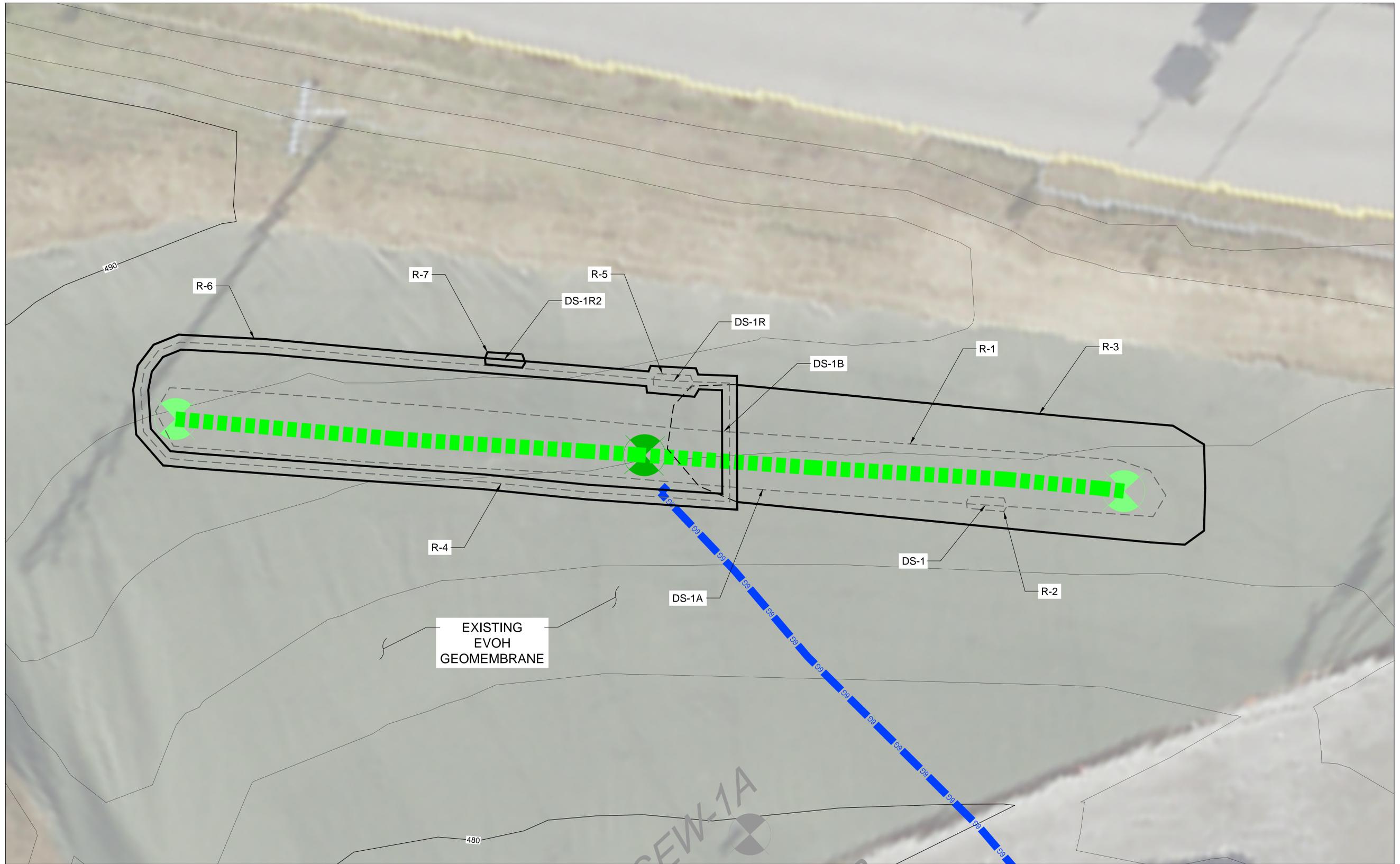
Num	Marked						Repaired							Tested				Notes		
	Panel 1	Panel 2	Panel 3	Panel 4	Panel 5	Panel 6	Station	Type	Date	Time	Length	Width	Tech	Mach	Date	Tech	QA ID	Pass / Fail	DS #	Comments
1	EX						SEE DIAGRAM	CAP	3/26/2019	1:10 AM	135	8	TG	1	3/27/2019	TG	DH	P		FUSION SOLUTIONS
2	R1	EX					SEE DIAGRAM	CAP	3/27/2019	8:10 AM	5	2	TG	1	3/27/2019	TG	DH	P	1	FUSION SOLUTIONS
3	R1	R2	EX				SEE DIAGRAM	CAP	4/16/2019	8:10 AM	71	16	CP	1	4/16/2019	AG	BV	P	1A, 1B	FUSION SOLUTIONS; CAPS DS-1A, 1B AND R-2
4	R1	R3	EX				SEE DIAGRAM	CAP	4/19/2019	9:10 AM	78	16	CP	1	4/19/2019	AG	BV	P		FUSION SOLUTIONS; TRIAL WELD FAILED AT LAB; CAPPED BY R-6
5	R4	EX					SEE DIAGRAM	CAP	4/19/2019	12:00 PM	5	2	CP	1	4/19/2019	AG	BV	P	1R	FUSION SOLUTIONS
6	R3	R4	R5	EX			SEE DIAGRAM	CAP	4/23/2019	11:35 AM	184	2	HV	3	4/23/2019	AC	BV	P		MID-AMERICA; CAPS R-4 AND DS-1R
7	R6	EX					SEE DIAGRAM	CAP	4/23/2019	4:00 PM	5	2	HV	3	4/23/2019	AC	BV	P	1R2	MID-AMERICA

## Appendix D

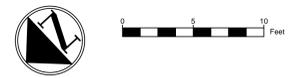
### As-Built Drawings

- #1 Surface Collector – Plan and Details
- #2 Surface Collector – FML Diagram





EXISTING  
EVOH  
GEOMEMBRANE



LEGEND			
	12/12/18 AERIAL GRADING (2' CONTOUR)		SURFACE COLLECTOR
	12/12/18 AERIAL GRADING (10' CONTOUR)		SURFACE COLLECTOR RISER WITH WELLHEAD
	GAS MONITORING PROBE		SURFACE COLLECTOR RISER STUB
	GAS EXTRACTION WELL		6" VACUUM LATERAL
	PREVIOUSLY ABANDONED EXTRACTION POINT		GEOMEMBRANE CAP
			COVERED GEOMEMBRANE CAP

NOTE:  
1.) GEOMEMBRANE ROLL NUMBER 10168467 USED FOR REPAIRS

	PREPARED BY 	PROJECT BRIDGETON LANDFILL GMP-8 BRIDGETON, ST. LOUIS COUNTY, MISSOURI	PREPARED FOR BRIDGETON LANDFILL LLC 13570 ST. CHARLES ROCK ROAD BRIDGETON, MO 63044	APRIL 2019 DESIGNED BY: BJV APPROVED BY: DRF	DRAWING # <b>2</b>
	3377 Hollenberg Dr. Bridgeton, MO 63044, PH: 217-483-3118 Missouri State Certificate Of Authority #: E-200912213	<b>FEEZOR</b> ENGINEERING, INC. Engineering for a Better World	<b>SURFACE COLLECTOR - FML DIAGRAM</b>		REVISIONS: