Slide Analysis Information

East Regional Landfill 2024 EDOP Slope Stability

Project Summary

File Name: Profile3 - 0.1 SD.slim
Slide Modeler Version: 6.039
Project Title: East Regional Landfill 2024 EDOP Slope Stability
Analysis: Profile 3 - Module 1 Final Cover and Waste
Author: Michael Bucari-Tovo
Company: American Environmental Consulting
Date Created: 8/23/2024, 7:47:53 AM
Comments:

Material and Seismic Standard Deviation: 10%
Min/Max: +/- 3 Standard Deviations

General Settings

Units of Measurement: Imperial Units
Time Units: seconds
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Bishop simplified
GLE/Morgenstern-Price with interslice force function: Half Sine
Janbu corrected
Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Invalid Surfaces
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.0818

Material Properties

Property	Cover Soils	Waste	Native Soils	Claystone
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]			104	
Saturated Unit Weight [lbs/ft3]			115	
Cohesion [psf]	78	200	10	1000
Friction Angle [deg]	25.7	32	30.5	18
Water Surface	None	None	Water Table	Water Table
Hu Value			Automatically Calculated	Automatically Calculated
Ru Value	0	0		

Probabilistic Analysis Input

General Settings

Sensitivity Analysis: Off
Probabilistic Analysis: On
Sampling Method: Latin-Hypercube
Number of Samples: 10000
Analysis Type: Overall Slope

Variables

Material	Property	Distribution	Mean	Min	Max	Standard Deviation
Cover Soils	Cohesion	Normal	78	54.6	101.4	7.8
Cover Soils	Phi	Normal	25.7	17.99	33.41	2.57
Cover Soils	Unit Weight	Normal	98	68.6	127.4	9.8
Waste	Cohesion	Normal	200	140	260	20
Waste	Phi	Normal	32	22.4	41.6	3.2
Waste	Unit Weight	Normal	60	42	78	6
Native Soils	Cohesion	Normal	10	7	13	1
Native Soils	Phi	Normal	30.5	21.35	39.65	3.05
Native Soils	Unit Weight	Normal	104	72.8	135.2	10.4
Claystone	Cohesion	Normal	1000	700	1300	100
Claystone	Phi	Normal	18	12.6	23.4	1.8
Claystone	Unit Weight	Normal	120	84	156	12

Seismic Coefficient	Property	Distribution	Mean	Min	Max	Standard Deviation
Horizontal Seismic Coefficient		Normal	0.0818	0.05726	0.10634	0.00818
Vertical Seismic Coefficient			0			

Global Minimums

Method: bishop simplified

FS: 1.762980
Center: 1071.519, 5803.000
Radius: 603.736
Left Slip Surface Endpoint: 553.494, 5492.923
Right Slip Surface Endpoint: 1412.154, 5304.538
Resisting Moment=2.27572e+009 lb-ft
Driving Moment=1.29084e+009 lb-ft
Total Slice Area=123381 ft2

Method: janbu corrected

FS: 1.665320
Center: 1071.519, 5686.120
Radius: 512.399
Left Slip Surface Endpoint: 597.846, 5490.705
Right Slip Surface Endpoint: 1413.509, 5304.551
Resisting Horizontal Force=3.74009e+006 lb
Driving Horizontal Force=2.24587e+006 lb
Total Slice Area=131636 ft2

Method: spencer

FS: 1.749260
Center: 1080.791, 5803.000
Radius: 598.747
Left Slip Surface Endpoint: 569.061, 5492.145
Right Slip Surface Endpoint: 1412.509, 5304.541
Resisting Moment=2.1437e+009 lb-ft
Driving Moment=1.22549e+009 lb-ft
Resisting Horizontal Force=3.26001e+006 lb
Driving Horizontal Force=1.86365e+006 lb
Total Slice Area=116782 ft2

Method: gle/morgenstern-price

FS: 1.748680
Center: 1080.791, 5803.000
Radius: 598.747
Left Slip Surface Endpoint: 569.061, 5492.145
Right Slip Surface Endpoint: 1412.509, 5304.541
Resisting Moment=2.14299e+009 lb-ft
Driving Moment=1.22549e+009 lb-ft
Resisting Horizontal Force=3.25726e+006 lb
Driving Horizontal Force=1.86269e+006 lb
Total Slice Area=116782 ft2

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 46963
Number of Invalid Surfaces: 2868

Error Codes:

Error Code -103 reported for 2860 surfaces
Error Code -106 reported for 1 surface
Error Code -109 reported for 7 surfaces

Method: janbu corrected

Number of Valid Surfaces: 46963
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Number of Valid Surfaces: 46963
Number of Invalid Surfaces: 2868

Error Codes:

Error Code -103 reported for 2860 surfaces
Error Code -106 reported for 1 surface
Error Code -109 reported for 7 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.
-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.
-109 = Soiltype for slice base not located. This error should occur very rarely, if at all. It may occur if a very low number of slices is combined with certain soil geometries, such that the midpoint of a slice base is actually outside the soil region,even though the slip surface is wholly within the soil region.

Slice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.76298

				Base	Base	Shear	Shear	Base	Pore	Effective

Number	[ft]	[lbs]	Material	Cohesion [psf]	Friction Angle [degrees]	Stress [psf]	Strength [psf]	Normal Stress [psf]	Pressure [psf]	Normal Stress [psf]
1	2.17733	373.412	Cover Soils	78	25.7	62.7142	110.564	67.6628	0	67.6628
2	37.1665	71142	Waste	200	32	522.144	920.529	1153.09	0	1153.09
3	37.1665	176372	Waste	200	32	1266.28	2232.43	3252.57	0	3252.57
4	37.1665	261890	Waste	200	32	1936.63	3414.24	5143.86	0	5143.86
5	37.1665	332968	Waste	200	32	2540.6	4479.03	6847.87	0	6847.87
6	37.1665	391986	Waste	200	32	3079.68	5429.41	8368.8	0	8368.8
7	11.8224	135338	Native Soils	10	30.5	3159.47	5570.08	9439.13	0	9439.13
8	36.8539	466726	Claystone	1000	18	2574.79	4539.31	11191.8	298.927	10892.9
9	36.8539	528191	Claystone	1000	18	2694.52	4750.39	13029	1486.49	11542.5
10	36.8539	575555	Claystone	1000	18	2781.08	4902.99	14494.7	2482.52	12012.2
11	36.8539	610201	Claystone	1000	18	2837.43	5002.34	15621.4	3303.44	12317.9
12	36.8539	633437	Claystone	1000	18	2867.19	5054.8	16440.5	3961.11	12479.4
13	36.8539	646470	Claystone	1000	18	2874.18	5067.13	16981.6	4464.24	12517.3
14	36.8539	648996	Claystone	1000	18	2855.54	5034.26	17235.1	4818.87	12416.2
15	36.8539	641277	Claystone	1000	18	2811.4	4956.44	17205.6	5028.91	12176.7
16	36.8539	623498	Claystone	1000	18	2741.83	4833.79	16895.7	5096.53	11799.2
17	36.8539	595733	Claystone	1000	18	2646.68	4666.04	16304.8	5021.86	11282.9
18	36.8539	557944	Claystone	1000	18	2525.5	4452.4	15428.8	4803.38	10625.4
19	36.8539	509984	Claystone	1000	18	2377.66	4191.77	14260.3	4437.01	9823.26
20	36.8539	451573	Claystone	1000	18	2202.29	3882.6	12787.6	3915.88	8871.73
21	36.8539	382294	Claystone	1000	18	1998.42	3523.17	10994.6	3229.1	7765.51
22	36.8539	308637	Claystone	1000	18	1802.2	3177.24	9065.48	2364.64	6700.84
23	36.8539	234466	Claystone	1000	18	1636.55	2885.21	7117.26	1315.17	5802.09
24	36.8539	126042	Claystone	1000	18	1315.82	2319.77	4140.15	78.3174	4061.83
25	32.3122	39173.5	Native Soils	10	30.5	521.818	919.954	1544.79	0	1544.79

Global Minimum Query (janbu corrected) - Safety Factor: 1.66532

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	1.49051	255.623	Cover Soils	78	25.7	55.0783	91.723	28.5142	0	28.5142
2	34.5506	80053.9	Waste	200	32	551.599	918.589	1149.98	0	1149.98
3	34.5506	198121	Waste	200	32	1432.48	2385.54	3497.59	0	3497.59
4	34.5506	287293	Waste	200	32	2209.98	3680.32	5569.67	0	5569.67
5	34.5506	358378	Waste	200	32	2900.58	4830.4	7410.18	0	7410.18
6	8.97973	103603	Native Soils	10	30.5	3092.56	5150.11	8726.15	0	8726.15
7	35.6868	468612	Claystone	1000	18	2649.56	4412.36	10980	477.855	10502.2
8	35.6868	550630	Claystone	1000	18	2847.98	4742.8	13501.4	1982.23	11519.2
9	35.6868	614713	Claystone	1000	18	3001.89	4999.11	15539.4	3231.38	12308
10	35.6868	663188	Claystone	1000	18	3116.01	5189.16	17151.5	4258.61	12892.9
11	35.6868	697967	Claystone	1000	18	3195.13	5320.92	18385.5	5087.1	13298.4

12	35.6868	720934	Claystone	1000	18	3245.42	5404.67	19289.3	5733.1	13556.2
13	35.6868	732325	Claystone	1000	18	3265.67	5438.38	19867.8	6207.83	13660
14	35.6868	732473	Claystone	1000	18	3255.72	5421.82	20127.9	6518.91	13609
15	35.6868	721727	Claystone	1000	18	3216.04	5355.73	20076.5	6670.98	13405.6
16	35.6868	700262	Claystone	1000	18	3146.62	5240.13	19715.8	6666.01	13049.8
17	35.6868	668098	Claystone	1000	18	3047.07	5074.34	19042.9	6503.37	12539.5
18	35.6868	625101	Claystone	1000	18	2916.53	4856.96	18050.3	6179.81	11870.5
19	35.6868	570961	Claystone	1000	18	2753.71	4585.81	16724.7	5688.67	11036
20	35.6868	505174	Claystone	1000	18	2556.79	4257.87	15045.9	5019.21	10026.7
21	35.6868	427309	Claystone	1000	18	2325.08	3872	12994.8	4155.65	8839.12
22	35.6868	348367	Claystone	1000	18	2127.53	3543.02	10908.1	3081.47	7826.6
23	35.6868	255685	Claystone	1000	18	1890.78	3148.75	8395.46	1782.28	6613.18
24	35.6868	134196	Claystone	1000	18	1519	2529.62	4946.7	239.002	4707.7
25	24.6276	27637.2	Native Soils	10	30.5	594.379	989.831	1663.42	0	1663.42

Global Minimum Query (spencer) - Safety Factor: 1.74926

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	2.21077	379.147	Cover Soils	78	25.7	61.1523	106.971	60.198	0	60.198
2	37.8604	72584.9	Waste	200	32	469.674	821.582	994.74	0	994.74
3	37.8604	179855	Waste	200	32	1137.09	1989.07	2863.11	0	2863.11
4	37.8604	266776	Waste	200	32	1765.8	3088.85	4623.11	0	4623.11
5	37.8604	338778	Waste	200	32	2353.82	4117.45	6269.24	0	6269.24
6	37.8604	393176	Waste	200	32	2861.1	5004.8	7689.3	0	7689.3
7	11.8647	132073	Native Soils	10	30.5	2903.75	5079.42	8606.19	0	8606.19
8	35.6941	438007	Claystone	1000	18	2385.55	4172.95	10020.6	255.259	9765.32
9	35.6941	493195	Claystone	1000	18	2494.53	4363.58	11724.3	1372.31	10352
10	35.6941	535656	Claystone	1000	18	2584.21	4520.46	13145.8	2311	10834.8
11	35.6941	566709	Claystone	1000	18	2655.28	4644.77	14303.2	3085.74	11217.4
12	35.6941	587776	Claystone	1000	18	2710.27	4740.97	15220.6	3707.12	11513.5
13	35.6941	599236	Claystone	1000	18	2747.81	4806.64	15898.4	4182.74	11715.7
14	35.6941	601047	Claystone	1000	18	2764.91	4836.55	16325.8	4518.12	11807.7
15	35.6941	593484	Claystone	1000	18	2760.45	4828.74	16500.4	4716.79	11783.7
16	35.6941	576707	Claystone	1000	18	2733.04	4780.79	16416.6	4780.53	11636.1
17	35.6941	550784	Claystone	1000	18	2680.96	4689.69	16065.3	4709.57	11355.7
18	35.6941	515684	Claystone	1000	18	2602.1	4551.75	15433.5	4502.35	10931.2
19	35.6941	471277	Claystone	1000	18	2493.83	4362.36	14503.4	4155.09	10348.3
20	35.6941	417320	Claystone	1000	18	2352.89	4115.82	13250.5	3661.04	9589.51
21	35.6941	353453	Claystone	1000	18	2175.03	3804.7	11642.6	3010.58	8631.99
22	35.6941	287057	Claystone	1000	18	2003.84	3505.24	9903.62	2193.3	7710.32
23	35.6941	219280	Claystone	1000	18	1846.58	3230.14	8067.13	1203.45	6863.68
24	35.6941	119037	Claystone	1000	18	1488.71	2604.14	4976.36	39.3186	4937.05

25	33.2707	40340.5	Native Soils	10	30.5	701.851	1227.72	2067.27	0	2067.27

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.74868

Slice Number	Width [ft]	Weight [lbs]	Base Material	Base Cohesion [psf]	Base Friction Angle [degrees]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]
1	2.21077	379.147	Cover Soils	78	25.7	63.3	110.691	67.928	0	67.928
2	37.8604	72584.9	Waste	200	32	515.815	901.996	1123.43	0	1123.43
3	37.8604	179855	Waste	200	32	1213.1	2121.32	3074.76	0	3074.76
4	37.8604	266776	Waste	200	32	1814.15	3172.36	4756.76	0	4756.76
5	37.8604	338778	Waste	200	32	2350.01	4109.41	6256.36	0	6256.36
6	37.8604	393176	Waste	200	32	2801.26	4898.51	7519.18	0	7519.18
7	11.8647	132073	Native Soils	10	30.5	2818.86	4929.29	8351.3	0	8351.3
8	35.6941	438007	Claystone	1000	18	2324.04	4064	9685.3	255.259	9430.04
9	35.6941	493195	Claystone	1000	18	2412.96	4219.5	11280.9	1372.31	9908.58
10	35.6941	535656	Claystone	1000	18	2493.23	4359.87	12651.6	2311	10340.6
11	35.6941	566709	Claystone	1000	18	2568.83	4492.07	13833.2	3085.74	10747.5
12	35.6941	587776	Claystone	1000	18	2642.9	4621.58	14853.2	3707.12	11146.1
13	35.6941	599236	Claystone	1000	18	2712.35	4743.03	15702.6	4182.74	11519.8
14	35.6941	601047	Claystone	1000	18	2770.43	4844.59	16350.5	4518.12	11832.4
15	35.6941	593484	Claystone	1000	18	2810.49	4914.64	16764.8	4716.79	12048
16	35.6941	576707	Claystone	1000	18	2824.38	4938.94	16903.4	4780.53	12122.8
17	35.6941	550784	Claystone	1000	18	2803.15	4901.81	16718.1	4709.57	12008.5
18	35.6941	515684	Claystone	1000	18	2738.03	4787.94	16160.4	4502.35	11658.1
19	35.6941	471277	Claystone	1000	18	2621.67	4584.47	15187	4155.09	11031.9
20	35.6941	417320	Claystone	1000	18	2449.49	4283.37	13766.2	3661.04	10105.2
21	35.6941	353453	Claystone	1000	18	2220.74	3883.37	11884.7	3010.58	8874.1
22	35.6941	287057	Claystone	1000	18	1985.59	3472.17	9801.86	2193.3	7608.56
23	35.6941	219280	Claystone	1000	18	1760.97	3079.38	7603.15	1203.45	6399.7
24	35.6941	119037	Claystone	1000	18	1374.68	2403.88	4360.02	39.3186	4320.7
25	33.2707	40340.5	Native Soils	10	30.5	545.223	953.42	1601.61	0	1601.61

Interslice Data

Global Minimum Query (bishop simplified) - Safety Factor: 1.76298

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	553.494	5492.92	0	0	0
2	555.672	5489.31	138.326	0	0
3	592.838	5435.08	49103.7	0	0
4	630.005	5391.22	159188	0	0

5	667.171	5354.67	296721	0	0
6	704.338	5323.76	441327	0	0
7	741.504	5297.44	579254	0	0
8	753.326	5289.92	624024	0	0
9	790.18	5268.82	803536	0	0
10	827.034	5250.98	979992	0	0
11	863.888	5236.09	1.14053e+006	0	0
12	900.742	5223.92	1.27609e+006	0	0
13	937.596	5214.3	1.38044e+006	0	0
14	974.45	5207.12	1.44954e+006	0	0
15	1011.3	5202.27	1.481e+006	0	0
16	1048.16	5199.72	1.47397e+006	0	0
17	1085.01	5199.41	1.42912e+006	0	0
18	1121.87	5201.37	1.34859e+006	0	0
19	1158.72	5205.59	1.23602e+006	0	0
20	1195.57	5212.15	1.09677e+006	0	0
21	1232.43	5221.1	938120	0	0
22	1269.28	5232.57	769701	0	0
23	1306.13	5246.72	600389	0	0
24	1342.99	5263.74	438150	0	0
25	1379.84	5283.93	316430	0	0
26	1412.15	5304.54	0	0	0

Global Minimum Query (janbu corrected) - Safety Factor: 1.66532

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	597.846	5490.71	0	0	0
2	599.337	5487.13	33.9672	0	0
3	633.888	5419.6	63607.7	0	0
4	668.438	5369.77	200539	0	0
5	702.989	5330.12	362228	0	0
6	737.539	5297.52	524611	0	0
7	746.519	5289.98	568825	0	0
8	782.206	5263.21	798697	0	0
9	817.893	5240.89	1.03505e+006	0	0
10	853.579	5222.38	1.25707e+006	0	0
11	889.266	5207.23	1.4508e+006	0	0
12	924.953	5195.13	1.60691e+006	0	0
13	960.64	5185.86	1.71929e+006	0	0
14	996.327	5179.27	1.78403e+006	0	0
15	1032.01	5175.25	1.79913e+006	0	0
16	1067.7	5173.74	1.76426e+006	0	0

17	1103.39	5174.71	1.68071e+006	0	0
18	1139.07	5178.19	1.55137e+006	0	0
19	1174.76	5184.23	1.38088e+006	0	0
20	1210.45	5192.91	1.17595e+006	0	0
21	1246.13	5204.39	945824	0	0
22	1281.82	5218.87	702859	0	0
23	1317.51	5236.63	455414	0	0
24	1353.19	5258.09	223129	0	0
25	1388.88	5283.83	48065.6	0	0
26	1413.51	5304.55	0	0	0

Global Minimum Query (spencer) - Safety Factor: 1.74926

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	569.061	5492.14	0	0	0
2	571.272	5488.53	112.984	24.9592	12.4571
3	609.132	5434.17	42323.7	9349.71	12.4571
4	646.993	5390.3	139514	30820.1	12.4572
5	684.853	5353.85	262905	58078.2	12.4571
6	722.714	5323.13	394023	87043.4	12.4571
7	760.574	5297.08	518025	114437	12.4572
8	772.439	5289.76	557305	123114	12.4571
9	808.133	5269.94	706485	156069	12.4571
10	843.827	5253.14	854608	188791	12.4571
11	879.521	5239.1	990686	218852	12.4571
12	915.215	5227.6	1.10653e+006	244442	12.4571
13	950.909	5218.51	1.19613e+006	264236	12.4571
14	986.603	5211.71	1.25507e+006	277258	12.4572
15	1022.3	5207.12	1.28036e+006	282844	12.4571
16	1057.99	5204.69	1.27033e+006	280629	12.4572
17	1093.69	5204.39	1.22467e+006	270542	12.4571
18	1129.38	5206.23	1.14441e+006	252811	12.4571
19	1165.07	5210.21	1.03205e+006	227990	12.4571
20	1200.77	5216.4	891809	197009	12.4571
21	1236.46	5224.84	729917	161246	12.4571
22	1272.16	5235.66	555189	122647	12.4572
23	1307.85	5248.98	375144	82872.9	12.4571
24	1343.54	5264.99	197926	43723.8	12.4571
25	1379.24	5283.94	60151.3	13288	12.4571
26	1412.51	5304.54	0	0	0

Global Minimum Query (gle/morgenstern-price) - Safety Factor: 1.74868

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [degrees]
1	569.061	5492.14	0	0	0
2	571.272	5488.53	136.261	0.316086	0.132909
3	609.132	5434.17	47611	1994.43	2.39872
4	646.993	5390.3	151244	12194.7	4.60975
5	684.853	5353.85	277733	32707.8	6.71662
6	722.714	5323.13	408678	62350.8	8.67456
7	760.574	5297.08	530610	97811.7	10.4446
8	772.439	5289.76	569063	110153	10.9552
9	808.133	5269.94	713868	156332	12.3524
10	843.827	5253.14	857533	206280	13.5256
11	879.521	5239.1	989999	255284	14.4595
12	915.215	5227.6	1.10361e+006	298662	15.1428
13	950.909	5218.51	1.19236e+006	332201	15.5683
14	986.603	5211.71	1.25132e+006	352468	15.7313
15	1022.3	5207.12	1.27661e+006	357160	15.6301
16	1057.99	5204.69	1.26553e+006	345401	15.2659
17	1093.69	5204.39	1.21683e+006	317923	14.6424
18	1129.38	5206.23	1.13109e+006	277118	13.7663
19	1165.07	5210.21	1.01106e+006	226889	12.648
20	1200.77	5216.4	862107	172293	11.3017
21	1236.46	5224.84	692483	118946	9.74644
22	1272.16	5235.66	513573	72235.9	8.00634
23	1307.85	5248.98	335597	35928	6.11064
24	1343.54	5264.99	168922	12089.8	4.0937
25	1379.24	5283.94	46945.4	1634.7	1.99431
26	1412.51	5304.54	0	0	0

Probabilistic Analysis Results (Overall Slope)

Method: bishop simplified
Factor of Safety, mean: 1.745977
Factor of Safety, standard deviation: 0.147625
Factor of Safety, minimum: 1.223190
Factor of Safety, maximum: 2.328380
Probability of Failure: 0.000% (= 0 failed surfaces / 10000 valid surfaces)
Reliability index: 5.05320 (assuming normal distribution)
Reliability index: 6.56099 (assuming lognormal distribution)
* best fit = Gamma

Method: janbu corrected
Factor of Safety, mean: 1.659132

Factor of Safety, standard deviation: 0.149024
Factor of Safety, minimum: 1.127510
Factor of Safety, maximum: 2.301990
Probability of Failure: 0.000% (= 0 failed surfaces / 10000 valid surfaces)
Reliability index: 4.42298 (assuming normal distribution)
Reliability index: 5.60325 (assuming lognormal distribution)
* best fit = Gamma

Method: spencer
Factor of Safety, mean: 1.734859
Factor of Safety, standard deviation: 0.145918
Factor of Safety, minimum: 1.219160
Factor of Safety, maximum: 2.310510
Probability of Failure: 0.000% (= 0 failed surfaces / 10000 valid surfaces)
Reliability index: 5.03612 (assuming normal distribution)
Reliability index: 6.51970 (assuming lognormal distribution)
* best fit = Gamma

Method: gle/morgenstern-price
Factor of Safety, mean: 1.733984
Factor of Safety, standard deviation: 0.145996
Factor of Safety, minimum: 1.217310
Factor of Safety, maximum: 2.310530
Probability of Failure: 0.000% (= 0 failed surfaces / 10000 valid surfaces)
Reliability index: 5.02742 (assuming normal distribution)
Reliability index: 6.50684 (assuming lognormal distribution)
* best fit = Gamma

Critical Probabilistic Surface

Method: bishop simplified
Normal Reliability Index: 4.44411
Probability of Failure: 0
Mean Factor of Safety: 2.04847
Center: 1182.78, 6011.71
Radius: 711.441
Left Slip Surface Endpoint: 704.102, 5485.39
Right Slip Surface Endpoint: 1324.85, 5314.6
Lognormal Reliability Index: 6.09058
Probability of Failure: 0
Mean Factor of Safety: 1.84025
Center: 997.344, 5727.86
Radius: 591.103
Left Slip Surface Endpoint: 452.783, 5497.96
Right Slip Surface Endpoint: 1409.87, 5304.52

Method: janbu corrected
Normal Reliability Index: 4.13275
Probability of Failure: 0
Mean Factor of Safety: 1.69493
Center: 1025.16, 5644.38

Radius: 514.673
Left Slip Surface Endpoint: 532.961, 5493.95
Right Slip Surface Endpoint: 1411.67, 5304.53
Lognormal Reliability Index: 5.28206
Probability of Failure: 0
Mean Factor of Safety: 1.69493
Center: 1025.16, 5644.38
Radius: 514.673
Left Slip Surface Endpoint: 532.961, 5493.95
Right Slip Surface Endpoint: 1411.67, 5304.53

Method: spencer
Normal Reliability Index: 4.45636
Probability of Failure: 0
Mean Factor of Safety: 2.04602
Center: 1192.05, 6011.71
Radius: 710.197
Left Slip Surface Endpoint: 715.874, 5484.8
Right Slip Surface Endpoint: 1326.02, 5314.27
Lognormal Reliability Index: 6.04014
Probability of Failure: 0
Mean Factor of Safety: 1.80887
Center: 1006.62, 5752.91
Radius: 603.184
Left Slip Surface Endpoint: 460.133, 5497.59
Right Slip Surface Endpoint: 1410.07, 5304.52

Method: gle/morgenstern-price
Normal Reliability Index: 4.45105
Probability of Failure: 0
Mean Factor of Safety: 2.05205
Center: 1182.78, 6011.71
Radius: 711.441
Left Slip Surface Endpoint: 704.102, 5485.39
Right Slip Surface Endpoint: 1324.85, 5314.6
Lognormal Reliability Index: 5.99895
Probability of Failure: 0
Mean Factor of Safety: 1.82492
Center: 1006.62, 5727.86
Radius: 584.954
Left Slip Surface Endpoint: 469.085, 5497.14
Right Slip Surface Endpoint: 1410.29, 5304.52

List Of Coordinates

Water Table

X	Y
0	5294.43

5.7929	5294.36
13.2976	5294.28
20.8023	5294.19
35.8118	5294.03
50.8212	5293.87
65.8306	5293.72
95.8495	5293.41
125.868	5293.11
185.906	5292.52
215.925	5292.23
245.944	5291.94
275.963	5291.65
305.981	5291.37
320.991	5291.24
336	5291.1
351.01	5290.97
366.019	5290.84
381.029	5290.72
396.038	5290.6
411.047	5290.49
426.057	5290.38
441.066	5290.28
443.107	5290.27
448.571	5290.23
451.492	5290.21
456.076	5290.17
459.877	5290.14
463.58	5290.11
468.262	5290.06
471.085	5290.02
476.647	5289.92
478.59	5289.89
485.032	5289.73
486.095	5289.71
493.599	5289.51
508.609	5289.09
516.113	5288.88
523.618	5288.68
531.123	5288.48
538.628	5288.29
546.132	5288.1
553.637	5287.91

AEC

SLIDEINTERPRET 6.039

Project	East Regional Landfill 2024 EDOP Slope Stability		
Analysis Description	Profile 3 - Module 1 Final Cover and Waste		
Drawn By	Michael Bucari-Tovo	*Company*	American Environmental Consulting
Date	8/23/2024, 7:47:53 AM	*File Name*	Profile3 - 0.1 SD.slim

561.142	5287.73
568.646	5287.56
576.151	5287.39
583.656	5287.22
591.161	5287.06
598.665	5286.9
606.17	5286.75
613.675	5286.6
621.18	5286.45
628.684	5286.31
636.189	5286.18
643.694	5286.04
651.198	5285.91
658.703	5285.78
666.208	5285.66
673.713	5285.54
681.217	5285.42
688.722	5285.3
696.227	5285.19
703.731	5285.08
711.236	5284.97
718.741	5284.86
726.245	5284.76
741.255	5284.55
756.264	5284.36
771.274	5284.17
786.283	5283.99
801.293	5283.81
816.302	5283.64
831.311	5283.47
846.321	5283.32
861.33	5283.16
876.34	5283.01
891.349	5282.86
906.359	5282.72
921.368	5282.58
951.387	5282.3
1011.42	5281.76
1041.44	5281.49
1056.45	5281.35
1071.46	5281.2
1086.47	5281.05

1101.48	5280.9
1116.49	5280.74
1124	5280.66
1131.5	5280.57
1139	5280.48
1146.51	5280.39
1154.01	5280.3
1161.52	5280.2
1169.02	5280.1
1176.53	5280
1184.03	5279.89
1191.54	5279.78
1199.04	5279.66
1206.55	5279.53
1214.05	5279.4
1221.56	5279.26
1229.06	5279.11
1236.57	5278.95
1244.07	5278.78
1251.58	5278.6
1259.08	5278.41
1266.58	5278.2
1274.09	5277.99
1281.59	5277.77
1289.1	5277.53
1296.6	5277.29
1298.37	5277.23
1304.11	5277.04
1306.76	5276.94
1311.61	5276.78
1315.14	5276.66
1319.12	5276.52
1323.53	5276.36
1326.62	5276.26
1331.91	5276.07
1334.13	5276
1340.3	5275.78
1348.68	5275.5
1357.07	5275.23
1365.45	5274.96
1371.65	5274.78
1379.16	5274.56

1386.66	5274.35
1394.16	5274.16
1437.96	5272.75

External Boundary

X	Y
1437.96	5304.92
1431.5	5305.03
1423.51	5304.67
1417.13	5304.58
1408.06	5304.5
1407.88	5304.5
1407.83	5304.51
1402.21	5305.03
1399.94	5304.97
1398.07	5304.95
1393.3	5304.85
1385.13	5308.87
1383.34	5308.87
1381.22	5307.87
1368.67	5301.61
1365.67	5301.61
1359.66	5304.61
1352.76	5306.63
731.954	5484
426.954	5499.25
426.849	5499.25
340.745	5495.65
21.2871	5485.07
0	5484.73
0	5481.23
0	5308.27
0	5301.94
0	5294.43
0	5126.86
1437.96	5126.86
1437.96	5272.75
1437.96	5283.32

Material Boundary

X	Y
0	5481.23
21.2871	5481.57
340.745	5492.15
426.849	5495.75
426.954	5495.75
731.954	5480.5
1333.31	5308.68
1352.76	5306.63

Material Boundary

X	Y
0	5308.27
20.6283	5308.02
47.5115	5307.68
71.9532	5307.36
94.5619	5307.06
115.811	5306.78
143.309	5306.42
166.843	5306.1
178.111	5305.94
202.458	5305.6
226.252	5305.26
252.761	5304.88
275.67	5304.55
312.39	5304.01
340.361	5303.59
367.125	5303.17
389.918	5302.82
417.79	5302.38
437.629	5302.07
441.707	5302
464.411	5301.64
471.412	5301.54
506.814	5301
533.704	5300.61
549.007	5300.38
575.105	5299.98
590.457	5299.79
594.265	5299.73
643.274	5299

691.964	5298.3
712.639	5298
816.371	5296
825.773	5295.74
851.821	5295
886.156	5294
911.845	5293.24
1039.17	5291.96
1133.09	5291
1229.53	5290.03
1275.48	5289.57
1275.95	5289.74
1325.02	5306
1333.31	5308.68

Material Boundary

X	Y
0	5301.94
17.6706	5301.57
41.4817	5301.08
51.3602	5300.87
71.6355	5300.45
85.0497	5300.18
101.789	5299.83
118.739	5299.49
131.943	5299.22
152.429	5298.81
162.097	5298.61
192.251	5298.01
222.405	5297.41
252.559	5296.82
282.713	5296.23
312.866	5295.66
343.02	5295.09
373.174	5294.52
403.328	5293.97
421.945	5293.63
455.635	5293.03
463.636	5292.9
489.324	5292.55
493.79	5292.48

523.943	5292.14
554.097	5291.82
584.251	5291.5
614.405	5291.2
644.559	5290.91
674.713	5290.62
704.866	5290.35
725.151	5290.16
758.841	5289.87
792.531	5289.59
826.22	5289.31
855.636	5289.07
859.91	5289.04
885.79	5288.83
893.599	5288.77
915.943	5288.59
927.289	5288.49
946.097	5288.34
960.979	5288.21
976.251	5288.08
994.668	5287.91
1006.41	5287.81
1028.36	5287.61
1036.56	5287.53
1062.05	5287.28
1066.71	5287.24
1096.87	5286.92
1127.02	5286.6
1157.17	5286.27
1196.81	5285.83
1217.48	5285.61
1247.64	5285.29
1277.79	5285
1437.96	5283.32

Appendix P

Gas Probe Installation Logs

AEC

AMERICAN ENVIRONMENTAL CONSULTING, LLC
6885 S. MARSHALL ST., SUITE 3
LITTLETON, COLORADO 80128
Phone: 303-948-7733 Fax: 303-948-7739

LOG OF BORING NUMBER: GP-4
SHEET NUMBER: 1 of 1

LOCATION DIAGRAM

CLIENT: Five Part Development	DRILLING METHOD:
PROJECT NAME: East Regional Landfill	SSA 5"
PROJECT NUMBER:	BOREHOLE SIZE: 5"
PROJECT LOCATION: 8201 Schumaker Road , Adams County, Colorado	Lithology from MW-04 Boring Log
	SAMPLING METHODS: spt/cuttings
BORING LOCATION: GP-4	
	GRD.SURFACE ELEV:5308.28
	TOP OF CSG ELEV:5310.46
START DATE:11/4/2010 FINISH DATE:11/4/2010	**SURVEYED** or ESTIMATED
START TIME:1340 FINISH TIME:1440	

SAMPLER TYPE	SAMPLE NO. AND DEPTH	OVA READING	SPT DRIVE/ RECOVERY	DEPTH IN FEET	SOIL GRAPH	SOIL DESCRIPTION AND DRILLING CONDITIONS
Cuttings	N/A	N/A	N/A	0-4		Soft, light yellowish, fine grain, some silt, little clay, clayey silty SAND(SP), slightly moist, medium dilatancy, ALLUVIUM.
Cutting	N/A	N/A	N/A	4-8		Soft, light yellowish brown, fine grain some silt, some very fine sand, sandy CLAY (CL), slightly moist, low to medium plasticity, ALLUVIUM.
Cuttings	N/A	N/A	N/A	8-15		Stiff, dark brown, fine grain, some silt, little sand, silty CLAY (CL), moist, low to medium plasticity.
SPT	15-17	N/A	100	15-20		Stiff, moderate yellowish brown, fine to medium, trace clay, little silt, SAND (SW), slightly moist, ALLUVIUM.
SPT	20-22	N/A	100	20-25		Very stiff, medium grayish brown, medium to coarse grain, SAND (SP), very moist, ALLUVIUM.
SPT	25-27	N/A	100	25-30		Very hard, olive gray, fine grain, CLAY(CL), slightly moist, medium plasticity, ALLUVIUM/Weathered CLAYSTONE.
SPT	30-32	N/A	100	30-32		Very hard, weathered, olive gray, homogeneous, fine grain, CLAYSTONE, slightly moist. T.D. @ 32' bgs.

COMPLETED BY: NQT CHECKED BY: MAM	WATER LEVELS: DATE TIME DEPTH TO WATER DATUM
DRILLING CONTRACTOR: Site Services	
NOTES:	

AEC

AMERICAN ENVIRONMENTAL CONSULTING, LLC
6885 S. MARSHALL ST., SUITE 3
LITTLETON, COLORADO 80128
Phone: 303-948-7733 Fax: 303-948-7739

LOG OF BORING NUMBER: GP-2
SHEET NUMBER: 1 of 1

LOCATION DIAGRAM

CLIENT: Five Part Development	DRILLING METHOD: Solid Stem Auger
PROJECT NAME: East Regional Landfill	
PROJECT NUMBER:	BOREHOLE SIZE: 4"
PROJECT LOCATION: East Regional Landfill	
	SAMPLING METHODS:
BORING LOCATION: GP-2 (Five feet east of MW-2)	Drill Cuttings
	GRD.SURFACE ELEV: 5305.47
	TOP OF CSG ELEV: 5307.93
START DATE: 7/26/2010 FINISH DATE: 7/26/2010	**SURVEYED** or ESTIMATED
START TIME:11:30 FINISH TIME:12:30	

SAMPLER TYPE	SAMPLE NO. AND DEPTH	OVA READING	SPT DRIVE/ RECOVERY	DEPTH IN FEET	SOIL GRAPH	SOIL DESCRIPTION AND DRILLING CONDITIONS
Cuttings	N/A	N/A	N/A	0-5		Soft, medium yellowish brown, fine grain, little fine sand, some clay, clayey SILT (ML), slightly moist, no to low plasticity, low dilatancy, EOLIUM/ALLUVIUM.
Cuttings	N/A	N/A	N/A	5-14		Stiff, light grayish brown, fine grain, some fine sand, sandy CLAY (CL), slightly moist, low plasticity, no dilatancy, EOLIUM/ALLUVIUM.
Cuttings	N/A	N/A	N/A	14-20		Stiff, dark olive brown, fine grain, CLAY (CL-CH), slightly moist, medium plasticity, no dilatancy, (highly weathered CLAYSTONE). TD@20

COMPLETED BY: NQT CHECKED BY: MAM

WATER LEVELS: N/A DATE TIME DEPTH TO WATER DATUM

DRILLING CONTRACTOR: Dakota Drilling

NOTES:

AEC

AMERICAN ENVIRONMENTAL CONSULTING, LLC
6885 S. MARSHALL ST., SUITE 3
LITTLETON, COLORADO 80128
Phone: 303-948-7733 Fax: 303-948-7739

LOG OF BORING NUMBER: GP-3
SHEET NUMBER: 1 of 1

LOCATION DIAGRAM

CLIENT: Five Part Development	DRILLING METHOD: Solid Stem Auger
PROJECT NAME: East Regional Landfill	
PROJECT NUMBER:	BOREHOLE SIZE: 4"
PROJECT LOCATION: East Regional Landfill	
	SAMPLING METHODS:
BORING LOCATION: GP-3 (Five feet south of MW-3)	Drill Cuttings
	GRD.SURFACE ELEV: 5297.88
	TOP OF CSG ELEV: 5300.15
START DATE: 7/26/2010 FINISH DATE: 7/26/2010	**SURVEYED** or ESTIMATED
START TIME:9:00 FINISH TIME:11:00	

SAMPLER TYPE	SAMPLE NO. AND DEPTH	OVA READING	SPT DRIVE/ RECOVERY	DEPTH IN FEET	SOIL GRAPH	SOIL DESCRIPTION AND DRILLING CONDITIONS
Cuttings	N/A	N/A	N/A	0-5		Soft, dark grayish brown, fine grain, little sand, CLAY (CL), slightly moist, low to medium plasticity, no dilatancy, EOLIUM/ALLUVIUM
Cuttings	N/A	N/A	N/A	5-15		Stiff, light brown, fine grain, some silt, little sand, silty CLAY (CL), slightly moist, low to medium plasticity, no dilatancy, EOLIUM/ALLUVIUM.
Cuttings	N/A	N/A	N/A	15-30		Stiff, light greenish brown, fine grain, some silt, trace sand, silty CLAY (ML-CL), slightly moist, low to medium plasticity, no dilatancy, TD@30

COMPLETED BY: NQT CHECKED BY: MAM	WATER LEVELS: N/A DATE TIME DEPTH TO WATER DATUM
DRILLING CONTRACTOR: Dakota Drilling	
NOTES:	

July 30, 2010

Mr. Craig Tessmer
Department of Planning and Development
Adams County
12200 North Pecos Street
3rd Floor
Westminster, Colorado 80234

Ms. Deanne Kelly
Tri-County Health Department
4201 East 72nd Ave. Suite D
Commerce City, Colorado 80022

Mr. Curt Stovall
Colorado Department of Public Health and Environment
HMWMD B-2
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

Re: Landfill Gas Probe Documentation
East Regional Landfill (formerly the Five Part Disposal Facility)
Adams County, Colorado

Dear Mr. Tessmer, Mr. Stovall, and Ms. Kelly:

American Environmental Consulting, LLC (AEC) is pleased to present the following report describing and documenting the landfill gas probe installation and the initial monitoring procedures employed at the East Regional Landfill (ERL), located approximately 7 miles northwest of the Town of Bennett, Adams County, Colorado. The following sections include the installation summary and the first gas probe monitoring event.

Gas Probe Installation

In July 26, 2010 AEC was retained by Five Part Development to drill and install two landfill gas probe for monitoring purposes at the East Regional Landfill facilities prior to beginning waste acceptance operations.

Gas Probes GP-2 and GP-3 were installed immediately adjacent to the corresponding groundwater monitoring wells, MW-2 and MW-3 respectively, as required by the approved Engineering Design and Operation Plan. Each of the gas probes were drilled and completed to depth above the groundwater at its respective location and to a depth corresponding to the base of the disposal cell adjacent to the probe. GP-3 was completed to an approximate elevation of 5267 feet below ground surface (bgs) and is adjacent to the Cell 10 sump with a bottom elevation of approximately 5271 feet bgs. The disposal cell in the area of GP-2 has not yet been designed, but GP-2 was completed to a total depth of 20 feet, which is at or deeper than the anticipated cell depth to be designed in that area. Construction of the gas probes was conducted by Dakota Drilling out of Denver, Colorado, under the supervision of an AEC representative. The boreholes were drilled using a CME 55 truck mounted drill rig with 4 inch solid stem augers and logging of the soils was conducted by AEC based on examination of the drill cuttings. Once the borehole was completed, a 1 inch schedule 40 PVC pipe was lowered to the total borehole depth for well casing, which consisted of a 0.010 inch factory slotted section from the total depth of the borehole to 8 feet bgs

with a slip cap at the bottom, followed by a solid (non-slotted) casing section to approximately 2 feet above ground surface. A 10-20 silica sand filter pack was placed in the annular space from the total depth of the borehole to 5 feet bgs followed by a environmental bentonite plug (hydrated 3/8 bentonite chips) to approximately 1 foot bgs. The gas probe were completed with a steel protective casing and a 2 by 2 feet concrete pad at surface. Slip caps were placed on the top of the PVC casing and drilled out for the installation of monitoring ports equipped with valves.

Monitoring

Monitoring was conducted at Gas Probes GP-2 and GP-3 on July 28, 2010. Methane monitoring was performed using a portable combustible gas monitor (MINI RAE). The portable gas monitor was lab calibrated in accordance with the manufacturer's recommendations prior to use. Gas measurements were recorded, along with the date and time, on a field form.

Results

Methane monitoring occurred in the afternoon of July 28, 2010. The results are summarized in Table 1. No methane was detected at any of the site's sampling locations.

TABLE 1
EAST REGIONAL LANDFILL
GAS PROBE MONITORING

PROJECT OWNER:	FIVE PART DEVELOPMENT	PROJECT TITLE:	EAST REGIONAL LANDFILL		
LOCATION:	BENNETT, CO	MONITORING PROBE:	MINIRAE		
COUNTY:	ADAMS		Monitor:	NQT	
WEATHER:	SUNNY		Date:	7/28/2010	

Section 2.3, 6 CCR 1007-2 Monitoring	Probe CH4 %	Probe CH4 %LEL	O2 %	CO2%	Remarks
GP-2	0	0	20.9	2	None
GP-3	0	0	20.9	12	None

Conclusions

GP-2 and GP-3 were installed and monitored prior to the acceptance of waste as requested by the Colorado Department of Public Health and Environment (CDPHE). The gas probes will be surveyed at the ground surface and top of PVC pipe and will be placed at the precise locations on a site map. The facility is in compliance with the requirements of Section 2.3.1 of 6 CCR 1007-2 and is ready to accept waste upon approved of the Cell 10-Phase 1 construction report. If you have any questions or need additional information, please do not hesitate to contact the undersigned.

Respectfully Submitted,

American Environmental Consulting, LLC

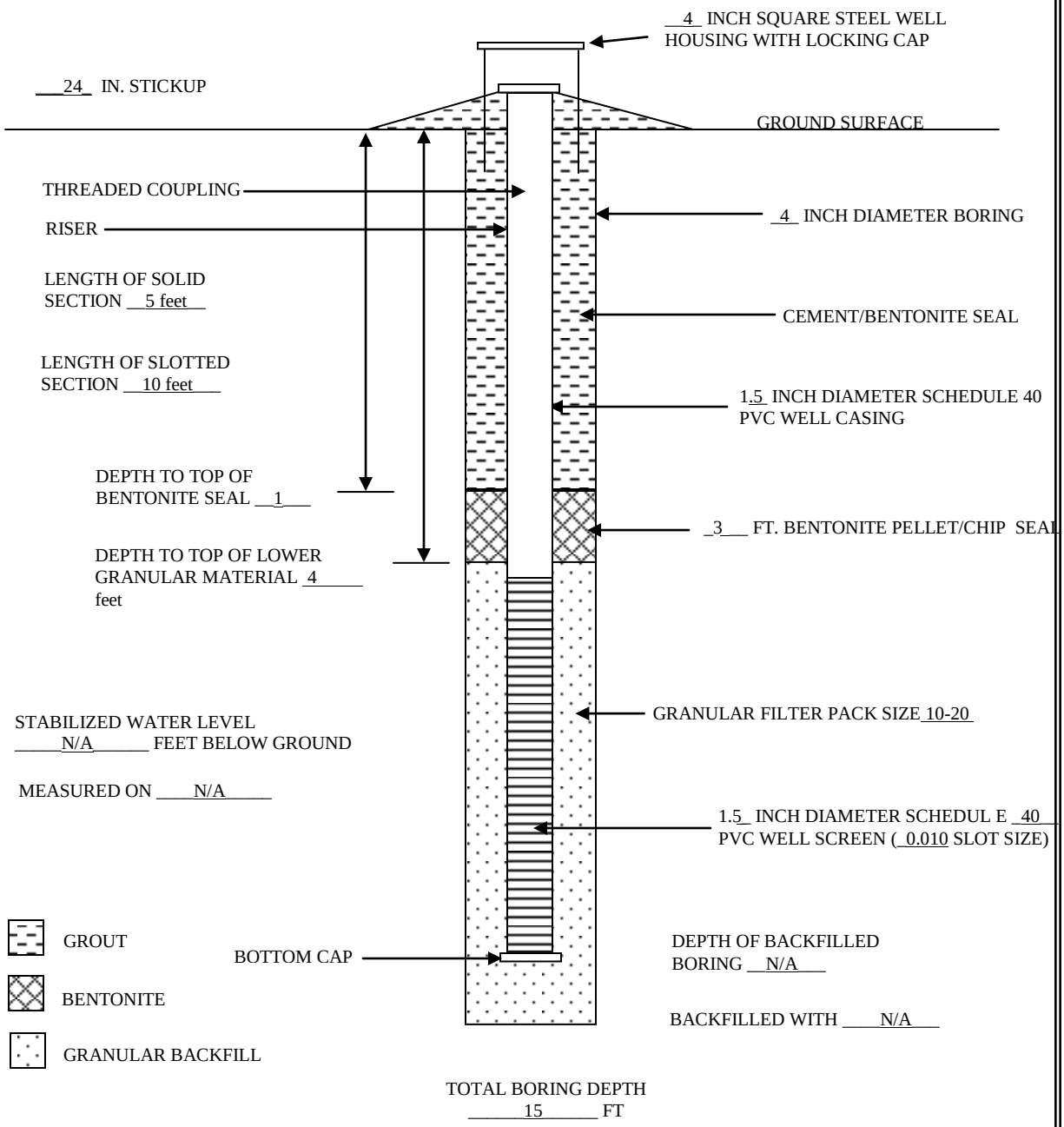
Mark A. McMullen
Principal/Project Manager

Attachments: Boring Logs
Probe Completion Logs

cc: Mr. Alek Orloff, Five Part
Mr. Jeremy Groves, Five Part

AMERICAN ENVIRONMENTAL CONSULTING, LLC
WELL COMPLETION FORM

JOB NAME: EAST REGIONAL LANDFILL		WELL NUMBER:GP-1
JOB NUMBER:	INSTALLATION DATE:3/31/2021	LOCATION: EAST REGIONAL LANDFILL
DATUM FOR WATER LEVEL MEASUREMENT: N/A		
DATUM ELEVATION:Not Surveyed	GROUND SURFACE ELEVATION: Not Surveyed	
SCREEN DIAMETER AND MATERIAL: 1.5 INCH/SCH.40 PVC		SLOT SIZE:0.010
RISER DIAMETER AND MATERIAL: 1.5 INCH/SCH.40 PVC		BOREHOLE DIAMETER: 4"
GRANULAR BACKFILL MATERIAL:N/A		REPRESENTATIVE:JR
DRILLING TECHNIQUE:SOLID STEM AUGER		DRILLING CONTRACTOR: Authentic Drilling, Inc



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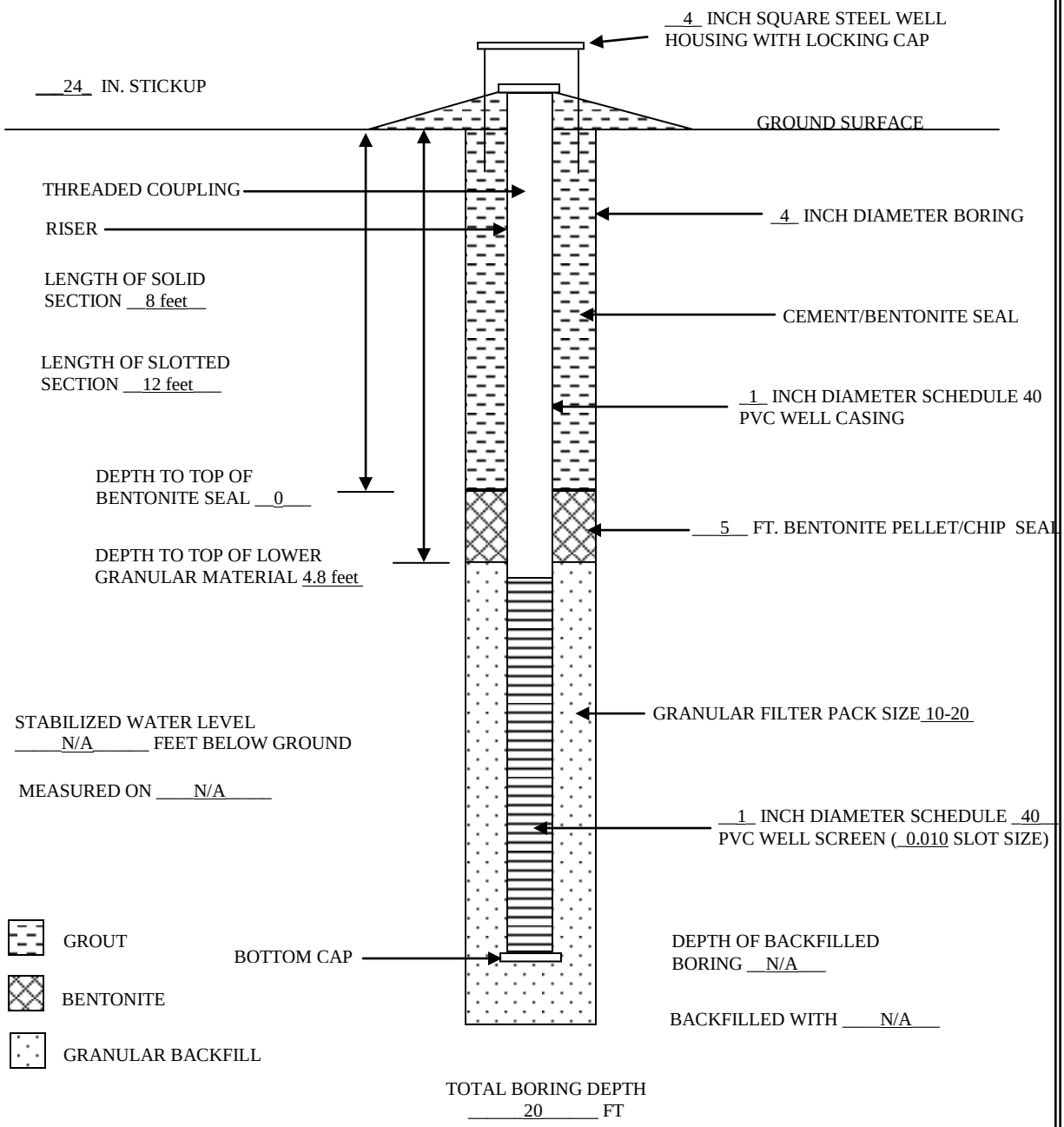
AMERICAN ENVIRONMENTAL CONSULTING, LLC
WELL COMPLETION FORM

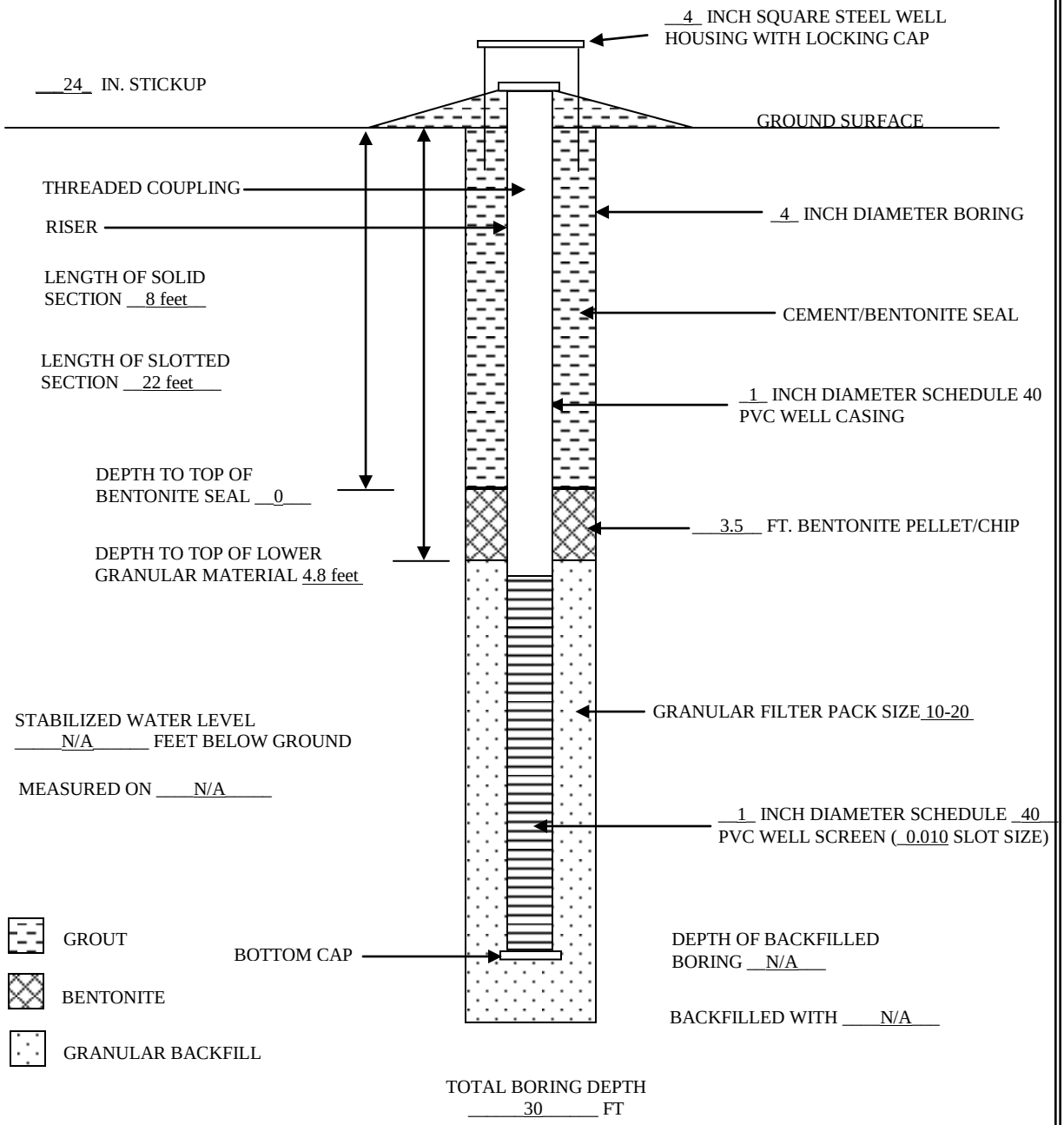
JOB NAME: EAST REGIONAL LANDFILL		WELL NUMBER:GP-2
JOB NUMBER:	INSTALLATION DATE:7/26/2010	LOCATION: EAST REGIONAL LANDFILL
DATUM FOR WATER LEVEL MEASUREMENT: TOP OF PVC		
DATUM ELEVATION: 5307.93	GROUND SURFACE ELEVATION: 5305.47	
SCREEN DIAMETER AND MATERIAL: 1INCH/SCH.40 PVC		SLOT SIZE:0.010
RISER DIAMETER AND MATERIAL: 1 INCH/SCH.40 PVC		BOREHOLE DIAMETER: 4"
GRANULAR BACKFILL MATERIAL:10-20 WASHED SILICA SAND		REPRESENTATIVE: NQT
DRILLING TECHNIQUE:SOLID STEM AUGER	DRILLING CONTRACTOR: DAKOTA DRILLING	



AEC

AMERICAN ENVIRONMENTAL CONSULTING, LLC
WELL COMPLETION FORM

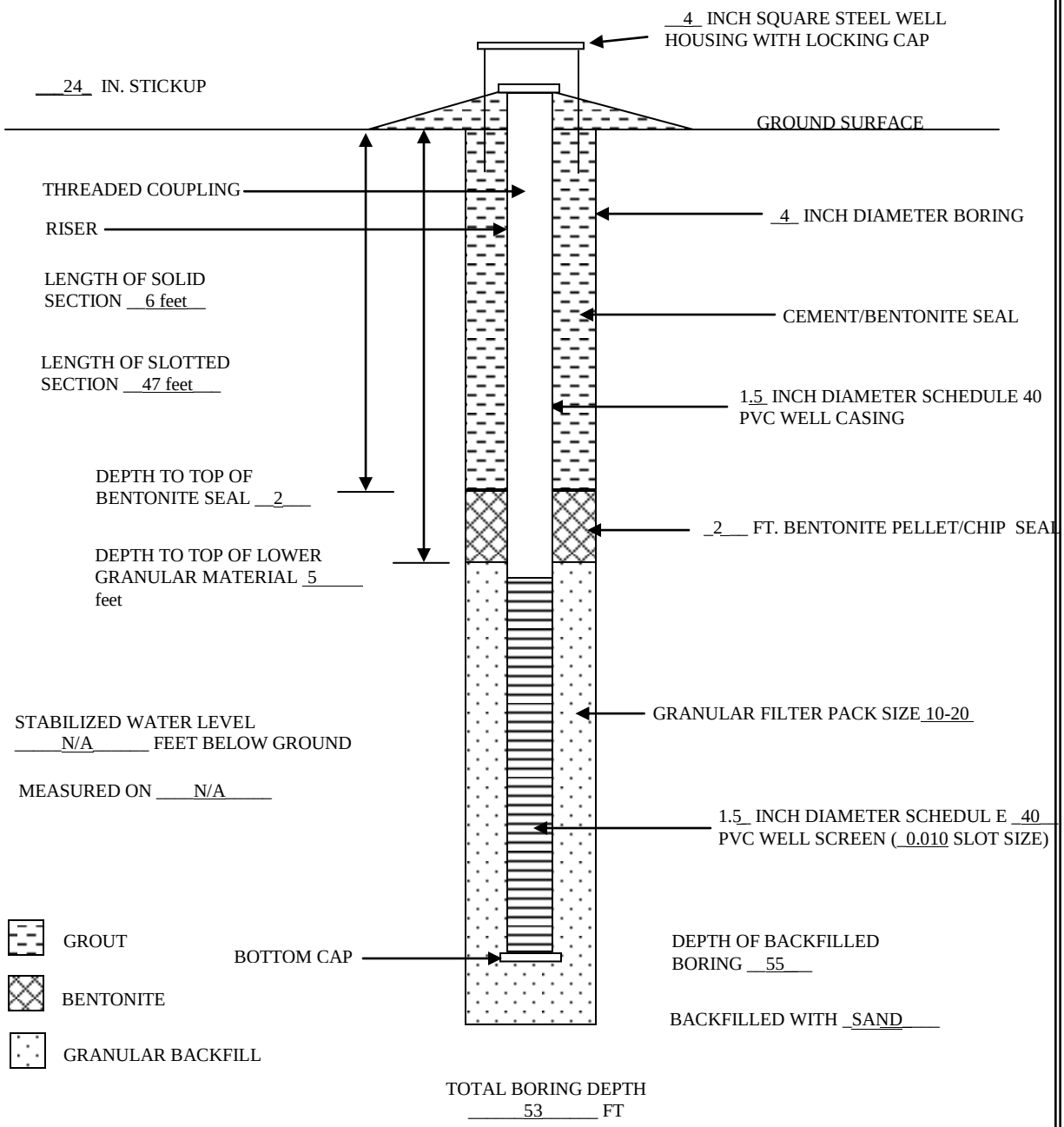
JOB NAME: EAST REGIONAL LANDFILL		WELL NUMBER:GP-3
JOB NUMBER:	INSTALLATION DATE:7/26/2010	LOCATION: EAST REGIONAL LANDFILL
DATUM FOR WATER LEVEL MEASUREMENT: TOP OF PVC		
DATUM ELEVATION: 5300.15	GROUND SURFACE ELEVATION: 5297.88	
SCREEN DIAMETER AND MATERIAL: 1INCH/SCH.40 PVC		SLOT SIZE:0.010
RISER DIAMETER AND MATERIAL: 1 INCH/SCH.40 PVC		BOREHOLE DIAMETER: 4"
GRANULAR BACKFILL MATERIAL:10-20 WASHED SILICA SAND		REPRESENTATIVE: NQT
DRILLING TECHNIQUE:SOLID STEM AUGER		DRILLING CONTRACTOR: DAKOTA DRILLING



AEC

AMERICAN ENVIRONMENTAL CONSULTING, LLC
WELL COMPLETION FORM

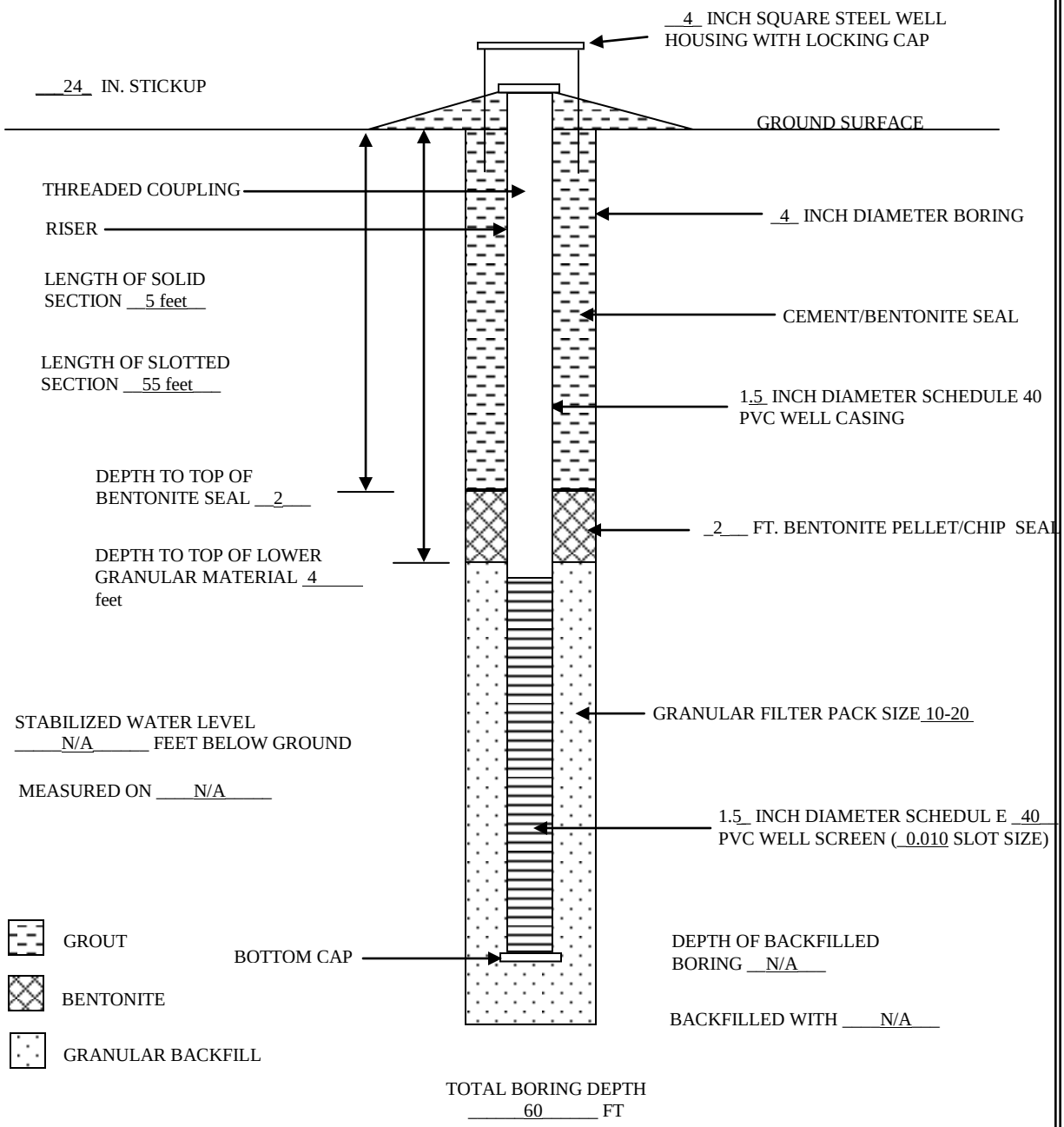
JOB NAME: EAST REGIONAL LANDFILL		WELL NUMBER:GP-5
JOB NUMBER:	INSTALLATION DATE:3/29/2021	LOCATION: EAST REGIONAL LANDFILL
DATUM FOR WATER LEVEL MEASUREMENT: N/A		
DATUM ELEVATION:Not Surveyed	GROUND SURFACE ELEVATION: Not Surveyed	
SCREEN DIAMETER AND MATERIAL: 1.5 INCH/SCH.40 PVC		SLOT SIZE:0.010
RISER DIAMETER AND MATERIAL: 1.5 INCH/SCH.40 PVC		BOREHOLE DIAMETER: 4"
GRANULAR BACKFILL MATERIAL:N/A		REPRESENTATIVE:JR
DRILLING TECHNIQUE:SOLID STEM AUGER		DRILLING CONTRACTOR: Authentic Drilling, Inc



AEC

AMERICAN ENVIRONMENTAL CONSULTING, LLC
WELL COMPLETION FORM

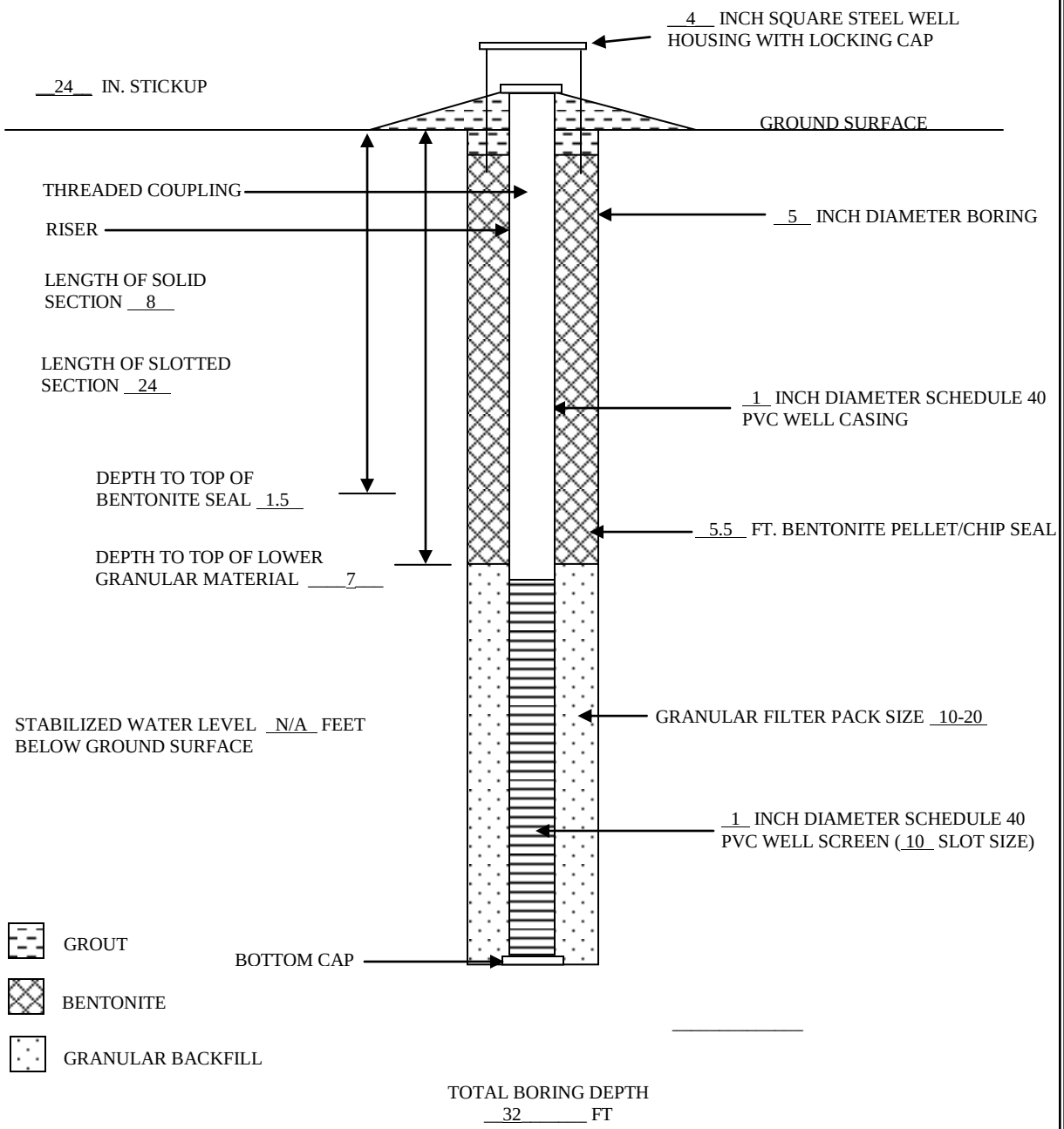
JOB NAME: EAST REGIONAL LANDFILL		WELL NUMBER:GP-6
JOB NUMBER:	INSTALLATION DATE:3/27/2021	LOCATION: EAST REGIONAL LANDFILL
DATUM FOR WATER LEVEL MEASUREMENT: N/A		
DATUM ELEVATION:Not Surveyed	GROUND SURFACE ELEVATION: Not Surveyed	
SCREEN DIAMETER AND MATERIAL: 1.5 INCH/SCH.40 PVC		SLOT SIZE:0.010
RISER DIAMETER AND MATERIAL: 1.5 INCH/SCH.40 PVC		BOREHOLE DIAMETER: 4"
GRANULAR BACKFILL MATERIAL:N/A		REPRESENTATIVE:JR
DRILLING TECHNIQUE:SOLID STEM AUGER		DRILLING CONTRACTOR: Authentic Drilling, Inc



AEC

AMERICAN ENVIRONMENTAL CONSULTING, LLC
WELL COMPLETION FORM

JOB NAME: EAST REGIONAL LANDFILL		GAS PROBE NUMBER: GP-4
JOB NUMBER:	INSTALLATION DATE:11/4/2010	LOCATION: EAST REGIONAL LANDFILL
DATUM FOR WATER LEVEL MEASUREMENT: N/A		
DATUM ELEVATION: 5310.46	GROUND SURFACE ELEVATION: 5308.28	
SCREEN DIAMETER AND MATERIAL: 1INCH, SCHEDULE 40, PVC		SLOT SIZE: .010
RISER DIAMETER AND MATERIAL: 1 INCH, SCHEDULE 40, PVC		BOREHOLE DIAMETER: 5 INCH
GRANULAR BACKFILL MATERIAL: 10-20 SILICA SAND		REPRESENTATIVE: NQT
DRILLING TECHNIQUE: SOLID STEM AUGER	DRILLING CONTRACTOR: SITE SERVICES	



AEC

3/26/2021 AEC E. Regional LF
Mobe to site and meet Mark McMullen of AEC, around noon. Mark gives me tour of LF and we both look @ cuttings near completion zone of MW-6.
Drill to 75 and set PVC from 75-55 WL ≈ 66' bgs.
Bring sand to 54. Will grout 3/27.
Visit other locations and discuss completion level of gas wells.
Leave site @ a little after 4PM.

3/27/2021 AEC E. Regional LF
Arrive onsite @ 7:55 AM. Drillers arrive shortly after 8 AM.
Place bentonite seal in MW-6. Using chips, so placed about 4' to be sure no cement gets to sandpack. Grouting is a very slow process for these guys.
Finish grouting @ 10:30.
Moving rig over to set up on GP-6.

3/27/2021 cont. AEC E. Regional UF

Drill to 60'. Material changes from clean fine to med. gr. sand to cls between 10 and 15 ft. Center bit dry (in sand) at 60'.

Run 55' of 1.5" screen. Screen is from 59-4' bgs. Sand to 3' bgs and 2' bent. seal.

Mobe to GP-5. After discussion w/ MM we decide that GP-5 can be 55 ft deep w/ 50' screen. Sand at top of hole is clean fine to med gr. w/ change between 15-20' bgs to cls. Got firm between 20-25' bgs. Then a bearing broke on the Kelley, so I think we are done for the day. They will try to get it repaired today or Sunday and be ready to go on Monday. Left site about 4 PM.

3/29/2021 AEC E. Regional LF

Arrive onsite @ 8AM. Have safety mtg. w/ drillers. Discuss trying to get as much done today as possible because weather going to change by tomorrow.

Continue drilling at GP-5, from 25' bgs. Drillers adding water to outside of augers to make cuttings come out easier. They are nervous after breaking Kelley bearing on Saturday.

Complete hole to 55' and there is a little over 1' of water in the bottom. Bring sand to 52' and will place screen from 52'-6' bgs, so 47' of screen.

Meet Justin and go check access to MW-1 location. Still pretty wet there.

WL @ MW-6 is 65.8' bgs.

GP-5 sand to 5' bgs. Bent. 5'-2' bgs

3/29/21 AEC E. Regional LF

Set up on MW-5. Water @ ≈ 52-53 so will drill to 65'.

Drives: 5'
10'
15'
20'
25'
} No SS 0-25'

30'	4-4-6-6	67% recovery
35'	4-8-9-6	88% recovery
40'	4-7-6-7	92% recovery
45'	7-12-18-19	100% recovery
50'	16-31-43 (18")	100% recovery
55'	17-31-43 (18")	100% recovery
60'	18-27-32 (18")	72% recovery
65'	24-37-38/2" (14")	67% recovery

SP 0-16 Sand, fine gr., well sorted, light brown, soft, some silt, dry to 7.5 then sl. moist

SW 16-23 Sand, fine to coarse, poorly sorted, medium brn., moist, with some fine gravel, firm

CL 23-33 Clay, sandy, brown, moist, dense, some calcareous mineralization

3/29/21 AEC E. Regional LF

SC
33-38 Sand, clayey, silty, fine grained sand, lt. brown, sl. moist, dense, Calcareous

CL
38-45 Clay, some fine sand and silt, brown, firm, sl. moist, Calcareous, Fe staining
grades to cls @ 43'

45-65 Sand, fine grained, sl. silty, tan w/ Fe staining, v. dense, moist to wet @ 55'

WL @ 56-57' bgs in augers after drilling. Tough well completion w/ flowing sands. Had to pull the well out and clean out the augers.

Screen is set from 64'-44' w/ sand to 42'. Had to use time release bentonite pellets due to amt. of water we added to clean out augers. Seal from 42'-38'.

Will grout tomorrow. Leave site @ 6:30 PM.

Shut down 3/30/21 due to weather.

3/31/2021 AEC E. Regional LF

Grout MW-5 to surface on top of bentonite seal. W.L. = 54.8' bgs

Mobe to GP-1.
Drill to 15' per spec.
0-15 Sand, fine grained, silty, occasional thin clay seams, moist 0-5, sl. moist and hard 5-10, moist 10-15, brown

Set screen @ 15-5' bgs. Sand to 4'. Bentonite from 4'-1' bgs.

Get materials together to start to set well pads.

WL @ MW-6 = 66.2' bgs

Set well pads @ MW-5, GP-5 location. And bollards; 4 @ each pad. Slow process. 2 well pads and 8 bollards took about 3-3½ hrs.

Finish up 4/1. Leave site about 4:30 PM.

4/1/2021 AEC E. Regional LF

Arrive onsite @ 11:10 AM.
Drillers have been working on pads and bollards for MW-6/GP-6 cluster since this AM.

MW-5 W.L. = 54.7' bgs

Make equipment to GP-1 location to set pad and bollards. Hydrate bentonite seal. These 4 bollards will be slightly closer to the pad due to space consideration wrt the proximity of the access road.

Hit the 1" irrigation line in SW bollard hole. We were told by a LF employee that could happen @ this location and not to worry about it.

The well protector @ GP-1 has a piece of the clasp broken. Greg said he could come back out and repair it.

Appendix Q

Waste Characterization Plan

AEC

Sustainability in Action

WASTE CHARACTERIZATION AND ACCEPTANCE PLAN
EAST REGIONAL LANDFILL
BENNETT, COLORADO

Prepared for:

Five Part Development, LLC
East Regional Landfill
8201 Schumaker Road
Bennett, CO 80102

Prepared by:
American Environmental Consulting, LLC
8191 Southpark Lane, Unit 107
Littleton, CO 80120

February 2025

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Attachment 6 – Special Waste Inspection Sheet

1.0 INTRODUCTION

Five Part Development, LLC (Five Part) has operated East Regional Landfill (ERL), located at 8201 Schumaker Road, Bennett, Colorado, 80102, approximately 7 miles northwest of the town of Bennett, Adams County, Colorado.

Five Part has developed and implemented waste screening procedures to assist in preventing prohibited wastes from entering ERL and has established waste acceptance procedures and acceptance levels for industrial solid wastes and other special wastes requiring additional handling. ERL accepts non-hazardous special wastes that have been properly sampled, analyzed, and found to be acceptable for disposal at the landfill as defined in this Waste Characterization Plan (WCP).

It is the policy of Five Part that all requests for disposal of non-hazardous industrial waste and other special wastes requiring additional handling be evaluated and approved by authorized persons within Five Part's corporate Special Waste Approvals Group or other authorized company representative prior to disposal. The objective of this policy is to prevent the disposal of hazardous and/or other prohibited wastes at ERL and protect Five Part's employees, the health and safety of the public, and the environment in and around the landfill. Five Part may, at its discretion, decline to accept a specific waste stream at ERL based on physical characteristics, analytical results, or other means of evaluating chemical composition, waste type/source, project volume, and/or frequency of the waste to be delivered, and/or other factors.

1.1 Definitions

As used within this document, these terms have the definitions as defined in Section 20.2 of 6 CCR 1007-1 Part 20, unless otherwise noted, as follows:

"Background radiation" means radiation from:

A. Extraterrestrial sources;

B. Naturally occurring radioactive material (which has not been technologically enhanced), including radon (except as a decay product of source or special nuclear material); and

C. Global fallout as it exists in the environment from the testing of nuclear explosive devices or from past nuclear accidents such as Chernobyl that are not under the control of the licensee or registrant.

Background radiation does not include sources of radiation from radioactive materials regulated by NRC.

Additionally, as provided by Colorado Department of Public Health and Environment (CDPHE) in 6 CCR 1007-1 Part 20, Addendum B: Site-specific Background Determination, a guidance document pertaining to Colorado's technologically enhanced naturally occurring radioactive material (TENORM) rules, background concentrations for TENORM radionuclides are established, wherein:

- The default natural background for Ra-226 is 1.4 pCi/g;
- The default natural background for Ra-228 is 1.3 pCi/g;
- The default natural background for Pb-210 is 1.4 pCi/g; and
- The default natural background for Po-210 is 1.4 pCi/g.

Practically, this means that waste containing up to 6.4 pCi/g of Ra-226, or 6.3 pCi/g of Ra-228, or 6.4 pCi/g of Pb-210, or 6.4 pCi/g of Po-210 could be accepted at ERL, provided all other waste acceptance criterion are met.

"Byproduct material" means:

A. Any radioactive material, except special nuclear material, yielded in or made radioactive by exposure to the radiation incident to the process of producing or using special nuclear material;

B. The tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including discrete surface wastes resulting from uranium or thorium solution extraction processes (underground ore bodies depleted by these solution extraction operations do not constitute "byproduct material" within this definition);

C.

1. Any discrete source of radium-226 that is produced, extracted, or converted after extraction, before, on, or after August 8, 2005, for use for a commercial, medical, or research activity; or

2. Any material that:
    a. Has been made radioactive by use of a particle accelerator; and
    b. Is produced, extracted, or converted after extraction, before, on, or after August 8, 2005, for use for a commercial, medical, or research activity; and

D. Any discrete source of naturally occurring radioactive material, other than source material, that:

1. The NRC, in consultation with the administrator of the Environmental Protection Agency, the Secretary of Energy, the Secretary of Homeland Security, and the head of any other appropriate federal agency, determines would pose a threat similar to the threat posed by a discrete source of radium-226 to the public health and safety; and

2. Before, on, or after August 8, 2005, is extracted, or converted after extraction, for use for a commercial, medical, or research activity.

"Dry weight" means the mass of materials excluding the mass of any water or moisture present within the materials.

"Exploration and production waste (E&P waste)" means those wastes associated with operations to locate or remove oil or gas from the ground or to remove impurities from such substances and which are uniquely associated with and intrinsic to oil and gas exploration, development, or production operations that are exempt from regulation under Subtitle C of the Resource Conservation and Recovery Act (RCRA), 42 USC Sections 6921, et seq. For natural gas, primary field operations include those production-related activities at or near the wellhead and at the gas plant (regardless of whether or not the gas plant is at or near the wellhead), but prior to transport of the natural gas from the gas plant to market. In addition, uniquely associated wastes derived from the production stream along the gas plant feeder pipelines are considered E&P wastes, even if a change of custody in the natural gas has occurred between the wellhead and the gas plant. In addition, wastes uniquely associated with the operations to recover natural gas from underground storage fields are considered to be E&P waste.

"Industrial wastes" are defined in Section 1 of the Colorado Department of Public Health and Environment (CDPHE) Regulations Pertaining to Solid Waste Sites and Facilities 6 CCR 1007-2 Part 1 [latest version], as follows:

> **"Industrial wastes"** means all solid wastes, including mill tailings and mining wastes, resulting from the manufacture of products or goods by mechanical or chemical processes that are not a hazardous waste regulated under 6 CCR 1007-3, the Colorado Hazardous Waste Regulations. Such waste may include, but is not limited to, construction and demolition debris, and waste resulting from the following manufacturing processes: electric power generation; fertilizer/agricultural chemicals; food and related products/by products; inorganic chemicals; iron and steel manufacturing; leather and leather products; nonferrous metals manufacturing/foundries; organic chemicals; plastics and resins manufacturing; pulp

and paper industry; rubber and miscellaneous plastic products; stone, glass, clay, and concrete products; textile manufacturing; transportation equipment; and water treatment. This term does not include oil and gas wastes regulated by the Colorado Oil and Gas Conservation Commission."

"Naturally occurring radioactive material" (NORM) means any nuclide that is radioactive in its natural physical state and is not manufactured. "Naturally occurring radioactive material" does not include source material, special nuclear material, byproduct material, or by-products of fossil-fuel combustion, including bottom ash, fly ash, and flue-gas emission by-products.

"Nuclear Regulatory Commission" (NRC) means the U.S. Nuclear Regulatory Commission or a duly authorized representive.

"Oil and gas operation" means exploring for oil and gas, including conducting seismic operations and the drilling of test bores; siting, drilling, deepening, recompleting, reworking, plugging, or abandoning a well; producing operations related to any well, including installing flowlines; the generating, transporting, storing, treating, or disposing exploration and production wastes; and any constructing, site preparing, or reclaiming activities associated with such operations.

"Source material" means uranium or thorium, or any combination of uranium or thorium, in any physical or chemical form, including ores that contain, by weight, one-twentieth of 1 percent (0.05 percent) or more, of uranium, thorium or any combination thereof. Source material does not include special nuclear material.

"Tank bottom" means extraneous materials which may settle to the bottoms of tanks.

Note: In this WCP, this includes extraneous materials which may settle to the bottom of vessels, especially in oil and gas operations.

"Technologically enhanced naturally occurring radioactive material" (TENORM) means naturally occurring radioactive material whose radionuclide concentrations are increased by or as a result of past or present human practices. "TENORM" does not include:

A. Background radiation or the natural radioactivity of rocks or soils;
B. "Byproduct material" or "source material", as defined by Colorado statute or rule; or
C. Enriched or depleted uranium as defined by Colorado or federal statute or rule.

"TENORM Radionuclides" means Radium-226, Radium-228, Lead-210, and Polonium-210.

1.2 Forms

The forms included as part of this WCP are intended to be representative of the forms and documents used in the waste characterization process. Unless substantive changes are made to the forms and/or documents, additional approvals from Colorado Department of Public Health and Environment (CDPHE) beyond the approval of this WCP to use modified forms are not required.

2.0 NOTIFICATION PROCEDURES

Five Part has developed two primary methods for notifying generators of wastes subject to this WCP of the procedures for review and acceptance of non-hazardous solid wastes, as follows:

1. The preferred approach is to initiate contact with representatives from the generator to describe the ERL program for managing non-hazardous industrial waste or other special wastes that require additional testing and/or handling.

2. The second form of notification may occur when waste is delivered to ERL for disposal without prior authorization. The generator will be contacted immediately informing them of the current regulations and requirements governing the disposal of industrial waste or other special wastes that require additional testing and/or handling and the reasons for Five Part's rejection of the waste in question.

3.0 APPLICATION FOR NON-HAZERDOUS WASTE APPROVAL

3.1 Prohibited Wastes

ERL will not accept the following types of solid wastes:

- Hazardous waste, as defined or classified as such by the Hazardous Waste Commission pursuant to 25-15-302, C.R.S., as amended;
- Residentially generated used lead-acid batteries, used oil, and waste tires (see Section 4.13);
- Solid wastes, electric equipment, or oils containing polychlorinated biphenyls (PCBs) in concentrations greater than or equal to 50 parts per million;
- Radioactive wastes, as defined and governed by Part 14 of the Colorado Radiation Control Regulations (6 CCR 1007-1);
- TENORM-impacted wastes in concentrations of greater than 5 pCi/g above background (See the definition for Background Radiation for implications of "above background"), as defined and governed by Part 20 of the Colorado Radiation Control Regulations (6 CCR 1007-1) - these are often found in waste streams from oil and gas, water treatment plants, and some mining operations;
- Residentially generated electronics waste (see Section 4.25); and
- Refrigerators, freezers, air conditioners, and similar items, if Freon is present.
- Friable asbestos waste (see Section 4.10)
- Bulk liquids (see Section 4.12)

3.2 Waste Screening Program

The detection and prevention of disposal of prohibited or unacceptable wastes at ERL is accomplished through a waste screening program that consists of the following approach:

1. Generator waste characterization and Special Waste Profile form (provided as Attachment 1).
2. Critical review of waste characterization by the Special Waste Approvals Group or authorized company representative.
3. Approval of waste through Special Waste Department Decision form (provided as Attachment 3).
4. Screening at the landfill, using the Special Waste Inspection Sheet (provided as Attachment 6).
5. Waste stream re-testing and re-certification.

3.3 Generator Waste Characterization and Waste Profile

When an initial contact has been made by a waste generator who is interested in disposal of a non-hazardous industrial waste or other special waste requiring additional testing and/or handling at ERL, an Five Part representative may either meet with the generator or provide a copy of the facility's procedures for the characterization, acceptance, and disposal of the waste. The written procedures and/or meetings are used to identify the information that must be provided by the generator to Five Part for review and consideration prior to the approval of the waste for disposal at ERL.

3.3.1 Waste Profile

Five Part requires a Special Waste Profile form or Express Waste Profile form (provided as Attachments 1 and 2) to be completed in its entirety and signed by an authorized company representative. The Special Waste Profile form requires detailed information concerning the following:

- The waste generator (name, address, and contact information)
- Description of the waste stream (name, type, source, and estimated volume)
- Waste characterization data (physical characteristics, chemical characteristics, special handling instructions)
- Generator certification that all samples were collected in accordance with the requirements of the CDPHE Identification and Listing of Hazardous Waste Regulation, 6 CCR 1007-3 Part 261 [latest version] or the United States Environmental Protection Agency (EPA) guidelines provided in SW-846

3.3.2 Waste Characterization

Consistent with the applicable provisions of the federal Resource Conservation and Recovery Act (RCRA) and the Colorado Hazardous Waste Act, a generator is required to characterize their waste. Additional sampling and analysis is also required in Part 20 of 6 CCR 1007-1, where there is potential for TENORM impact. Five Part has developed waste characterization criteria that are used in the evaluation of manifested waste requests. Depending on the type of waste, a generator is required to characterize one or both of the following waste characteristics by submitting a Special Waste Profile form:

- Physical characteristics through observations of the waste generation process and the waste material.
- Chemical characteristics through standard analytical procedures and/or other sources of information. The types of information and various tests that may be transmitted with the Special Waste Profile form, depending on the particular waste streams, include:

  – Safety Data Sheets (SDSs)

– Chemical composition analysis
– Toxic characteristic leaching procedure (TCLP) test results
– Paint filter liquids test results
– Reactivity, corrosivity, and ignitability tests results
– Radiochemistry analysis

3.3.3 Sampling Requirements

Sampling procedures and sample handling are key portions of accurately determining the chemical makeup of a waste. The sampler or generator is required to verify by his/her signature that the samples collected for waste characterization are a true representation of the waste as defined by Colorado Hazardous Waste Regulations and/or 6 CCR 1007-1 Part 20 (and related guidance), where TENORM impact is a possibility. Representative samples must be obtained by following the sampling methods specified in the following document or an equivalent method selected by the generator or his/her authorized representative and be pre-approved by ERL:

- Appendix I of the CDPHE Identification and Listing of Hazardous Waste Regulation, 6 CCR 1007-3 Part 261 [latest version], and/or
- For waste streams potentially impacted by TENORM, Addendum A (Implementation Guidance) [latest version] of Part 20 of 6 CCR 1007-1, which requires three to six samples and the use of CDPHE's approved SW-846 calculator to make a TENORM determination.

The number of samples required, the volume of each sample, the sample container size and type, shipping requirements, and holding times are dependent on the waste analyses to be conducted. Generators are instructed to consult with the analytical laboratory conducting the sample analyses for complete information concerning sample container size and type, sample handling, and sample preservation requirements. It is a Five Part policy that no Five Part employee collect samples, transport samples, or handle waste characterization samples in any way. All samples are to be collected for analysis and transported to the laboratory independently by the generator or the generator's representative.

Chain-of-custody forms must be used with each sample collected. The chain of custody shall include information about the sample size, required testing, date and time of sample collection, name of sampling personnel, name of waste generator, identification of waste stream/type, and signatures of persons sampling and accepting custody of sample for analysis.

3.3.4 E&P Exempt Waste – Similar Waste Streams at Various Locations

Generators of E&P exempt waste streams that are similar in matrix and composition (generated by the same process but at various locations) may be able to characterize and profile the waste stream on a broad basis (including for TENORM) by submitting a sampling and analysis plan to CDPHE for their approval. Once the plan has been reviewed and approved by CDPHE, the

generator may complete sampling and analysis. The analytical results should then be forwarded to CDPHE for their review and approval of the sufficiency of the broad basis characterization effort. Finally, the analytical results, along with approval from CDPHE, may be forwarded to the Special Approvals Group for final waste acceptance. Note: This scenario is common with oil and gas producers who generate similar waste streams as part of the same processes across multiple well sites/locations/facilities. Note: This approach does **not** require every site/location/facility to be sampled and reported, so long as CDPHE has approved the sampling and analysis plan. However, the generator must comply with any additional sampling requirements and frequency of sampling as required by their CDPHE approval.

3.4 Waste Profile Review and Pre-Approval

The Special Waste Approvals Group or other authorized company representative will review the Special Waste Profile form and analytical results for completeness and compliance with facility acceptance standards. Five Part reserves the right to require re-sampling and analysis of any waste submitted for disposal consideration. Submitted Special Waste Profile forms and waste characterization test results (including rejected wastes with notation of the cause for rejection) will be maintained by Five Part as a part of the permanent operating record.

If the waste stream is determined to be acceptable, a Special Waste Department Decision form (Attachment 3) will be issued to the waste generator. The Special Waste Department Decision form includes the approved waste name/type and approved volume and assigns a unique waste approval code. The criteria that will be used to determine the chemical/radiochemistry acceptability of the waste include the following:

- The presence of any listed or characteristic wastes (i.e., ignitability, corrosivity, reactivity, or toxicity).
- The presence of any hazardous waste identified in accordance with the CDPHE Identification and Listing of Hazardous Waste Regulation, 6 CCR 1007-3 Part 261 [latest version] and any applicable 40 Code of Federal Regulations (CFR) Part 261 (Identification and Listing of Hazardous Waste) [latest version] standards.
- The presence of chemical characteristics in excess of the ERL acceptance criteria, as specified in applicable sections of Section 4 of this WCP.
- The presence of TENORM radionuclides greater than 5 pCi/g above background (See the definition for Background Radiation for implications of “above background”) as specified in 6 CCR 1007-1 Part 20 (and related guidance) where TENORM impact is a possibility.

3.5 Screening Program

Five Part has adopted a three-part waste inspection and detection program for non-hazardous industrial waste or other special waste brought in for disposal at ERL.

3.5.1 Gatehouse Inspection

The first level of inspection occurs as the first waste load arrives at the facility gatehouse. For each applicable waste load, the gate attendant will receive a Non-Hazardous Special Waste and Asbestos Manifest form (provided as Attachment 4) from the waste hauler. The manifest will contain the name of the generator, type and volume of waste, and the name of the transporter. The gate attendant will compare the manifest to the Special Waste Department Decision information to verify that the waste type and packaging requirements are consistent with the approved Special Waste Profile form and any specified approval conditions. When possible, the gate attendant will visually screen the load to verify that it appears representative of the waste description in the approved profile. If visual screening at the gate house is not possible, a visual inspection will occur upon unloading at the working face. If the information contained in the Non-Hazardous Special Waste and Asbestos Manifest form does not match the approved profile or if the waste visually appears to not match the approved waste type, the waste will not be accepted for disposal and the load rejected from ERL until an additional investigation into the discrepancy has been conducted and a satisfactory resolution has been reached. The screening will be documented using the Special Waste Inspection Sheet (Attachment 6).

3.5.2 Radiation Portal Detectors at Scale

Stationary radiation monitors are installed at the scales to survey each load for radiological activity. The monitors are re-calibrated on an annual basis. In the event of an alarm, the load will be redirected to pass through the monitors a second time to confirm the level of the initial reading. If the reading is confirmed, a hand-held gamma survey meter will be used to survey the surface of the load (and the load driver) to identify the source of maximum radiological activity. CDPHE will be contacted, and the load will be staged pending further direction from CDPHE.

3.5.3 Random Inspections at Working Face

Additional inspection is performed on a random basis by ERL equipment operators when the waste is unloaded near the active working face. Random inspections are performed at a frequency of eight per week, as outlined below:

- Three special waste profile inspections per week, and
- Five municipal solid waste and/or construction and demolition debris waste inspections per week.

If a load is chosen for inspection, the operators will direct the unloading of the waste away from the working face and visually inspect the load for the presence of any waste that looks uncharacteristic when it is unloaded. Examples of waste that may look uncharacteristic may be an unmarked barrel in a load of mixed municipal refuse, a container of liquids or the presence of free liquids, placarded containers, containers bearing warning labels, powders or dusts, unusually strong or irritating odors not associated with typical acceptable waste types. If the waste is found to be unacceptable for disposal, ERL equipment operators will attempt to identify the source of

the unacceptable waste and notify the ERL manager (or their designee) immediately. The ERL manager (or their designee) will require the transporter to make the necessary arrangements to collect the waste and return it to the generator.

If unacceptable wastes are identified after the transporter leaves the facility, the waste will be separated from the active working face and identification of the generator will be attempted. If the generator is identified, a Five Part representative will contact the generator and request that the waste be removed and properly disposed of. If the generator cannot be identified, Five Part will contract to have the waste removed and disposed of at a permitted facility. If identified as a hazardous, radioactive, or TENORM-impacted waste, Five Part will follow containment, labeling, manifesting, and handling requirements for proper disposal.

3.5.4 Frequency of Testing/Recertification

The frequency of follow-up waste characterization for an approved non-hazardous waste will be based on the type of waste material, the process that is used to generate the waste, and the chemicals/constituents of concern in the waste. A Special Waste Profile – Recertification form (provided as Attachment 5) from the generator will generally be required every 3 years. Waste profile recertifications will require certification from the generator that the waste remains the same as the initial characterization, and additional waste characterization data supporting the certification, as applicable.

4.0 WASTE ACCEPTANCE CRITERIA

This section provides information regarding analytical testing requirements, acceptance criteria, and handling procedures for commonly received non-hazardous industrial waste and other special wastes requiring additional handling.

4.1 General Requirements

The analytical testing requirements specified herein do not relieve a generator from conducting any additional testing necessary to properly characterize their waste based on specific knowledge of the waste generating process and applicable regulations. Additionally, alternate or modified analytical requirements and/or waste handling procedures may be developed for wastes in these categories from a specific generator based on the Special Waste Profile form received from any such generator.

4.1.1 Alternatives to TCLP Testing

Generally, non-hazardous waste testing requirements are specified by TCLP parameter groups. Total analysis performed on a solid may be substituted for TCLP analysis in certain cases. For example, when testing a solid material, if the total analysis result divided by 20 yields a value below the regulatory limit for acceptance, the waste can be considered nonhazardous (20 times dilution of the waste exists when the extraction fluid is added during the TCLP). However, if a total analysis result divided by 20 equals or exceeds the regulatory limit for acceptance, it does not necessarily mean a TCLP of the waste will also exceed the regulatory limit. In these situations, the TCLP analysis may be requested in an effort to assess whether the waste is hazardous.

4.1.2 Safety Data Sheets

For unused products that have not been spilled, mixed with any other products, or contaminated in any way (and that do not contain TENORM), generators may be able to provide an SDS for the waste in lieu of analytical testing. However, Five Part reserves the right to require analytical testing even when an SDS is supplied for the waste stream.

4.2 Exempt E&P Wastes

RCRA-exempt oil and gas E&P wastes are defined in 40 CFR 261.4 (b)(5) as “drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas or geothermal energy,” that are exempt from regulation as hazardous wastes under RCRA Subtitle C (40 CFR Parts 260 to 279). This exemption, however, does not cover TENORM isotopes. Oil and gas waste streams have been identified by CDPHE as having the potential to contain TENORM; therefore, generators will be required to submit sufficient analytical data with the Special Waste Profile Form to demonstrate compliance with the waste acceptance criteria specified in Section 3.4 of this WCP. Alternatively, generators may have previously presented analytical data to CDPHE and received an exemption for certain waste

streams from the TENORM rules; this may also be accepted by the Special Waste Approvals Group.

In order to be classified as RCRA-exempt, the E&P waste must have been generated from a material or process uniquely associated with the exploration, development, and production of crude oil or natural gas. Waste may also be generated during activities or processes such as transportation or delivery of crude or finished products to refineries and/or other treating facilities; these are known as midstream activities and may include transportation via truck, rail, ship, or pipeline. Downstream activities include refineries and final treating facilities, as well as delivery systems to consumers, including such things as traditional consumer and commercial gas stations and transport of natural gas to homes. Waste generated during midstream and downstream activities/processes is not E&P exempt and additional analytical may be required by Five Part's Special Waste Approvals Group. In addition to the information in Table 1 below, see Section 4.3 for a detailed list of oil and gas waste streams.

Examples of E&P exempt waste streams are delineated below, separated into columns by exempt exploration, production, and "either" exploration or production wastes, where "either" could be exploration or production, depending upon the location and use of the equipment or material.

Table 1: Exempt Exploration and Production (E&P) Wastes

Exempt Exploration Wastes	Exempt Production Wastes	Either Exploration or Production Wastes
Drill cuttings and muds	Accumulated materials such as hydrocarbons, solids, sand, and emulsion from production separators, fluid treating vessels, and production impoundments	Spent filters, filter media, and backwash solids (assuming the filter itself is not hazardous and the residue in it is from an exempt waste stream)
Rig wash solids	Solids from production sites, including filter cake from oil reclamation and water recycling operations	Constituents removed from flowback and produced water before it is injected or otherwise disposed of (e.g., filters, tank bottom sediments)
Sediment and other tank bottoms from exploration activities, including wastes generated by closed loop recycling	Gas plant dehydration wastes and sweetening wastes; filter media and backwash solids	Debris (crude oil soaked or stained)
Pit sludges and solids generated during exploration and drilling activities	Pipe scale, pigging wastes (from gathering lines), hydrocarbon solids, hydrates, and other deposits removed from piping and production equipment prior to transportation	Mixtures of exempt exploration and exempt production wastes
Proppant/sand wastes and flowback (excluding unused product)	Hydrogen sulfide abatement wastes from geothermal energy production	Crude oil contaminated solids generated during exploration, drilling, and production activities (prior to transportation from a reclamation facility)

Note: The term "solids" refers to wastes that occur in a solid, semi-solid, or sludge form and/or that may contain free liquids.

Table 1 is a list of typical exempt E&P solid waste types/streams that may be accepted, but are not all-inclusive. Variations or additions to the list will be evaluated on a case-by-case basis using the same criteria. If uncertainty exists regarding the acceptability of a particular waste, CDPHE will be contacted for guidance and/or approval, as appropriate. The mixture of an exempt waste with another exempt waste remains exempt.

4.2.1 Acceptance of Exempt E&P Wastes

Exempt exploration waste will be accepted at ERL, provided it meets all the following requirements:

1. The generator certifies that the material is RCRA-exempt (i.e., that it was generated from a material or a process "uniquely associated with the exploration, development, and production of crude oil and/or natural gas");
2. The material meets the TENORM criteria outlined in Section 4.3; and
3. The material has successfully passed a Paint Filter Test (USEPA Method 9095B or equivalent).

Please see Attachment 1 – Special Waste Profile Form for additional information regarding requirements for disposal at ERL.

4.2.2 Acceptance of Non-exempt E&P and Other Oil and Gas Wastes

Oil and gas wastes that are not E&P exempt include waste that may be generated outside of primary field operations, and include wastes generated as a result of spills during treatment and transport. Non-exempt E&P wastes may be considered for acceptance at ERL provided it meets the following criteria:

1. Is not a listed hazardous waste (i.e., is not a waste generated from any process, source, or discarded products categorized under waste codes F, K, P or U per 6 CCR 1007-3 Part 261 (see Section 3.1, above);
2. Is not a hazardous waste by characteristics for toxicity, ignitability, reactivity, or corrosivity;
3. The ignitability (flash point) is equal to or greater than 140 °F and will not pose a chemical reaction hazard;
4. Contains no free petroleum or other liquids and has successfully passed a Paint Filter Test (USEPA Method 9095B)
5. Meets the TENORM criteria found in Section 3.4; and
6. Does not contain PCBs in concentrations equal to or greater than 50 parts per million (see Section 3.1, above).

For the purposes of this WCP, personal protective equipment (PPE) generated in direct association with the acceptance and handling of NORM/TENORM-containing waste will be considered an exempt waste and may be disposed of in ERL without screening, analytical testing, or a separate profile.

All wastes identified as non-exempt oil and gas wastes will be deemed acceptable only if they meet each and every criterion identified above. If uncertainty exists regarding the acceptability of a particular waste, CDPHE will be contacted for guidance and/or approval, as appropriate. In no event will ERL accept any waste if they are listed hazardous wastes, more specifically if they are generated from any process, source, or discarded products categorized under waste codes F, K, P or U per 6 CCR 1007-3 Part 261, or if the waste exhibits hazardous waste characteristics.

4.3 Acceptance of Mill Tailings and Mining Wastes

Mill tailings and mining wastes will only be accepted for disposal on a case-by-case basis with approval from Adams County and the CDPHE and if it meets the following criteria:

1. Is not a listed hazardous waste (i.e., is not a waste generated from any process, source, or discarded products categorized under waste codes F, K, P or U per 6 CCR 1007-3 Part 261 (see Section 3.1, above);
2. Is not a hazardous waste by characteristics for toxicity, ignitability, reactivity, or corrosivity as defined in 6 CCR 1007-3 Part 261 Subpart C, as amended;
3. Meets the TENORM criteria found in Sections 3.4 and 4.5; and

4.4 Acceptance of Domestic Wastewater Treatment Residuals

Domestic wastewater treatment residuals will only be accepted for disposal on a case-by-case with approval from Adams County and the CDPHE and it meets the following criteria:

1. Is not a hazardous waste by characteristics for toxicity, ignitability, reactivity, or corrosivity as defined in 6 CCR 1007-3 Part 261 Subpart C, as amended;
2. Meets the TENORM criteria found in Sections 3.4 and 4.5.

4.5 TENORM and Unimportant or Exempt Quantities of Source Material

Wastes that are reasonably expected to contain TENORM and/or unimportant or exempt quantities of source material must be characterized for radiological content prior to acceptance for disposal at the landfill. This may include materials produced as a result of concentrating solids/metals, such as:

- Drinking water treatment media and residuals
- Domestic wastewater treatment facility residuals
- Industrial wastewater treatment residuals
- Mine water treatment residuals
- Oil and gas E&P wastes
- Natural gas pigging line wastes

- Filter socks from saltwater disposals or flowback operations
- Natural gas filters
- Oil and gas processing waste such as tank bottoms, filter solids or cake, condensate sludges, molecular sieve residuals, and amine filters
- Oily waste such as condensate and pit sludge
- Pipes, pipe scale, and other processing equipment, also known as surface contaminated objects (SCO)

Note: ERL will only accept waste streams that are exempt as per Section 20.4 of 6 CCR 1007-1 Part 20 (see exempt levels below).

The landfill will accept wastes containing exempt levels of TENORM as follows:

- Must not exhibit hazardous characteristics, as defined in the CDPHE Identification and Listing of Hazardous Waste Regulation, 6 CCR 1007-3 Part 261 [latest version], and

- Must exhibit concentrations at or below the following radioactivity acceptance thresholds:

  - Ra-226 less than or equal to 5 pCi/g (dry weight) above background where default background is 1.4 pCi/g
  - RA-228 less than or equal to 5 pCi/g (dry weight) above background where default background is 1.3 pCi/g
  - Pb-210 less than or equal to 5 pCi/g (dry weight) above background where default background is 1.4 pCi/g
  - Po-210 less than or equal to 5 pCi/g (dry weight) above background where default background is 1.4 pCi/g

See Table A.1.2 in CDPHE's Addendum A: TENORM Characterization of their Guidance for Implementation of the Final Rule for 6 CCR 1007-1 Part 20 rules for a list of recognized laboratory methods for TENORM sample analysis of various matrices.

See Table 2 below for a summary of analytical requirements for each waste stream.

Table 2: Industry and Waste-Specific TENORM Isotopic Characterization Requirements

Industry Waste	Characterization Requirements
Drinking water treatment sludge/residuals/filter media, in particular where raw water is sourced from groundwater wells	Ra-226, Ra-228, U-nat, Th-nat
Domestic wastewater grit, intermediate process solids [1] *(only if TENORM is accepted as an influent)*	Ra-226, Ra-228
Industrial wastewater residuals 2	Ra-226, Ra-228, Pb-210, Po-210
Oil exploration & production wastes – tank bottoms, filter socks, flowback	Ra-226, Ra-228
Gas exploration & production wastes – pigging, rinsewater, filters, spent amine, condensate, molecular sieve residuals, condensate [3]	Pb-210, Po-210
Mine water treatment residuals	Ra-226, Ra-228, U-nat, Th-nat
Pipe, tank debris, heater treaters, fire tubes, used equipment (SCO)	Survey in accordance with Section 20.4.5 of 6 CCR 1007-1 Part 20, Registration and Licensing of Technologically Enhanced Naturally Occurring Radioactive Material and associated Guidance, which may change from time to time.

Notes: SCO = surface contaminated objects

[1] Also analyze for Pb-210 and Po-210 if these levels are expected to exceed Ra-226 levels

[2] Not all isotopes may need to be analyzed depending on process knowledge

3 Some gas waste streams may also contain hazardous or other RCRA constituents and additional analytical may be required

4.6 Empty Containers

Containers that previously contained hazardous waste must be "empty" as defined in the CDPHE Identification and Listing of Hazardous Waste Regulation, 6 CCR 1007-3 Part 261, Section 261.7 [latest version] before they will be accepted for disposal at ERL. The regulatory definitions for "empty container" vary depending on the previous contents of the container (i.e., acute or non-acute hazardous wastes or compressed gas). The requirements regarding empty containers only apply to tanks that meet the definition of a container. The definition of container currently contained in the CDPHE Hazardous Waste Regulations, 6 CCR 1007-3 [latest version] is "any portable device in which a material is stored, transported, treated, disposed of, or otherwise handled." The generator must declare that the waste is an "empty container" on the Special Waste Profile form.

Aerosol cans in shipments known to contain empty containers or that were discovered during the random inspection program shall be punctured by the generator prior to shipment to ERL. For gas cylinders, the generator must remove the valves and allow it to air out for at least 24 hours.

All empty containers, regardless of what they previously contained, need to meet the following procedures:

- Warning labels depicting hazardous waste, hazardous materials, chemicals or substances, radioactive materials, and commercial chemical products or trade names on empty containers shall be painted over or removed prior to shipment to ERL.
- Containers shall be received crushed, or if whole, one end must be removed to allow ERL personnel the ability to verify that they are "RCRA empty."

4.7 Animal Carcasses

Animal carcasses delivered in bulk or on an ongoing basis from veterinary clinics, educational facilities, laboratories, city animal control facilities, or similar facility will be profiled. The Express Waste Profile Form (Attachment 2) requires that the generator certify that the animal carcass is non-infectious.

4.8 Paint Waste

Paint wastes accepted at ERL include paint filters, paint residues or sludge, and paint dust or dry paint chips. These paint wastes will only be accepted in a non-liquid state. Paint wastes accepted in drums will be fitted with removable/resealable lids.

Paint filters, paint residues or paint sludge should be analyzed for the appropriate TCLP constituents. Also, paint sludge should be tested for free liquids via a paint filter test.

When accepting paint dust or dry paint chip waste, controls should be implemented to reduce the amount of dusting that could occur during transport and disposal. These wastes should be analyzed for appropriate TCLP constituents based on the constituents of the paint chips.

4.9 Sludge

As with all industrial wastes, the process generating the waste sludge must be accurately characterized, including material-specific information. If the particular sludge is a listed waste or a listed waste mixture pursuant to any "mixture" rates applicable at that time, then the sludge will not be approved for disposal.

Because a majority of sludge may include excessive water, additional care shall be taken by the generator to ensure that excessive free moisture has been removed prior to the acceptance of the sludge for disposal. All sludge must pass the paint filter test administered by the generator.

Additional analyses may be necessary for the various sludge types (including those not listed below) based on the nature of the sludge and the process that generated the sludge. Sludges (and tank bottoms) from oil and gas operations, drinking water, and wastewater treatment may contain TENORM. Any sludges from oil E&P activities, as well as from water treatment, must be

analyzed for Ra-226 and Ra-228. Any sludges from natural gas pipeline pigging operations must be analyzed for Pb-210 and Po-210.

4.9.1 Ink Sludge

Ink sludge has the potential of containing metals and organics that are found in the solvents used to prepare the ink. If the process does not employ "listed" constituents, ink sludge must be tested for appropriate TCLP constituents. Ink sludge must also pass the paint filter test.

4.9.2 Lime Sludge

In addition to having a potential for high moisture content, lime sludge can sometimes have heavy metals present. For this reason, lime sludge must be tested for appropriate TCLP constituents. Lime sludge must also pass the paint filter test.

4.9.3 Paper Mill Sludge

Paper mill sludge must be tested for appropriate TCLP constituents and must pass the paint filter test. These sludges should also be tested for TENORM radionuclides (Ra-226, Ra-228, Pb-210, and Po-210).

4.9.4 Sand Trap Wastes

Sand trap wastes must be tested for appropriate TCLP constituents and must pass the paint filter test. If the sand trap is associated with produced water from oil and gas operations or from other oil and gas activities, the sand trap waste must also be analyzed for TENORM radionuclides.

4.9.5 Alum Sludge/Ferric Chloride Sludge

Alum sludge or ferric chloride sludge from water treatment facilities may be acceptable for disposal at ERL provided the provisions of the CDPHE Regulations Pertaining to Solid Waste Sites and Facilities 6 CCR 1007-2 Part 1, Section 12 [latest version] are met. Additionally, the sludge must pass the paint filter test. The generator should also test for TENORM radionuclides. Also, refer to Section 4.19 of this WCP.

4.10 Glass Waste

Several types of glass wastes may be accepted at ERL, including granular, powder, and broken pieces. Prior to disposal approval, a component inventory review is required. If lead or other heavy metals are used in the production process, then a TCLP metal analysis must be conducted (these types of glass typically include optical glass and windshields). Window glass will not typically require TCLP analysis prior to disposal. Powdered glass and glass dust will require prompt burial and cover.

4.11 Spent Filters

Filters can be used to remove solids, organics, or metals from water and other liquids. The analytical requirements for the various filter types will be based on the media that were filtered and the nature of the filtration process. For example, filters that have removed metals must be tested for TCLP heavy metals and filters used to remove organics must be tested for TCLP organic constituents. Analytical may also be required for TENORM radionuclides.

Used motor oil filters can be accepted for disposal following the provisions of the CDPHE Identification and Listing of Hazardous Waste Regulation, 6 CCR 1007-3 Part 261, Section 261.4(b)(13) [latest version].

Spent filters from oil E&P facilities, as well as natural gas pipelines and facilities and including compressor and meter stations, will require laboratory analytical according to Table 2.

4.12 Asbestos-Containing Materials

Non-friable asbestos waste will be accepted for disposal at the Landfill. Friable asbestos waste will not be accepted for disposal at the Landfill. A generator of non-friable asbestos waste will be required to submit a profile form (Attachment 1 or 2) for approval.

Within 24 hours of receipt of non-friable asbestos waste and any storage thereof in accordance with CDPHE Regulations Pertaining to Solid Waste Sites and Facilities, 6 CCR 1007-2 [latest version], Part 1, Section 5.4, the waste will be covered with a minimum of nine inches of soil or 18 inches of non-asbestos cover material. The Landfill operators will minimize the potential for release from, and exposure to, non-friable asbestos waste after placement in the disposal area (i.e., the working face) and will not compact the waste prior to application of cover materials. Landfill compaction equipment will not come into contact with non-friable asbestos waste, containers, or packaging. Non-friable asbestos waste management will be accomplished in a manner that minimizes any change in the friability of the waste.

It is the responsibility of the generator to determine if the asbestos waste is friable or non-friable. If the determination is not made, the waste will not be accepted.

Storage of asbestos waste at an asbestos waste disposal area, prior to burial, will be conducted in accordance with the following requirements:

- Asbestos shall be stored only in rigid containers and in segregated locations used solely for the purpose of such storage where asbestos waste packages can be handled, stored, and maintained without being opened or disturbed.
- Asbestos waste will be stored at an asbestos waste disposal area for no more than 20 calendar days prior to burial.
- A warning sign will be posted on each side of an area where asbestos waste is stored prior to burial. Such signs shall conform to CDPHE Regulations Pertaining to Solid

Waste Sites and Facilities 6 CCR 1007-2 Part 1, Section 5.3.4. The legend of each such sign will conform to CDPHE Regulations Pertaining to Solid Waste Sites and Facilities 6 CCR 1007-2 Part 1, Section 5.3.4, except that the first line will read, "Asbestos Waste Storage".

The spill contingency plan, in the event that asbestos waste is spilled or requires repackaging, is as follows:

- The area will be secured and the Operations Manager or designee will be contacted.
- Responders will wear the required PPE.
- The leaking container will be secured, sealed, and/or wetted to prevent any further escape of asbestos fibers.
- All visible asbestos waste will be collected by either hand equipment or heavy equipment and placed in a bag provided for spills. For spills on soil, the top layer of soil that may be contaminated may also be collected. A second bag will be used to double wrap the spilled asbestos waste.
- The bag will be sealed and the required labels applied. The bag will be placed in the asbestos waste disposal area.

4.13 Petroleum-Contaminated Soils

Petroleum-contaminated soils will be accepted at ERL if the soil does not exhibit hazardous or radioactive (TENORM) characteristics, as defined in the CDPHE Identification and Listing of Hazardous Waste Regulation, 6 CCR 1007-3 Part 261 [latest version] and 6 CCR 1007-1 Part 20, respectively, except as qualified below for underground storage tank (UST) corrective actions.

Contaminated soils resulting from UST corrective actions regulated by 40 CFR Part 280 (Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks) [latest version] are exempted from the TCLP volatile and semi-volatile analysis if the constituent(s) of concern was the original component(s) of product released. However, as provided in 40 CFR Part 280, soils resulting from UST corrective action must meet the following:

- Soils contaminated with leaded gasoline must have less than 100 ppm total lead, unless the TCLP lead concentration is less than 5.0 milligrams per liter (mg/L); and
- Soils contaminated by waste oils must be evaluated for TCLP lead, cadmium, and chromium.

For contaminated soils of known origin not resulting from UST corrective actions, the following analyses may be required, depending on the source or type of contamination:

- TCLP lead, cadmium, and chromium for soil contaminated with used oils

- TCLP lead for soil contaminated with leaded gasoline
- Total organic halide (TOX) for volatile and semi-volatile compounds (if above 1000 ppm, TCLP volatile organic compound (VOC) and semi-volatile organic compound (SVOC) are required)
- Benzene, ethylbenzene, toluene, and xylenes (BTEX) concentrations

4.14 Liquids

ERL will not accept bulk waste liquids for disposal.

Wastes that previously contained free liquids that have been solidified, stabilized, or dried to pass the paint filter test will be accepted for disposal. If appropriate, EPA paint filter tests (EPA Method 9095B) will be used to determine the presence of free liquids in a waste.

4.15 Residential Generated Used Batteries, Used Oil, and Waste Tires

Disposal of residentially generated used lead-acid batteries, used oil, and waste tires in ERL is prohibited. The procedure to minimize the disposal of these items includes signage at the entrance of the landfill notifying customers that these items are prohibited.

4.16 Incinerator Ash

Incinerator ash means the bottom ash, fly ash, or air pollution control residues and other residues of the combustion process from the operation of an incinerator or energy recovery facility, including the combustion of any municipal, commercial, or industrial solid waste.

Incinerator ash is generally composed of oxides of silicon, aluminum, iron, and calcium. Incinerator ash may also contain other trace elements that vary by type and level, depending on the ash particle size and source of the combustion material. Many of these elements are in the form of oxides tied up in complex silicates. Therefore, incinerator ash being considered for disposal at ERL will be required to be analyzed for TCLP metals.

Additional analyses may be required, depending on the nature of the incinerated material and the incineration process.

Loads of incinerator ash will typically be wetted to prevent fugitive dust emissions (but not to the point where they contain free liquids) and the generators will be instructed that the load must be properly contained to prevent leakage, spillage, or dispersion during transport.

4.17 Coal-Fired Utility Ash

Coal-fired utility ash must pass the paint filter test and be analyzed for appropriate TCLP constituents. Loads of coal-fired utility ash will typically be wetted to prevent fugitive dust emissions (but not to the point where they contain free liquids) and the generators will be

instructed that the load must be properly contained to prevent leakage, spillage, or dispersion during transport.

4.18 Solid Wastes from Other Land Disposal Activities

Waste excavated from other land disposal activities, such as closed landfills, may be disposed at ERL. Representative samples must be submitted for waste characterization. If available, groundwater and/or surface-water monitoring test results may also be submitted with the Special Waste Profile form.

4.19 Fluorescent Light Bulbs/Ballasts

Fluorescent light bulbs and ballasts may be disposed at ERL. Waste acceptance guidelines are provided below.

4.19.1 Segregated Fluorescent Light Bulbs

Generators of fluorescent bulbs, high intensity discharge (HID) lamps or mercury vapor bulbs are required to test their waste for appropriate TCLP constituents or submit SDS information to verify that the bulbs are non-hazardous.

4.19.2 Segregated Ballasts

For management of light ballasts, the generator must determine whether the ballasts to be disposed of are PCB-containing or non-PCB-containing ballasts. The generator must indicate "non-PCB" on the Special Waste Profile form or provide additional information.

4.19.3 PCB Ballasts

PCB-containing ballasts will be managed in accordance with 40 CFR Part 761 (Polychlorinated Biphenyls Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions [latest version], Parts 761.60(b)(2)(ii) and 761.62).

4.20 Sanitary Sewer Grit or Bar Screenings

Sanitary sewer grit or bar screenings may contain excessive amounts of liquids. Therefore, they must pass the paint filter test. Sanitary sewer grit or bar screenings must also be analyzed for appropriate TCLP constituents. Bar screenings do not need to be analyzed for TENORM isotopes. Grit also does not need to be analyzed for TENORM isotopes, unless the wastewater treatment plant accepts nonexempt TENORM, in which case the grit must be analyzed for Ra-226, Ra-228, Pb-210, and Po-210.

4.21 Treated Wood

Treated wood is wood that has been treated with preservatives such as creosote, pentachlorophenol, or chromate copper arsenate. Treated wood can be fresh or weathered. Fresh treated wood has the potential to have semi-volatile constituents; therefore, it must be

analyzed for TCLP semi-volatile for creosols, pentachlorophenol, hexachlorobenzene, and TCLP metals for arsenic and chromium, depending on the type of preservative used.

Weathered treated wood does not need to be tested for disposal in the landfill, but the waste needs to be profiled by the generator prior to acceptance.

4.22 Treated Formerly Characteristic Hazardous Waste

Treated formerly characteristic hazardous waste, which has been rendered nonhazardous in accordance with accepted treatment standards, will be accepted upon review of the following analyses:

- TCLP for toxicity characteristic (D code) constituents or total analysis, whichever is indicated at 40 CFR 268.40;
- Underlying hazardous constituents (UHCs) for utilizing universal treatment standards for applicable UHCs based on the generator's knowledge of process, materials, and analysis; and
- Description of the treatment process used referencing 40 CFR 268 (Land Disposal Restrictions) [latest version] acceptable hazardous waste treatment standards.

4.23 Foundry Sand and Dust, Sand Blast Waste, and Ceramic Waste

Foundry sand and dust are generated from metallurgical processes, typically in the forging of casting of metal products. Such residues can be disposed of at ERL. Required testing by the generator includes TCLP metals of concern. Ceramic waste must be tested for these same constituents.

4.24 Treated Medical Waste

In accordance with the CPDHE Regulations Pertaining to Solid Waste Sites and Facilities 6 CCR 1007-2 Part 1, Section 13.8.3 [latest version], solid waste disposal facilities can accept medical waste that has been treated so as to render the waste non-infectious. Appropriate treatment methods by the generator may include, but are not limited to, autoclaving, decontamination, sterilization, or other methods approved by CDPHE.

4.25 Automobile Bodies and Shredder Fluff

Automobile bodies can be accepted for disposal if potentially hazardous components such as batteries, antifreeze, oils, and gasoline have been removed. The car body will be transported to the active face and crushed by ERL equipment.

Auto shredder fluff is generated through the processing and/or demolition of automobiles and trucks. The fluff includes the non-metallic components of the vehicle, including seats and other interior items. Generators are required to have this waste analyzed for appropriate TCLP constituents and total PCBs prior to disposal.

4.26 Other Industrial Wastes and Wastes Requiring Additional Handling

Other industrial wastes or wastes requiring additional handling will be subject to the review process outlined below.

- Wastes and process-specified characteristics must be indicated on a Special Waste Profile form (Attachment 1). Appropriate SDSs must be submitted for review. No hazardous waste, as identified pursuant to the CDPHE Identification and Listing of Hazardous Waste Regulation, 6 CCR 1007-3 Part 261 [latest version] or applicable federal regulations, will be approved for disposal.

- Wastes must be characterized properly. Appropriate analytical test results must be submitted for review or additional representative samples submitted for the required analysis. Five Part reserves the right to require resampling and analysis of any waste submitted for approval.

- Physical properties of the waste will be considered for determining safe handling and disposal procedures.

- Upon receipt of the Profile Approval Notification, generators are required to provide a Non-Hazardous Special Waste and Asbestos Manifest form (Attachment 4) for each load of approved waste to be delivered to ERL.

- Pigging sludge (from natural gas maintenance operations) and filters from natural gas meter stations, compressor stations, or gas plants must be analyzed for Pb-210 and Po-210 at a minimum. Sludges may also contain other regulated chemicals/constituents such as mercury, arsenic, and other hazardous materials.

4.27 Electronics Waste

Disposal of residentially generated electronics waste (e-waste) in ERL is prohibited. Electronics waste includes household electronics such as televisions, computers, computer monitors, computer peripherals (i.e., keyboards and mice), laptops, notebooks/ultrabooks/ netbooks, electronic tablets, printers, fax machines, DVD/VCR players, radios/stereos, video game consoles, and video display devices with viewing screens greater than 4 inches diagonally.

Devices including appliances, non-hazardous industrial or commercial devices, motor vehicle components, or any type of telephone are permitted to be disposed of in ERL.

ERL will post a sign at the entrance of the landfill stating that disposal of e-waste devices is prohibited. ERL staff will direct customers needing to dispose of e-waste to an appropriate local e-waste recycling facility. A list of electronics drop-off locations and recyclers can be found on the CDPHE website.

5.0 RECORDKEEPING AND REPORTING

Copies of facility personnel training records and approved Special Waste Profile forms, SDSs, analytical results, Special Waste Approvals Group decisions, profile rejection notifications, and manifests will be maintained in a file at the ERL facility and/or at Five Part administrative offices during the active site life and post-closure period. Records of random load inspections will be maintained in accordance with Section 2.1.2(B)(1) of 6 CCR 1007-2 Part 1 of the CDPHE Regulations Pertaining to Solid Waste Sites and Facilities.

Facility personnel must be appropriately trained to identify unacceptable waste streams. If an unacceptable waste stream is discovered, specific information will be documented and maintained onsite. The information includes the following:

- Date and time of detection
- Name of transporter
- Name of generator
- Notice of rejection of load to transporter/generator
- Material detected (if known)
- Actions taken to manage material, if generator or transporter is not known
- Final disposal location, if managed by an independent contractor

If waste is determined to be hazardous, CDPHE will be notified pursuant to applicable regulatory requirements.

ATTACHMENT 1
SPECIAL WASTE PROFILE FORM

Special Waste Profile

Disposal Facility: --Select Facility--

Waste Profile #:

Sales Rep #:

I. Generator Information

Generator Name:

Generator Site Address:

City: County: State: Colorado Zip:

State ID/Reg No: State Approval/Waste Code: NAICS #:

Generator Mailing Address ☐ (if different)

City: County: State: --Select State-- Zip:

Generator Contact Name: Email:

Phone Number: Ext: Fax Number:

II. Billing Information

Bill To: Contact Name:

Billing Address: Email:

City: State: --Select State-- Zip: Phone:

III. Waste Stream Information

Name of Waste:

Process Generating Waste:

Type of Waste: --Select Waste Type-- Physical State: --Select Physical State Method of Shipment: --Select Shipment Metho

Estimated Volume: Volume Type: --Select Volume Type--

Frequency: --Select Frequency-- Disposal Consideration: --Select Disposal Consideration--

IV. Representative Sample Certification

☐ **No Sample Taken**

☐ **Sample Taken** **Type of Sample** --Select Sample Type--

Is the representative sample collected to prepare this profile and laboratory analysis, collected in accordance with U.S. EPA 40 CFR 261.20(c) guidelines or equivalent? ☐ **Yes** ☐ **No**

Sample Date:

Sample ID Numbers or SDS:

Remember to attach Laboratory Analytical Report (and/or Material Safety Data Sheet) including Chain of Custody and required parameters provided for this profile.

Special Waste Profile

REPUBLIC SERVICES

V. Physical Characteristics of Waste

Characteristic Components (must equal 100%:)	% By Weight (out of 100% - ranges acceptable):
1.	
2.	
3.	
4.	
5.	

Color:	Odor (describe):	Does Waste Contain Free Liquids?	% Solids:	pH:	Flash Point:
		☐ Yes ☐ No			°F

Attach Laboratory Analytical Report (and/or Material Safety Data Sheet) including Chain of Custody and required parameters provided for this profile.

RCRA Regulatory Questions

1. Does this waste or generating process contain regulated concentrations of the following Pesticides and/ or Herbicides: Chlordane, Endrin, Heptachlor (and its epoxides), Lindane, Methoxychlor, Toxaphene, 2,4-D, or 2,4,5-TP Silvex as defined in 40 CFR 261.33?	☐ Yes ☐ No
2. Does this waste contain reactive sulfides (greater than 500 ppm) or reactive cyanide (greater than 250 ppm) [reference 40 CFR 261.23(a)(5)]?	☐ Yes ☐ No
3. Does this waste contain regulated concentrations of Polychlorinated Biphenyls (PCBs) as defined in 40 CFR Part 761?	☐ Yes ☐ No
4. Does this waste contain concentrations of listed hazardous wastes defined in 40 CFR 261.31, 261.32, 261.33, including RCRA F-Listed Solvents?	☐ Yes ☐ No
5. Has this waste been delisted under 40 CFR 260.20 and 260.22? If yes, attach the final decision to delist the waste as published in the Federal Register.	☐ Yes ☐ No
6. Does this waste exhibit a Hazardous Characteristic as defined by Federal and/or State regulations? If Yes, identify the applicable waste code and specify if the waste is hazardous as defined by Federal, State or both?	☐ Yes ☐ No
7. Does this waste contain regulated concentrations of 2,3,7,8-Tetrachlorodibenzodioxin (2,3,7,8-TCCD), or any other dioxin as defined in 40 CFR 261.31?	☐ Yes ☐ No
8. Is this a regulated Medical or Infectious Waste as defined by Federal and/or State regulations?	☐ Yes ☐ No
9. Is this a regulated Radioactive Waste as defined by Federal and/or State regulations?	☐ Yes ☐ No
10. Is this a solid waste that is not a hazardous waste in accordance with 40 CFR 261.4(b)? If yes, please provide the corresponding regulatory citation.	☐ Yes ☐ No

Republic Services Waste Handling Questions

1. Does this waste generate heat or react when contacted with water/moisture?	☐ Yes ☐ No
2. Does the waste contain sulfur or sulfur by-products?	☐ Yes ☐ No
3. Is this waste generated at a State or Federal Superfund cleanup site subject to regulation under CERCLA?	☐ Yes ☐ No
4a. Is this waste from a TSD facility, TSD-like facility or consolidator (i.e. multiple wastes/multiple generators)?	☐ Yes ☐ No

4b. If yes to the above question, please provide clarification.

Special Waste Profile

VI. Certification

I hereby certify that to the best of my knowledge and belief, the information contained herein is a true, complete and accurate description of the waste material being offered for disposal and all known or suspected hazards have been disclosed. All Analytical Results/Material Safety Data Sheets submitted are truthful and complete and are representative of the waste.

I further certify that by utilizing this profile, neither myself nor any other employee of the company will deliver for disposal or attempt to deliver for disposal any waste which is classified as toxic waste, hazardous waste or infectious waste, or any other waste material this facility is prohibited from accepting by law. I shall immediately give written notice of any change or condition pertaining to the waste not provided herein. Our company hereby agrees to fully indemnify this disposal facility against any damages resulting from this certification being inaccurate or untrue.

I understand that attaching an electronic signature, I am signing this document, consent to complete this transaction and receive all related communication electronically, and agree this document will be binding as though I had physically signed it. A printout of this document may be accepted with the same authority as the original.

If electronic signature is preferred, please submit completed (unsigned) form to your Special Waste Coordinator or Special Waste Sales Executive to initiate signature process.

I further certify that the company has not altered the form or content of this profile sheet as provided by Republic Services.

Authorized Representative Name (Printed)	Title (Printed)	Company Name

Representative Signature	Date

ATTACHMENT 2
EXPRESS WASTE PROFILE FORM

Express Waste Profile

Disposal Facility: --Select Facility--

Waste Profile #

Sales Rep #

I. Generator Information

Generator Name:

Generator Site Address:

City: County: State: --Select State-- Zip:

State ID/Reg No: State Approval/Waste Code: NAICS #:

Generator Mailing Address ☐ (if different)

City: County: State: --Select State-- Zip:

Generator Contact Name: Email:

Phone Number: Ext: Fax Number:

II. Billing Information

Bill To: Contact Name:

Billing Address: Email:

City: State: --Select State-- Zip: Phone:

III. Waste Stream Information

Name of Waste:

☐ Weathered Wood ☐ RCRA Empty Containers ☐ Treated Medical Waste ☐ Animal Carcass (non-infectious)

☐ Friable Asbestos ☐ Nonfriable Asbestos ☐ Tires ☐ Meth Contaminated Debris

Has a sample of this waste been taken? ☐ Yes ☐ No

Process Generating Waste:

Method of Shipment: --Select Shipment Method-- Complete if "other"

Frequency: --Select Frequency--

Estimated Annual Volume: Volume Type: --Select Volume Type--

Color: Odor:

IV. Certification

I hereby certify that to the best of my knowledge and belief, the information contained herein is a true, complete and accurate description of the waste material being offered for disposal and all known or suspected hazards have been disclosed. I further certify that by utilizing this profile, neither myself nor any other employee of the company will deliver for disposal or attempt to deliver for disposal any waste which is classified as toxic waste, hazardous waste or infectious waste, or any other waste material this facility is prohibited from accepting by law. I shall immediately give written notice of any change or condition pertaining to the waste not provided herein. Our company hereby agrees to fully indemnify this disposal facility against any damages resulting from this certification being inaccurate or untrue. I further certify that the company has not altered the form or content of this profile sheet as provided by Republic Services.

I understand that attaching an electronic signature, I am signing this document, consent to complete this transaction and receive all related communication electronically, and agree this document will be binding as though I had physically signed it. A printout of this document may be accepted with the same authority as the original."

If electronic signature is preferred, please submit completed (unsigned) form to your Special Waste Coordinator or Special Waste Sales Executive to initiate signature process

Authorized Representative Name (Printed)	Title (Printed)	Company Name

Authorized Representative Signature	Date

ATTACHMENT 3
SPECIAL WASTE DEPARTMENT DECISION FORM

Republic Services

18500 N. Allied Way, Phoenix, AZ 85054

SPECIAL WASTE DEPARTMENT DECISION

	Waste Profile #	**Expiration Date**	
I. Decision Request:	☐ **Initial** ☐ **Recertification** ☐ **Change**		
Disposal Facility:			
Generator Name:			
Generator Site Address:			
City:	**County:**	**State:**	**Zip:**
Name of Waste:			
Estimated Annual Volume:			

II. Special Waste Department Decision: ○ **Approved** ○ **Rejected**

Management Method(s): ☐ Landfill ☐ Solidification ☐ Bioremediation ☐ Deep Well ☐ Transfer Facility

Problematic Special Waste according to Republic? ○ Yes ○ No

If yes, which one?

Approved by Special Waste Review Committee? ○ Yes ○ No ○ Not Applicable

Precautions, Conditions or Limitations on Approval

Special Waste Analyst Signature: _____ **Name (Printed):** _____

Date:

III. Facility Decision: ○ **Approved** ○ **Rejected**

Precautions, Conditions or Limitations on Approval

By signing below, the General Manager or Designee agrees that a fully executed Special Waste Service Agreement is on file for this profile and that the special waste file is complete.

General Manager or Designee: _____ **Name (Printed):** _____

Date:

ATTACHMENT 4
NON-HAZARDOUS SPECIAL WASTE AND ASBESTOS MANIFEST

REPUBLIC SERVICES

NON-HAZARDOUS SPECIAL WASTE & ASBESTOS MANIFEST

3168000

If waste is asbestos waste, complete Sections I, II, III and IV
If waste is **NOT** asbestos waste, complete Sections I, II and III

I. GENERATOR (Generator completes Ia-r)

a. Generator's US EPA ID Number	b. Manifest Document Number	c. Page 1 of
d. Generator's Name and Location: f. Phone:	e. Generator's Mailing Address: g. Phone:	
If owner of the generating facility differs from the generator, provide: h. Owner's Name:	i. Owner's Phone No.:	

j. Waste Profile #	k. Exp. Date	l. Waste Shipping Name and Description	m. Containers No.	m. Containers Type	n. Total Quantity	o. Unit Wt/Vol

GENERATOR'S CERTIFICATION: I hereby certify that the above named material is not a hazardous waste as defined by 40 CFR 261 or any applicable state law, has been properly described, classified and packaged, and is in proper condition for transportation according to applicable regulations; AND, if this waste is a treatment residue of a previously restricted hazardous waste subject to the Land Disposal Restrictions. I certify and warrant that the waste has been treated in accordance with the requirements of 40 CFR 268 and is no longer a hazardous waste as defined by 40 CFR 261.

p. Generator Authorized Agent Name (Print)	q. Signature	r. Date

II. TRANSPORTER (Generator completes IIa-b and Transporter completes IIc-e)

a. Transporter's Name and Address: b. Phone:		
c. Driver Name (Print)	d. Signature	e. Date

III. DESTINATION (Generator complete IIIa-c and Destination Site completes IIId-g)

a. Disposal Facility and Site Address: b.	c. US EPA Number	d. Discrepancy Indication Space:

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is true and accurate.

e. Name of Authorized Agent (Print)	f. Signature	g. Date

IV. ASBESTOS (Generator completes IVa-f and Operator complete IVg-i)

a. Operator's Name and Address: b. Phone:	c. Responsible Agency Name and Address: d. Phone:
e. Special Handling Instructions and Additional Information:	
f. ☐ Friable ☐ Non-Friable ☐ Both % Friable % Non-Friable	

OPERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

g. Operator's Name and Title (Print)	h. Signature	i. Date

*Operator refers to the company which owns, leases, operates, controls, or supervises the facility being demolished or renovated, or the demolition or renovation operation or both

ATTACHMENT 5
SPECIAL WASTE PROFILE – RECERTIFICATION

Special Waste Profile - Recertification

Disposal Facility: --Select Facility--

Waste Profile #:

Sales Rep #:

I. Generator Information

Generator Name:

Generator Site Address:

City: County: State: --Select State-- Zip:

State ID/Reg No: State Approval/Waste Code: NAICS:

Generator Mailing Address ☐ (if different)

City: County: State: --Select State-- Zip:

Generator Contact Name: Email:

Phone Number: Ext: Fax Number:

II. Waste Stream Information

Name of Waste:

Check Section 1 or 2 below

1. ☐ ***There has been a change*** in the characteristics of the waste stream due to the following:
   a. Change of a raw material used in the waste generating process.
   b. Change in the waste generating process itself.
   c. Change in a physical characteristic of the waste.
   d. New information has been documented concerning the human health effects of exposure to the waste.

   If any of these changes have occurred, a new profile sheet must be completed, and new analysis and/or SDS must be provided as appropriate.

2. ☐ ***There have been no changes*** that would alter the physical characteristics of the special waste stream. Updated analytical may be required.

III. Representative Sample Certification

☐ **No Sample Taken**

☐ **Sample Taken** **Type of Sample** --Select Sample Type--

Is the representative sample collected to prepare this profile and laboratory analysis, collected in accordance with U.S. EPA 40 CFR 261.20(c) guidelines or equivalent? ☐ **Yes** ☐ **No**

Sample Date:

Sample ID Numbers:

Special Waste Profile - Recertification

IV. Certification

I hereby certify that to the best of my knowledge and belief, the information contained herein is a true, complete and accurate description of the waste material being offered for disposal and all known or suspected hazards have been disclosed. All Analytical Results/Material Safety Data Sheets submitted are truthful and complete and are representative of the waste.

I further certify that by utilizing this profile, neither myself nor any other employee of the company will deliver for disposal or attempt to deliver for disposal any waste which is classified as toxic waste, hazardous waste or infectious waste, or any other waste material this facility is prohibited from accepting by law. I shall immediately give written notice of any change or condition pertaining to the waste not provided herein. Our company hereby agrees to fully indemnify this disposal facility against any damages resulting from this certification being inaccurate or untrue.

I understand that attaching an electronic signature, I am signing this document, consent to complete this transaction and receive all related communication electronically, and agree this document will be binding as though I had physically signed it. A printout of this document may be accepted with the same authority as the original."

If electronic signature is preferred, please submit completed (unsigned) form to your Special Waste Coordinator or Special Waste Sales Executive to initiate signature process.

I further certify that the company has not altered the form or content of this profile sheet as provided by Republic Services.

Authorized Representative Name (Printed)	Title (Printed)	Company Name

Authorized Representative Signature	Date

ATTACHMENT 6
SPECIAL WASTE INSPECTION SHEET

Date: _____

Time: _____

SPECIAL WASTE INSPECTION SHEET

☐ **Initial** ☐ **Random** ☐ **Suspicious** ☐ **Recertification**

Disposal Facility: _____ Waste Profile # _____

Generator Name: _____

Name of Waste: _____

Transporter Name: _____

Transporter Phone Number: _____

Driver Name: _____

Vehicle License Plate Number and State: _____

Physical Screening

INDICATE **YES** OR **NO** FOR EACH OF THE FOLLOWING TESTS AND NOTE ANY DESCREPANCIES. DO THE CHARACTERISTICS OF THE WASTE MATCH THE PROVIDED INFORMATION ON THE SPECIAL WASTE PROFILE?

Characteristics	Profile	Yes	No	Comments and/or Observations:
Color	_____	☐	☐	_____
Odor	_____	☐	☐	_____
Physical State	_____	☐	☐	_____
Free Liquids	_____	☐	☐	_____

Is a Photograph Attached? ☐ ☐ Initial Load Must Include Photograph

IF WASTE FAILS ONE OR MORE OF THE PHYSICAL SCREENING TESTS, THE WASTE IS DEEMED UNACCEPTABLE FOR DISPOSAL AND SHOULD BE REJECTED.

Waste Accepted

_____

Inspector Printed Name Date

Waste Rejected (If Rejected then a Photograph MUST be attached.)

Reasons for Rejection

☐ Extraneous and/or Unauthorized Material ☐ Suspected Hazardous Waste ☐ Does Not Match Profile

☐ Suspected PCB Waste ☐ Free Liquids

Comments

_____

_____

_____

Inspector Printed Name Date

_____

General Manager or Designee Printed Name Date

Appendix R

Alternative Daily Cover Request and Approval

COLORADO
Department of Public
Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

September 22, 2016

Mr. Justin Keever
Site Manager
Five Part Development, LLC
8201 E. Schumaker Road
Bennett, Colorado 80102

Re: **Approval**: EDOP Amendment for use of 12-Inch Nominal Shredded Tires as Alternative Daily Cover, East Regional Landfill
SW/ADM/FIV 2.2

Dear Mr. Keever,

The Hazardous Materials and Waste Management Division (Division) of the Colorado Department of Public Health and Environment has received the following document:

> *EDOP Amendment for use of 12-Inch Nominal Shredded Tires as Alternative Daily Cover, East Regional Landfill* (Amendment). Document dated: September 15, 2016.

The Division has reviewed the above-referenced Amendment. Based on the success you reported using shredded tire material as ADC in the field trial demonstration and the appropriate and comprehensive conditions contained in the Amendment, the Division hereby **approves** the Amendment.

The Division is authorized to bill for its review of technical submittals at $125 per hour, pursuant to Section 1.7 of the Solid Waste Regulations. An invoice for the Division's review of the subject document will be sent under separate cover.

Please contact me at 303-691-4049, Andrew.Todd@state.co.us if you have any questions.

Sincerely,

Andy Todd

Andy Todd
Solid Waste Permitting Unit
Solid Waste and Materials Management Program
Hazardous Materials and Waste Management Division

Ec: Lisa Oliveto, Tri-County Health Department
Jen Rutter, Adams County Planning Department
Mark McMullen, American Environmental Consulting, LLC
Jennifer Reynolds, Division Compliance Assurance Unit

Community & Economic
Development Department
www.adcogov.org

ADAMS COUNTY
COLORADO

4430 South Adams County Parkway
1st Floor, Suite W2000
Brighton, CO 80601-8204
PHONE 720.523.6800
FAX 720.523.6998

September 22, 2016

Justin Keever
Site Manager
East Regional Landfill
Alpine Waste & Recycling
8201 Schumaker Road
Bennett, CO 80102

Re: Minor Amendment to a Certificate of Designation (Case # EXG2009-00001)
Modification to the Engineering Design and Operations Plan to allow an
Alternative Daily Cover of 12-Inch Nominal Shredded Tires

Dear Mr. Keever,

This Department has completed its review of your application titled *EDOP Amendment for use of 12-Inch Nominal Shredded Tires as Alternative Daily Cover, East Regional Landfill* (Amendment), dated September 15, 2016. This application revises the Engineering Design and Operations Plan (EDOP) to allow 12-inch nominal shredded tires as Alternative Daily Cover for East Regional Landfill. The subject site previously received land use approval through Case # EXG2009-00001, Alpine Waste & Recycling. All conditions contained within Case # EXG2009-00001 shall remain in full effect.

CDPH&E approved the plan on September 22, 2016. Based upon the review of the application by this Department and CDPH&E's approval, the Adams County Community & Economic Development Department issues East Regional Landfill a Notice to Proceed to begin using shredded tires as alternative daily cover.

Sincerely,

Norman Wright
Director
Community & Economic Development Department

BOARD OF COUNTY COMMISSIONERS

Eva J. Henry — DISTRICT 1
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ADAMS COUNTY
COLORADO

Community & Economic Development Department
4430 South Adams County Parkway,
1st Floor, Suite W2000
Brighton, CO 80601-8205
PHONE 720.523.6800 FAX 720.523.6998

MEMORANDUM

TO:	**Norman Wright, Director of the Community & Economic Development Department** **Kristin Sullivan, Deputy Director of the Community & Economic Development Department**
FROM:	**Jen Rutter, Senior Environmental Analyst**
SUBJECT:	**Minor Amendment to a Certificate of Designation to Allow the Use of 12-Inch Nominal Shredded Tires as Alternative Daily Cover at East Regional Landfill**
DATE:	**September 22, 2016**

East Regional Landfill, operated by Alpine Waste & Recycling, is located adjacent to and west of Schumaker Road, approximately south of 88th Avenue in south central Adams County. On June 29, 2009, the Board of County Commissioners approved a Certificate of Designation (CD) to allow the use of the property as a municipal solid waste landfill. On August 3, 2011, the Board of County Commissioners approved a major amendment to the CD to allow composting operations on the property.

On September 15, 2016, an application for a minor amendment to the Certificate of Designation was submitted to Adams County by American Environmental Consulting, LLC on behalf of East Regional Landfill to allow for the use of 12-inch nominal shredded tires as alternative daily cover (ADC). The minor amendment would allow the operator to use 12-inch pieces of shredded tires, instead of the typical earthen material to cover the active face of the municipal solid waste landfill at the end of each operating day. The cover is used to control vectors, fires, odors, blowing litter, and scavenging. Shredded tires are a commonly used ADC in many states. The County approved a similar request on April 7, 2016 for smaller sized tire shreds as ADC.

The Hazardous Materials and Waste Management Division of the Colorado Department of Public Health and Environment (CDPHE) approved the ADC plan on September 22, 2016 as an amendment to the Engineering Design and Operations Plan (EDOP). CDPHE determined the amendment to the EDOP to be a "non-significant" change. East Regional Landfill was required to perform a field trial demonstration to determine the effectiveness of using shredded tire material as ADC. CDPHE acknowledged the reported success of the field trial and based their approval on that information.

According to Section 2-02-03-05, 10.a.(4)(a) of the Adams County Development Standards and Regulations, the Director of the Community and Economic Development Department has the authority to determine whether the change is a minor amendment to the CD and approve, deny, or approve with conditions. After reviewing the application and the CDPHE approval letter, Staff has determined that the change in operations is minor and therefore recommends an administrative approval of the amendment to the Certificate of Designation

to allow the use of 12-imch nominal tire sheds as alternative daily cover at East Regional Landfill.

AEC *AMERICAN ENVIRONMENTAL CONSULTING, LLC*

September 15, 2016

Mr. Andrew Todd, P.E.
Colorado Department of
Public Health and Environment
Solid Waste Permitting Unit
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

Ms. Jennifer Rutter
Adams County Department of
Planning and Development
4430 South Adams County Parkway
1st Floor, Suite W2000A
Brighton, Colorado 80601

Re: EDOP Amendment for use of 12-Inch Nominal Shredded Tires as Alternative Daily Cover
East Regional Landfill
Adams County, Colorado

Dear Mr. Todd and Ms. Rutter:

The enclosed document is an amendment to the approved Engineering Design and Operations Plan (EDOP) to permit the use of 12-inch nominal size shredded tires as an Alternative Daily Cover (ADC) at the East Regional Landfill (ERL). The ERL is already approved for use of 8-inch maximum size shredded tires as ADC.

This Amendment and the September 15, 2016 30-day Field Trial Documentation Report submitted concurrently with this request supports the approval of the use of 12-inch nominal size shredded tires as ADC in conformance with Section 3.3.4(B) of 6 CCR 1007-2, Part 1 and allows occasional 18-inch (in the longest dimension) shreds. The ERL has received certification from the CDPHE as a Waste Tire Collection Facility and End User and is prepared to implement this ADC program following approval from the CDPHE and Adams County.

Please call me or Mr. Justin Keever (Landfill Manager) at (303)-685-2700 if you have any questions.

Respectfully,

American Environmental Consulting, LLC

Mark A. McMullen, P.G.
Principal/Project Manager

Enclosure: Amendment to the EDOP

cc: Mr. Justin Keever, Landfill Manager-ERL

8191 Southpark Lane, Suite 107, Littleton, CO 80120 phone 303-948-7733 fax 303-948-7739

AMENDMENT TO THE ENGINEERING DESIGN AND OPERATIONS PLAN EAST REGIONAL LANDFILL

USE OF 12-INCH NOMINAL SHREDDED TIRES AS ALTERNATIVE DAILY COVER

Prepared for:

Alpine Waste/East Regional Landfill
8201 Schumaker Road
Bennett, Colorado

Prepared by:

American Environmental Consulting, LLC
8191 Southpark Lane, Unit 107
Littleton, Colorado 80120

September 15, 2016

This document amends the approved Engineering Design and Operations Plan (EDOP, Doty & Associates, LLC dated June 1, 2006) for the use of 12-inch nominal shredded tires size (with occasional shreds up to 18-inches in the longest dimension) as an Alternative Daily Cover (ADC) at the East Regional Landfill (ERL) in conformance with Section 3.3.4 (B) of 6 CCR 1007-2, Part 1. The ERL has completed a 30-day field trial demonstration to validate the effectiveness of these shredded tires as ADC. The results of the 30-day field trial demonstration are submitted with this amendment request to the Colorado Department of Public Health and Environment (CDPHE) and Adams County in a letter report dated September 15, 2016.

The ERL will adhere to the following conditions for the use of shredded tires as ADC that are consistent with the requirements approved in the March 19, 2016 CDPHE approval letter for the 8-inch tire shreds:

1. The ERL understands that the Division reserves the right to review the effectiveness of the tire shreds as an ADC at the Facility.

2. The use of tire shreds as an ADC will be discontinued should it not prevent nuisance conditions pursuant to Sections 1.2, 2.1.3, and 3.3.2 of the Solid Waste Regulations, 6 CCR 1007-2, Part 1.

3. Tire shreds shall be applied in the manner found to be effective during the field trial.

4. Because of a statutory prohibition on disposal of this tire-derived material, placement of the tire shreds in a lift thicker than necessary to achieve the purpose of daily cover is prohibited.

5. Tire shreds shall be consistent in size with those used in the field trial and shall be a maximum size of 12-inch nominal with occasional shreds up to 18 inches in the longest dimension.

6. At the end of each operating week, or more frequently if conditions warrant, a minimum of six (6) inches of soil cover shall be placed over any areas where tire shreds have been used as an ADC and are exposed.

7. Tire shreds used at the end of the working day to meet the daily cover requirements may only be used on days when the landfill is to be open the following day. If the landfill is scheduled to be closed on the following day, a minimum of six (6) inches of soil cover shall be placed at the end of the working day over any area of exposed waste.

8. For each day of alternative daily cover use the Facility will record the following information and place it into the operating record: (1) date, (2) type of alternative daily cover material used, (3) name of person applying the alternative daily cover, (4) and weather conditions.

9. The tire shreds will be placed only on interior slopes such that stormwater or snow-melt that comes into contact with the ADC is controlled in accordance with the requirements of Section 2.1.6 of 6 CCR 1007-2, Part 1.

10. The tire shreds used as ADC will be applied in the smallest practicable area consistent with Section 2.1.10 of 6 CCR 1007-2, Part 1.

11. The tire shreds will only be placed in areas where they will be covered with solid waste during the following business day; otherwise a minimum six inches of soil or other approved ADC (Posi-Shell is currently approved) will be used as daily cover.

12. Tire shreds will not be used as ADC during periods when heavy rain or heavy snow is forecasted.

The ERL will maintain the records required in #8 above in the Operating Record for all approved ADC materials and will be made available for regulatory inspection upon request.

AEC AMERICAN ENVIRONMENTAL CONSULTING, LLC

May 9, 2011

Mr. Roger Doak
Colorado Department of Public
Health and Environment
HMWMD B-2
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

Re: Request for Approval for Alternative Daily Cover
East Regional Landfill
Bennett, Colorado

Dear Mr. Doak:

Five Part Development, LLC, the owner of the East Regional Landfill (ERL) in Adams County, Colorado is requesting approval for use of an Alternative Daily Cover (ADC) material at the ERL in compliance with the definition of "Adequate Cover" in Section 1.2 of 6 CCR 1007-2, Part 1, *Regulations Pertaining to Solid Waste Sites and Facilities* (Regulations) and the provision for alternative materials in Section 3.3.4 of the Regulations.

The ERL is proposing to use a spray-on product known as Posi-Shell® from Posi-Shell Environmental Coatings as an alternative to six-inches of soil used to cover exposed waste at the end of each day. The ERL will continue to use a six-inch thick soil cover once per week to mitigate fly infestation in accordance with guidance provided by the Colorado Department of Public Health and Environment (CDPHE) for other facilities using an ADC. The weekly application of soil cover will also help provide periodic fire breaks within the refuse mass. In accordance with regulations, any refuse disposal area that is unused for a period of 30 days or longer will have a minimum of one-foot of daily cover soil applied.

The ERL is located in an area of the eastern Colorado Plains that often experiences windy conditions and has residentially used property adjacent to the south of the landfill. ERL believes that the use of an effective ADC such as Posi-Shell® that can be applied quickly will greatly assist in their litter control efforts under these conditions.

Posi-Shell® is a non-hazardous, non-flammable, fibrous material that includes a dye for a more aesthetically pleasing appearance. It may be used with its basic formulation, but also has the flexibility to incorporate a Portland cement if needed to enhance the durability of the ADC. A Material Safety Data Sheet (MSDS) for the proposed ADC material and results of TCLP and flammability testing conducted on the Posi-Shell® Advanced Formulation containing Portland cement is included in Attachment 1.

6885 South Marshall St., Suite 3, Littleton, CO 80128 phone 303-948-7733 fax 303-948-7739

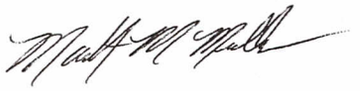
Posi-Shell® ADC has gained wide regulatory acceptance at Colorado landfills as a viable and functional ADC. Posi-Shell® is applied by spraying, typically with hydroseeding equipment or similar mobile sprayer systems. The main benefit to using an ADC such as Posi-Shell® is the conservation of airspace, and a spray on material like Posi-Shell® has the added benefit of the ease and quickness of application relative to a soil cover and its ability to "anchor" loose refuse and minimize blowing litter by its superb adherence to refuse. A batch can be prepared before it is needed and be made readily available in case of sudden winds. In addition, a spray-on material can often be used to reach places that may be inaccessible or hard to reach with typical earthmoving equipment or tarps. AEC has observed demonstrations of both types of Posi-Shell® products and was particularly impressed with its ability to adhere to and anchor paper and other light weight refuse that is susceptible to wind.

The Landfill Manager of the ERL has observed a demonstration of the proposed ADC at another Colorado landfill and was impressed with the results and Posi-Shell's ability to meet the performance requirements in the Regulations.

ERL feels confident that Posi-Shell will greatly enhance the ability to contain blowing litter in compliance with the Regulations and is requesting approval for its use as described in this letter. Please feel free to contact me or Mr. Jeremy Groves at the ERL if you have any questions and we look forward to your approval.

Respectfully,

American Environmental Consulting, LLC



Mark A. McMullen
Principal

cc: Mr. Jeremy Groves, ERL
Mr. Craig Tessmer, Adams County

Attachments: MSDS and Test Results

Adirondack Environmental Services Inc

Experience is the solution

314 North Pearl Street ♦ Albany, New York 12207
(800) 848-4983 ♦ (518) 434-4546 ♦ Fax (518) 434-0891

RECEIVED
JUL 17 2006

July 13, 2006

Joel E. Lanz
Landfill Service Corporation
2183 Pennsylvania Avenue
Apalachin, NY 13732

TEL: (607) 625-3050
FAX: (607) 625-2689

Work Order No: 060630045

RE: Product testing

Dear Joel E. Lanz:

Adirondack Environmental Services, Inc received 3 samples on 6/30/2006 for the analyses presented in the following report.

There were no problems with the analyses and all associated QC met EPA or laboratory specifications, except if noted.

If you have any questions regarding these tests results, please feel free to call.

Sincerely,

Tara Daniels
Laboratory Manager

ELAP#: 10709
AIHA#: 100307

Qualifiers:	ND - Not Detected at the Reporting Limit	S - Spike Recovery outside accepted recovery limits
	J - Analyte detected below quanititation limits	R - RPD outside accepted recovery limits
	B - Analyte detected in the associated Method Blank	T - Tentitively Identified Compound-Estimated Conc.
	X - Value exceeds Maximum Contaminant Level	E - Value above quantitation range

Adirondack Environmental Services, Inc

Date: *13-Jul-06*

CLIENT: Landfill Service Corporation
Work Order: 060630045
Project: Product testing
PO#:

Client Sample ID: Posi-AF Petri#2
Collection Date:
Lab Sample ID: 060630045-002
Matrix: SOLID

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
TCLP ICP METALS SW6010B/1311 (**Prep: SW1311 - 7/5/2006**)						Analyst: **SM**
Aluminum-TCLP	< 1.0	1.0		mg/L	1	7/13/2006 1:18:00 PM
Antimony-TCLP	< 0.60	0.60		mg/L	1	7/13/2006 1:18:00 PM
Arsenic-TCLP	< 0.050	0.050		mg/L	1	7/13/2006 1:18:00 PM
Barium-TCLP	1.3	0.10		mg/L	1	7/13/2006 1:18:00 PM
Beryllium-TCLP	< 0.050	0.050		mg/L	1	7/13/2006 1:18:00 PM
Boron-TCLP	< 0.50	0.50		mg/L	1	7/13/2006 1:18:00 PM
Cadmium-TCLP	< 0.050	0.050		mg/L	1	7/13/2006 1:18:00 PM
Chromium-TCLP	0.16	0.050		mg/L	1	7/13/2006 1:18:00 PM
Cobalt-TCLP	< 0.50	0.50		mg/L	1	7/13/2006 1:18:00 PM
Copper-TCLP	< 0.050	0.050		mg/L	1	7/13/2006 1:18:00 PM
Iron-TCLP	< 0.50	0.50		mg/L	1	7/13/2006 1:18:00 PM
Lead-TCLP	< 0.050	0.050		mg/L	1	7/13/2006 1:18:00 PM
Magnesium-TCLP	< 0.50	0.50		mg/L	1	7/13/2006 1:18:00 PM
Manganese-TCLP	< 0.20	0.20		mg/L	1	7/13/2006 1:18:00 PM
Molybdenum-TCLP	< 0.10	0.10		mg/L	1	7/13/2006 1:18:00 PM
Nickel-TCLP	< 0.20	0.20		mg/L	1	7/13/2006 1:18:00 PM
Selenium-TCLP	< 0.050	0.050		mg/L	1	7/13/2006 1:18:00 PM
Silver-TCLP	< 0.10	0.10		mg/L	1	7/13/2006 1:18:00 PM
Thallium-TCLP	< 0.10	0.10		mg/L	1	7/13/2006 1:18:00 PM
Titanium-TCLP	< 0.10	0.10		mg/L	1	7/13/2006 1:18:00 PM
Vanadium-TCLP	< 0.20	0.20		mg/L	1	7/13/2006 1:18:00 PM
Zinc-TCLP	< 0.10	0.10		mg/L	1	7/13/2006 1:18:00 PM
Zirconium-TCLP	< 0.50	0.50		mg/L	1	7/13/2006 1:18:00 PM

Qualifiers:

ND - Not Detected at the Reporting Limit
J - Analyte detected below quanititation limits
B - Analyte detected in the associated Method Blank
X - Value exceeds Maximum Contaminant Level
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
T - Tentitively Identified Compound-Estimated Conc.
E - Value above quantitation range

FLI
FRIEND LABORATORY INC

32 ITHACA STREET
TELEPHONE (607) 565-3500

WAVERLY, NY 14892 - 1532
FAX (607) 565 - 4083

NY 10252 NJ 73168
PA 68180 EPA NY00033

Certificate of Analysis

Landfill Service Corp.
2183 Pennsylvania Ave
Apalachin, NY 13732
Attn: Nancy Crane

Order Number: 0607-01218
Date Reported: 7/26/2006
Date Received: 7/25/2006
Invoice Number: 32761
Customer Number: L083
Customer PO:
Certification Date: 7/26/2006

Subject:
Flamabilitiy

SMP	Analysis Performed	Result	Units	Detection Limit	Method	Analysis Information
001	**Posi-Shell Advanced Formulation**	**7/11/2006 13:00 Client**				
	Flamability Potential	negative			ASTM D 4982	7/25/06, 14:22, JHR

RECEIVED
JUL 31 2006

Approved By: Richard Hammer, Managing Director

Key: E = estimated value
ND or U = analyte not detected
B = analyte was detected in the method or trip blank
< = less than the indicated value
ug/L = micrograms per liter (equivalent to parts per billion)
mg/L = milligrams per liter (equivalent to parts per million)
mg/Kg = milligrams per kilogram (equivalent to parts per million)

The information in this report is accurate to the best of our knowledge and ability. In no event shall our liability exceed the cost of these services. Your sample will be discarded after 14 days unless we are advised otherwise.

LSC
ENVIRONMENTAL
PRODUCTS, LLC

MATERIAL SAFETY DATA SHEET

MATERIAL: **OSHA 29CFR 1910.1200**

POSI-SHELL® FINISHED SLURRY **DATE OF PREPARATION:** **APRIL 2006**

SECTION I -- IDENTITY

Distributor's Name and Address:	LSC Environmental Products, LLC 2183 Pennsylvania Avenue Apalachin, NY 13732
Emergency Telephone:	(607) 625-3050
Chemical Name and Synonyms:	Aqueous clay based slurry
Generic Name:	N/A
Trade Name:	Posi-Shell®

SECTION II -- HAZARDOUS INGREDIENTS

N/A

SECTION III -- PHYSICAL DATA

Boiling Point (ºF) (Aqueous Portion):	212 (100º C)
Vapor Pressure (mm. Hg):	N/A
Vapor Density (Air=1):	N/A
Solubility in Water:	N/A
Percent Volatile by Volume (%):	N/A
Specific Gravity (H2O=1):	1.21
Evaporation Rate:	N/A
Appearance and Odor:	Brown viscid liquid slurry with a smell similar to liquid clay and wet cement if Portland cement is used.

SECTION IV -- CHEMICAL DATA

Chemical family:	N/A
Formula:	The major constituents are water (or landfill leachate), sodium montmorillinite clay, cellulosic polymers, soda ash, P.E.T. fibers, iron oxide coloring, and optional Portland cement.
Hazardous mixtures of other liquids, solids, or gases:	N/A

SECTION V -- FIRE AND EXPLOSION HAZARD DATA

Non-explosive, Non-flammable

SECTION VI -- HEALTH HAZARD DATA

Threshold Limit Value: N/A

Effects of Overexposure:

Acute: Can dry skin and cause alkali burns. May cause eye and skin irritation to those with sensitive skin.

Chronic: Non-observed, if properly handled. If cured material is pulverized and dispersed, fugitive dust can cause inflammation of the lining tissue of the interior of the nose and inflammation of the cornea. Hypersensitive individuals may develop an allergic dermatitis.

Emergency and First Aid Procedures: Irrigate eyes with water. Wash exposed skin areas with soap and water.

SECTION VII -- REACTIVITY DATA

Stability:	Product is stable.
Hazardous Polymerization:	Will not occur.
Incompatibility:	None known.
Hazardous Decomposition Products:	None known.

SECTION VIII -- SPILL PROCEDURES

Steps to be Taken if Material is Released or Spilled: Handle as normal non-hazardous solid waste.

SECTION IX -- EXPOSURES OF CONCERN

N/A

SECTION X -- HANDLING AND USE PRECAUTIONS

Waste Disposal Methods: Material can be disposed of as common waste in approved landfill.

SECTION XI -- INDUSTRIAL HYGIENE CONTROL MEASURES

Ventilation Requirements: Local exhaust may be used.

Respiratory Protection: A dust mask is recommended during mixing procedures.

Eye Protection: Use of safety glasses is recommended during application.

Skin Protection: Avoid skin contact with wet slurry. Wear leather gloves.

Other Protective Clothing or Equipment: Use barrier creams; wear coveralls; shower with soap and water.

SECTION XII -- SPECIAL PRECAUTIONS

No special precautions need to be taken in handling and storing.

SECTION XIII -- DISPOSAL AND SHIPPING INFORMATION

Shipping Name:	N/A (Not Regulated)
Hazardous Substance:	N/A
Hazard Class:	N/A
Caution Labeling:	N/A

N/A = Not Applicable. **N/D = Not Determined

All information presented herein is believed to be accurate; however, it is the user's responsibility to determine in advance of need that the information is current and suitable for their circumstances.
No warranty or guarantee, expressed or implied, is made by LSC Environmental Products, LLC as to this information or as to the safety, toxicity, or effect of the use of this product.

STATE OF COLORADO

John W. Hickenlooper, Governor
Christopher E. Urbina, MD, MPH
Executive Director and Chief Medical Officer

Dedicated to protecting and improving the health and environment of the people of Colorado

4300 Cherry Creek Dr. S.
Denver, Colorado 80246-1530
Phone (303) 692-2000
Located in Glendale, Colorado

Laboratory Services Division
8100 Lowry Blvd.
Denver, Colorado 80230-6928
(303) 692-3090

http://www.cdphe.state.co.us

Colorado Department
of Public Health
and Environment

July 7, 2011

Mr. Alek M. Orloff
Alpine Disposal, Inc.
7475 E. 84th Avenue
Commerce City, CO 80022

Re: Approval, Subject to Conditions, of Request to use
Posi-Shell® Spray-On Slurry as Alternative Daily Cover
East Regional Landfill, Bennett, Colorado

Dear Mr. Orloff:

The Hazardous Materials and Waste Management Division ("the Division") of the Colorado Department of Public Health and Environment received on May 12, 2011 a letter from American Environmental Consulting, LLC (AEC) dated May 9, 2011 regarding a request to use Posi-Shell® spray-on slurry as alternative daily cover ("ADC") at East Regional Landfill. The Division has reviewed your request pursuant to Section 3.3.4(B) of the Regulations Pertaining to Solid Waste Sites and Facilities 6 CCR 1007-2 and the facilities approved Engineering Design and Operations Plan. The Division hereby approves, subject to the following conditions, your request to use Posi-Shell® spray-on slurry as ADC at East Regional Landfill:

1. Posi-Shell® must be mixed and applied in accordance with manufacturer's recommendations.

2. Posi-Shell® must be applied from various vantage points to minimize a shadowing effect.

3. At the end of each operating week, or more frequently if conditions warrant, a minimum of six (6) inches of soil cover shall be placed over any areas of exposed Posi-Shell® and the working face.

4. Posi-Shell® shall not be used as ADC when heavy or prolonged rain or snow is forecast.

5. Posi-Shell® shall be applied only to interior slopes of the landfill where stormwater that comes in contact with the Posi-Shell® will be collected within the disposal cell and managed as leachate.

6. Posi-Shell® shall not be applied to haul roads.

7. Posi-Shell® shall not be applied while customers are unloading at the working face.

8. Each day that Posi-Shell® is used as ADC, the following information must be recorded and placed into the operating record: (1) application date and time, (2) name of person applying the Posi-Shell®, (3) weather conditions, (4) number of bags of Posi-Shell® setting agent used in slurry mixture, (5) amount of water used in slurry mixture, (6) quantities of optional materials used in slurry mixture (Posi-Paks, Portland Cement, etc.), (7) type of equipment used to apply the Posi-Shell®, (8) size of application area, and (9) location of application area.

The Division's approval of Posi-Shell® for use as ADC at East Regional Landfill is specific to the Posi-Shell® product. Any proposed use of alternative spray-on products as ADC must be reviewed and approved by the Division prior implementing such use.

The Division is authorized to bill, $125/hr, for its review of technical submittals, pursuant to 6 CCR 1007-2, Part 1, Section 1.7. An invoice for the Division's review of your request will be transmitted to Alpine Disposal, Inc. under separate cover.

Should you have questions regarding this correspondence, please call me at (303) 692-3437.

Sincerely,

Roger Doak, Unit Leader
Solid Waste Permitting Unit
Solid Waste and Materials Management Program
Hazardous Materials and Waste Management Division

cc: Jeremy Groves – East Regional Landfill
Deanne Kelly, Tri-County Health Department
Christopher La Rue, Adams County Planning and Development Department
Mark McMullen – AEC
Craig Tessmer, Adams County Planning and Development Department

ec: Darrell Dearborn – CDPHE, HMWMD

File: SW/ADM/FIV 2.2

Abel Montoya
DIRECTOR

ADAMS COUNTY
COLORADO

Planning & Development Department
4430 South Adams County Parkway
1st Floor, Suite W2000A
Brighton, CO 80601-8216
PHONE 720.523.6800
FAX 720.523.6998
www.adcogov.org

August 11, 2011

Mark A. McMullen
6885 South Marshall St., Suite 3
Littleton, CO 80128

Re: Use of Alternative Daily cover at the Alpine Waste East Regional Landfill
Minor Amendment to Case Number EXG2009-00001

Dear Mr. McMullen:

This Department has completed its review of your request to use an alternative cover material at the Alpine Waste's East Regional Landfill. The alternative cover material is a mineral mortar slurry supplied by Posi-Shell and applied by spraying.

Colorado Department of Public Health and Environment (CDPH&E) has approved the use of the alternative daily cover with conditions by letter dated July 7, 2011. Based upon CDPH&E's approval this Department approves the use of the Posi-Shell alternative daily cover as minor amendment to Case Number EXG2009-00001. All conditions listed in the CDPH&E letter of approval dated July 7, 2011, shall be followed.

Please do not hesitate calling me at 720-523-6841 should you have any questions regarding this approval of a Minor Amendment to allow the use of alternative daily cover at the East Regional Landfill.

Sincerely,

Craig Tessmer
Environmental Analyst

cc: Tri-County Health Department
CDPH&E
County Administrator

BOARD OF COUNTY COMMISSIONERS

W. R. "Skip" Fischer
DISTRICT 1

Alice J. Nichol
DISTRICT 2

Erik Hansen
DISTRICT 3

Appendix S

Post-Closure Inspection Form

AEC

EAST REGIONAL LANDFILL
POST-CLOSURE INSPECTION RECORD

INSPECTED BY:_____
DATE OF INSPECTION:_____
APPROXIMATE ACREAGE INSPECTED_____

COVER MAINTENANCE

1) Is Vegetative Cover Adequate Yes_____ No_____
(If No, describe Corrective Actions)

---

2) Any Settlement or Subsidence Greater than 1.6 ft Observed? Yes_____ No_____
(If Yes, describe Corrective Actions)

---

3) Any Erosion or Other Damage Observed? Yes_____ No_____
(If Yes, describe Corrective Actions)

ENVIRONMENTAL MONITORING

1) Groundwater

A) Has Groundwater Monitoring Been Performed? Yes_____ No_____

B) Have Monitoring Results Been Placed in Operating Record? Yes_____ No_____

2) Methane Monitoring

A) Was Methane Detected During Monitoring of Landfill Boundary? Yes_____ No_____

B) Was Methane Detected During Monitoring at Buildings? Yes_____ No_____

C) If Methane Was Detected, Was the Level Above the LEL? Yes_____ No_____
(If Yes, Describe Corrective Actions)

---

3) Leachate Monitoring

A) Was Moisture Detected In Sumps of a Depth Greater than 1-foot from the sump edge? Yes_____ No_____
(If Yes, State Actions Taken)

ACCESS CONTROL

1) Is Site Fencing In Good Condition? Yes_____ No_____
(If No, describe Corrective Actions)

---

2) Are Posted Signs Present and Readable? Yes_____ No_____
(If No, describe Corrective Actions)

3) Are Access Control Structures In Place? Yes_____ No_____
(If No, describe Corrective Actions)

ADDITIONAL NOTES/ACTIONS TAKEN OR REQUIRED:

INSPECTED BY: _____ DATE: _____

SIGNATURE: _____

MANAGEMENT REVIEW: _____ DATE: _____
Name

Appendix T

ERL Gas Collection and Control System Plan

AEC

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Landfill Gas Management Plan

East Regional Landfill
Bennett, Colorado

Prepared for:

GFL Environmental, Inc.

S+G Project No. ERLGCCS-21-1

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Attachment 2 Calculations
Attachment 3 Technical Specifications
Attachment 4 Landfill Gas Collection & Control System (LFGCCS) Drawings

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This Landfill Gas Management (Plan) has been prepared by Smith Gardner, Inc. (S+G) for the East Regional Landfill Facility (landfill) to present the following:

- Procedures for quarterly monitoring of landfill gas (LFG) in perimeter wells and structures surrounding the landfill; and
- Design of the gas collection and control system (GCCS) that manages LFG generated from the decomposition of municipal solid waste (MSW) at the landfill.

This Plan is designed to meet standards to collect and control LFG regulated under the following Federal, State, and Local regulations:

- Standards of Performance for New and Stational Sources, 40 CFR Part 60 Subpart WWW (**Reference 1**);
- Approval and Promulgation of State Plans for Designated Facilities and Pollutants, CFR Part 62 Subpart OOO (**Reference 2**);
- Solid Waste Certificate of Designation (**Reference 3**);
- Greenhouse Gas Monitoring and Reporting Rules (**Reference** 4);
- State and Federal requirements to control odors and LFG migration under 40 CFR Part 258 Subtitle D (**Reference 5**);
- Colorado Air Quality Control Commission Rule 5 CCR 1001 (**Reference 6**);
- Adams County Development Standards and Regulations Solid Waste Section (**Reference 7**); and
- Hazardous Materials and Waste Management Division, Code of Colorado Regulations, Rule 6 CCR 1007 (**Reference 8**).

Attachment 1 includes relevant variances and approvals that have been granted by the U.S. EPA for GCCS design and operation. **Attachment 2** contains the calculations upon which this design plan was based.

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The East Regional Landfill (ERL) is located at 8201 Schumacher Road in Bennett, Colorado. The landfill is a municipal solid waste (MSW) landfill with approval from the Colorado Hazardous Materials and Waste Management Division (HMWMD) of the Colorado Department of Public Health and the Environment (CDPHE). The facility currently consists of an active landfill phase and an active industrial composting operation, as shown on **Sheet No. 2, Existing Conditions**, from the **Landfill Gas Collection & Control System Design Permit Drawings**, included in **Attachment 4**.

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The East Regional Landfill is located 35 miles east of the structural axis of the Denver Basin. The underlying bedrock of the facility consists of rock formations from geologic time periods ranging from the Precambrian to the Tertiary periods. Surficial materials in the area consist of loess and eolian deposits derived from erosion of the Rocky Mountain Range. Land surface elevations at the site range from approximately 5,300 feet to 5,330 feet (above mean sea level, MSL datum) at natural ground conditions. According to the facility Engineering Design and Operations Plan (**Reference 9**), the site geology consists of three zones: the alluvial aquifer zone, the perched groundwater zone, and the Denver aquifer zone. The alluvial aquifer zone is located along the western boundaries of the property and is dominated by sandy alluvial materials consisting of shallow aquifer depths and contains an ephemeral stream. The perched groundwater zone is located in the western and southern portions of the site and is dominated by clay stones and interbedded sand lenses. The Denver Aquifer Zone is in the central and northern portions of the site consisting of sandstone bedrock formations.

The near surface sedimentary materials are primarily surficial weathered alluvial materials consisting of sand and clay that are light brown to grey and range from one (1) to 20 feet in depth. Underneath the initial alluvial zone, the Denver Formation ranges in thickness from 200 to 1000 feet, which is subsequently underlain by the Arapahoe Formation. These layers are dominated by mixtures of shale, conglomerate, sandstone, siltstone, and claystone.

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Along with geological formations, groundwater is a factor in the potential subsurface migration of gas and typically acts as a barrier. The facility is overlaying the Arapahoe Aquifer in the Denver Basin. The underlying bedrock of the facility consists of rock formations from geologic time periods ranging from the Precambrian to the Tertiary periods. A review of historical hydrogeologic investigations, the permanent landfill monitoring wells, and installed piezometers indicates that the uppermost aquifer beneath the East Regional Landfill ranges from approximately 5,310 feet to 5,240 feet MSL. Groundwater mapping indicates a groundwater "high" from the southwest portion of the

proposed Landfill footprint in Module 2. Dominant groundwater flow directions are generally from the southwest to the northeast.

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The landfill is owned by Five Part Development, LLC and operates under the Solid Waste Certificate of Designation Case No. EXG2009-00001 issued by the Adams County Board of County Commissioners (**Reference 3**). The facility is also regulated under Title V air permit No. 10OPAD353 (**Reference 10**), issued August 2016 by CDPHE in adherence with 40 CFR Part 60, Subpart WWW – Standards of Performance for Municipal Solid Waste Landfills (NSPS). The facility is also subject to the recently adopted 40 CFR Part 62, Subpart OOO - Approval and Promulgation of State Plans for Designated Facilities and Pollutants.

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An amended Design Capacity Report was prepared for submittal in September 2012, in accordance with §60.757(a)(1)(ii). This report showed the permitted landfill capacity to exceed 2.5 million cubic meters and 2.5 million megagrams. This triggered Tier 1 Non-Methane Organic Compound (NMOC) emissions calculation and reporting requirements under §60.752(b)(2). Tier 1 reporting calculates emissions using waste acceptance records, default values for methane generation volume, methane (CH_4) generation rate, and a conservatively high NMOC concentration of 4,000 parts per million (ppm).

As a result, calculated NMOC emissions exceeded the threshold of 50 megagrams per year (Mg/yr). A Tier 2 NMOC emission sampling event was then performed in May 2016, in accordance with §60.754, to determine a site-specific NMOC concentration. Using the site-specific NMOC concentration, calculated NMOC emissions still exceeded the 50 Mg/yr threshold in 2020. As a result, the landfill has the following compliance requirements under §60.752(b)(2):

i. *"Submit a collection and control system design plan prepared by a professional engineer to the Administrator within 1 year"; and*

ii. *"Install and start up a collection and control system that captures the gas generated within the landfill as required… within 30 months".*

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The landfill is submitting this design plan for its gas collection system, which will be installed to provide the required coverage specified in the NSPS Subpart WWW. Technical specifications associated with the GCCS design and construction are included in **Attachment 3. Attachment 4** includes GCCS design drawings.

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The landfill is regulated under Title V Operating Permit No. 10OPAD353 issued on August 1, 2016 by the Colorado Air Quality Control Division. The landfill and one on-site gasoline tank are the only listed emission sources at the facility.

Emissions of greenhouse gases are reported at this facility as required under 40 CFR Part 98 – Subpart HH, Greenhouse Gas Mandatory Reporting Rule (**Reference 4**). Reports are submitted annually, as documented in annual GHG Monitoring and Reporting Plans maintained on-site.

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Under NSPS WWW, the flare requires a one-time initial performance stack test within 180 days following installation and startup. Maximum anticipated LFG flow to the flare was based on historical and projected waste acceptance in accordance with §60.755(a)(1).

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Federal and State air regulations applicable to the GCCS are listed in **Tables 1 and 2**, and cross-referenced to the corresponding section of the Plan that addresses these requirements.

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In addition to air quality regulations, the landfill is subject to LFG management requirements under the site's Solid Waste Certificate of Designation referenced in **Section 1.4** and the CDPHE Hazardous Materials and Waste Management Rules (6 CCR 1007) (**Reference 8**), which implement Federal standards for operation of MSW landfills. Control of explosive gases and air pollution particles are directly affected by the design and operations of the GCCS. **Table 2** contains the state solid waste regulatory requirements related to the GCCS, as cross-referenced in the Plan. **Section 7** of the Plan contains specific monitoring, notifications, and contingency requirements related to the migration of explosive gases.

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The GCCS design plan was prepared based on S+G's experience preparing plans for other similar landfill facilities and the supporting information in this document. In addition to the design guidelines provided in the NSPS (**Reference 1**), the following guidelines, procedures, and tools were referenced during the design phase:

1. Landfill Gas Operations & Maintenance Manual of Practice (**Reference 11**);
2. Landfill Gas System Engineering Design - A Practical Approach - Based on a Decade of Experience (**Reference 12**);
3. GEM™ Gas Analyzer & Extraction Monitor Operation Manual (**Reference 13**);
4. State of the Art of Landfill Gas Recovery (**Reference 14**);
5. Compilation of Air Pollutant Emission Factors (**Reference 15**);
6. Landfill Gas Emissions Model (LandGEM) (**Reference 16**);
7. Pipe 2020 (**Reference 17**); and
8. Mandatory Greenhouse Gas Reporting Rule (**Reference 18**).

The GCCS is designed to collect LFG at a sufficient rate to minimize LFG fugitive emissions to the atmosphere. The design capacity of the GCCS is based on the LFG generation rates calculated using the LandGEM model plus a reasonable amount of surplus capacity. At a minimum, the GCCS is designed to collect LFG generated from the entire permitted MSW landfill at peak LFG generation, which is assumed to occur the year following closure.

Regulatory compliance matrices are provided in **Tables 1 & 2** to outline Federal air regulatory requirements and Colorado air and solid waste regulatory requirements, respectively.

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As a general note, developing a GCCS over either active or closed landfills includes several factors that must be acknowledged and managed. One factor is landfill settlement, either general or differential, which may result in condensate accumulation in low points or "bellies" in the header lines, fractured well casings, or well boot tears/ruptures. Other factors to be cognizant of include filling sequences, traffic patterns, final/interim capping, or cell construction considerations. Therefore, this design plan includes reasonable estimates for pipe design and installation for a desired range ("design basis") of LFG flow. The Design Engineer (in consultation with the Owner) has utilized the best available practices, experience and judgment to develop this plan. However, the system will likely require maintenance and retrofits (modifications, expansions, etc.) over time to accommodate changing landfill gas generation, either increasing or decreasing (based on factors presented in this document).

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Landfill gas collection and control systems require skilled, knowledgeable operators to function safely and effectively, regardless of design. Although this plan does not include an operations and maintenance (O&M) plan, it is recommended that the operator(s) be trained in the operations and management of landfill gas systems and consult such sources as referenced in this Plan (**References 11 & 13**). Additionally, operations may

be outsourced to service firms experienced in the operations of LFG systems, at the Owner's direction. A trained operator should inspect and "tune" the system, as needed, on a routine basis.

There are many hazards associated with management of explosive gases. **All operational staff should be specifically trained in the management and response to situations such as fire or explosion, confined space, drilling and overhead hazards, or any other mechanical hazards addressed by the equipment manufacturer's literature.**

The solid waste Operations Plan for the site references this Landfill Gas Management Plan for specific operations related to extraction wells, header lines, blower/flare skid, and LFG treatment systems. Where solid waste operations continue in areas after the collection system is installed, special attention and care should be given to all exposed components within the active areas, and near hauling/access roads. Additionally, this Plan should be referenced to locate below grade components of the LFG system to prevent or repair damage. Collected data should be analyzed to identify potential damage to components below grade that may not be visible.

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The design and operations of the GCCS are generally in accordance with the design and operational guidelines presented in **Sections 4 and 5**, including the ability to monitor oxygen, nitrogen, pressure, and temperature at each well head, and to maintain these parameters within the following:

1. Oxygen less than 5% and nitrogen less than 20%;
2. Pressure less than 0.0 inches water column; and
3. Temperature less than 55°C (131°F).

While the design of the GCCS system is intended to maintain these compliance thresholds, this Plan maintains the flexibility to request variances, as needed, to exceed oxygen, nitrogen, pressure, and/or temperature parameters, if it can be demonstrated through monitoring data that doing so will not inhibit the methanogenic processes within the landfill or create conditions that could cause a subsurface fire. Any such requests will be made in writing to CDPHE and will be accompanied by supporting data and previous determinations as available from the U.S. EPA Clean Air Act Applicability Determination Index (ADI), available on-line at http://cfpub.epa.gov/adi/. All approved variances will be incorporated into the Design Plan.

This section discusses specific variances for NSPS operational parameters that have been approved by EPA for sites with similar regulations as those that apply to the ERL.

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Wellheads located within the limits of geomembrane or synthetic cover may be operated with positive pressure up to and including six (6) inches of water column (in. W.C.). These wellheads are attached to LFG extraction wells,

leachate cleanouts, downslope collectors, and other collectors located within the limits of a geomembrane cover system, geosynthetic rain cap, or other synthetic cover system. These collectors may be allowed to operate with up to six (6) in. W.C. as measured during routine monitoring without being considered an exceedance, deviation, or violation of the NSPS or MACT standards, and shall not be required to be recorded as such.

Pressure limits may also be exceeded at vertical extraction wells, horizontal/near-surface collectors, and leachate cleanout risers due to isolated moisture issues, localized reductions in LFG production, and shallow cover conditions. In such conditions, even minimal vacuum may result in elevated oxygen or balance gas levels exceeding 5% or 20%, respectively, prompting the collectors to be shut off or decommissioned. In these cases, EPA has determined (**Attachment 1**) that it is preferable to maintain intermittent control over non-productive areas or areas susceptible to air infiltration as opposed to full decommissioning of collectors in these areas. The following procedure as previously approved by EPA will be followed in these events:

1. Monthly monitoring shall be conducted at all collectors subject to the NSPS rule. Vacuum will be shut off to the collector if oxygen concentrations do not decline to acceptable levels (as determined by the field operator) within one (1) hour of reduced vacuum.
2. Monthly monitoring shall be conducted for all collectors subject to the NSPS rule, including those previously shut off, but positive pressure or elevated oxygen concentrations shall not be considered as an exceedances of the NSPS operational limits.
3. If continued monthly monitoring indicated that pressure has accumulated in the collector, and/or oxygen continues to be elevated, the collector shall be opened to relieve pressure, and then shut off until the next monthly monitoring event.
4. If continued monthly monitoring indicates that oxygen levels are no longer elevated, the collector shall be opened and vacuum applied until such time as LFG quality declines.

To confirm that positive pressures are not contributing to excess emissions, quarterly surface emissions monitoring shall continue to be conducted as required by the NSPS. Standard remedial actions shall be followed in response to detection of methane concentrations at or above 500 parts per million (ppm) above background concentrations, regardless of the operational status of the collector(s) in that area.

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Wellheads subject to the NSPS operational requirements in **Sections 4 and 5** of this Plan are generally operated with LFG temperatures less than 55^{0}C (131^{0}F), as required by the NSPS. However, periodically, variances of this temperature limit are requested in response to exceedances discovered during monthly monitoring. As allowed in the NSPS, variances of the temperature limit may be

requested if it can be determined that the elevated temperature readings have not significantly impacted oxygen or methane readings, and carbon monoxide monitoring demonstrates low concentrations at the wellhead. Once sufficient data have been compiled, this demonstration shall be made to CDPHE, accompanying a formal variance request.

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To facilitate LFG collection in areas that are active, or inactive but not closed or at final grade, a variance is required to manifold two or more collectors into a common pipe that is extended to the edge of fill while filling operations continue in the area of the collectors. This allows for continued monitoring and operation of the collectors without placing operators in hazardous working conditions associated with active filling operations, and avoids damage to extended or elevated well casings. EPA's approval letter for a similar variance request is included in **Attachment 1** for reference.

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LFG generation and production estimates are calculated to properly design and size the collection system, as well as to determine the appropriate type and number of control devices. Generation is affected by factors including:

- Waste acceptance rates;
- CH_4 (methane) generation rate constant (k); and
- Potential CH_4 generation capacity (L_o).

The LFG generation rate in 2021 is calculated to be approximately 970 standard cubic feet per minute (cfm). Under assumptions and criteria discussed in this section, the maximum generation rate is anticipated to occur in about 2037, the year after final waste acceptance at approximately 2,155 cfm. Generation calculations are presented in **Attachment 2**.

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Waste acceptance rates for ERL are based on waste-in-place quantities through 2016 from previous Tier 2 reports. Waste acceptance rates from 2017 through present were reported by the facility. Projected waste acceptance rates were determined based on guidance from the facility. Waste design capacity is based on an amended design capacity report submitted in September 2012 and permit documents. The landfill is expected to reach capacity in about 2036.

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For the purposes of this plan, LFG is assumed to be comprised of 50% CH_4. The CH_4 generation rate constant (k) determines the rate of landfill gas generation and is a function of moisture content in the waste, nutrients available to methanogenic bacteria, pH, and temperature. The default k values typically used in generation modeling are 0.05 yr^{-1}, and 0.04 yr^{-1}, and are provided in the New Source Performance Standards

(NSPS) (**Reference 1**), and the EPA's AP-42 (**Reference 14**), respectively. The default k values typically used in generation modeling for arid regions is are 0.02 yr^{-1}, provided in the New Source Performance Standards (NSPS) (**Reference 1**), and the EPA's AP-42 (**Reference 14**). EPA's mandatory Greenhouse Gas (GHG) Reporting Rule (**Reference 4**) also uses a k value of 0.057 yr^{-1} for landfills that recirculate leachate, or receive 40 inches or more of precipitation annually. Landfills operated as anaerobic bioreactors have been estimated by EPA to have k values as high as 1.0 yr^{-1} (**Reference 17**). For the East Regional Landfill, a k value of 0.02 yr^{-1} was selected for modeling based on condition 2.6.5 of the landfill's Title V operating permit and regional arid conditions at the facility.

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The potential CH_4 generation capacity (L_o) represents the volume of LFG that will be generated per mass unit of waste. This value depends mainly on the amount and ratios of cellulose, hemi-cellulose, and lignin of the waste, which is determined by the types of waste accepted. Two typical values include:

- 170 m^3/Mg (NSPS), and
- 100 m^3/Mg (AP-42).

Based on condition 2.6.5 of the landfill's Title V operating permit, the higher value of 170 m^3/Mg was used for methane generation potential was utilized for landfill gas projections. Additionally, this value produces higher LFG generation rates which allow for a more conservative design.

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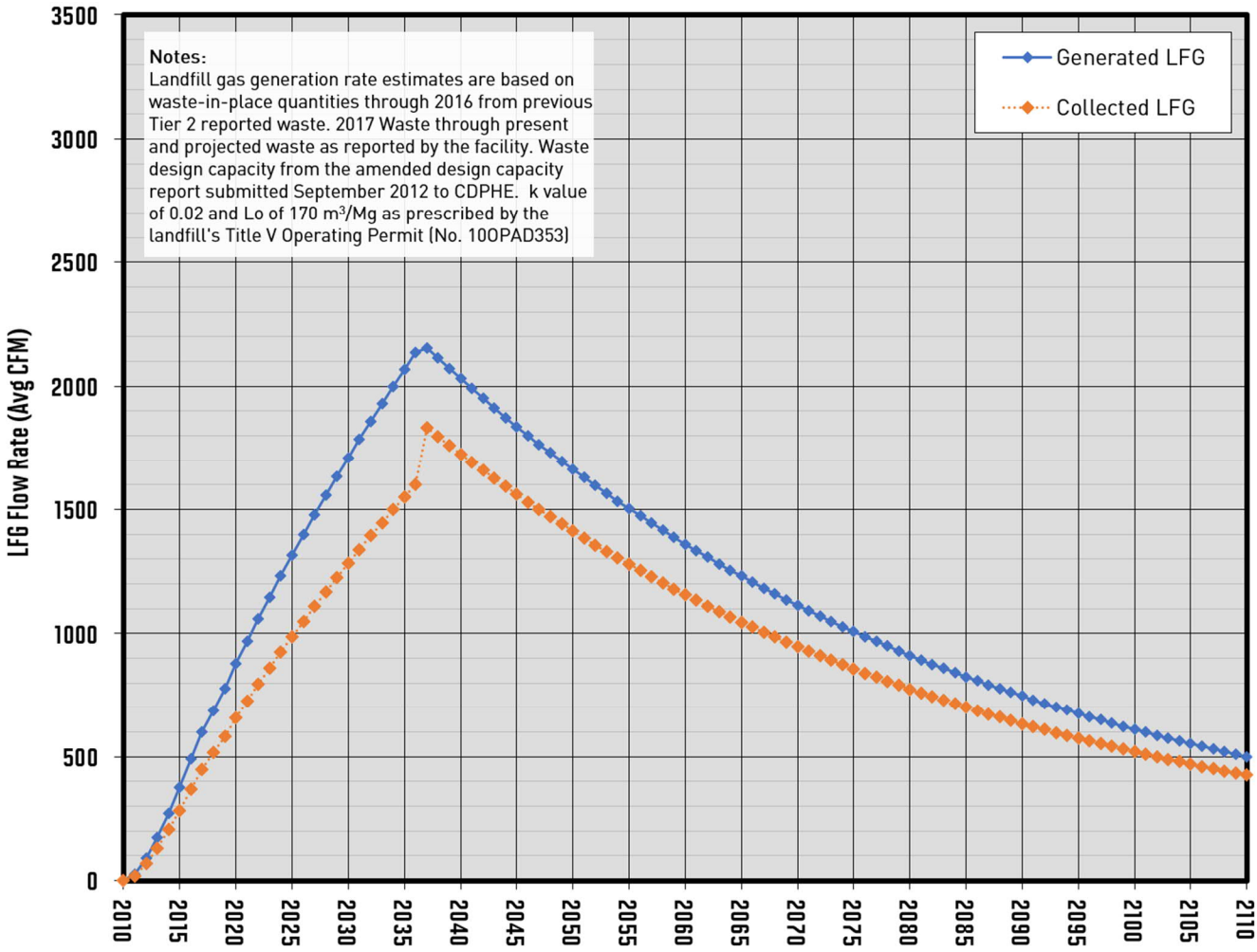
The GCCS is designed as an active collection system to be constructed in phases as the landfill is filled and reaches final grade. System components will be installed within five (5) years if the area, cell, or group of cells is active, or within two (2) years if closed or at final grade. The GCCS system is designed for incremental expansion and employs a "looped" configuration for isolation of individual sections without adversely impacting the overall system. LFG is extracted from the landfill through a system of extraction wells. The collected LFG is conveyed through transmission piping for destruction (in the on-site flare).

Based on this design approach, a collection efficiency of approximately 75% of the generated LFG is believed to be attainable as the active landfill expands and the system is expanded in accordance with NSPS requirements. Upon closure, this efficiency is expected to reach 85%. **Figure 2** shows estimated LFG generation and collection rates over the life of the landfill.

Figure 2: East Regional Landfill Gas Generation and Collection Estimate



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System component selection and design is based on calculations of optimum vacuum distribution throughout the well field. These calculations are documented in **Attachment 2**. LandGEM modeling was performed using inputs and waste acceptance data current through 2020 as described in **Section 3** to confirm calculated flow rates are sufficient. Projected waste acceptance rates were provided be the facility manager. The third-party software package Pipe 2020 (**Reference 17**) is also used to verify adequate vacuum distribution is provided across the entire system. The LandGEM model and Pipe 2020 output are also included in **Attachment 2**.

The LFG is collected through a series of vertical extraction wells and is conveyed through transmission piping for treatment by a system that filters, dewaters, and compresses the LFG. From this point the LFG may be delivered to a flare for destruction. Components of the system include:

- Vertical extraction wells;
- Wellheads;
- Lateral piping and looped headers;
- Transmission piping;
- Condensate management traps and pumping stations;
- Primary and back-up flare systems;
- Final cover.

Technical specifications for GCCS components are provided in **Attachment 3**. The MSWLF Landfill Gas Management Plan and Details drawing sheets are provided in **Attachment 4** that show the planned location and details of system components.

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Extraction wells are typically installed at a spacing of approximately one (1) well per two (2) acres, such that assumed 170-foot radii of influence (ROI) (as typical of landfills with waste depths equal to or greater than 50 feet) are tangential to each other. Each extraction well consists of 6 or 8-inch diameter SCH 80 PVC pipe placed in a 36-inch diameter boring. HDPE pipe has also been used in some well installations. The top 15 feet of pipe below the top of the intermediate or final cover is solid to minimize the possibility of air intrusion. The remaining length of pipe within the waste is perforated to exert vacuum on the surrounding waste and maximize capture efficiency. The specified stone of other suitable porous material, as appropriate, is used as backfill in the perforated zone of the well. Impermeable bentonite clay plugs are placed between the perforated pipe zone and the surface to avoid a pathway for ambient air to enter the well. Well casings extend approximately three (3) to four (4) feet above final cover for visibility and monitoring access.

Extraction wells located in areas of intermediate cover or areas not at final grade may be buried during future filling practices. To maintain collection in these areas, wells may be connected via a manifold assembly into a common lateral or

header that extends beyond the area of filling. LFG extraction from these manifold pipes may be controlled at either end through wellheads.

Leachate Cleanouts

Leachate cleanout pipes may be utilized to receive condensate from the collection system header pipes as it drains via gravity to traps located at low points in the system. Condensate will continue to drain via gravity to leachate cleanout pipes, where it will enter the leachate collection system. Leachate cleanout pipes may also be retrofitted with wellheads and isolation valves to enable collection of landfill gas that has entered the leachate collection system. These LFG collection points may be manifolded together as waste from adjacent cells covers cleanouts to allow collection of LFG from multiple cleanouts through a common wellhead.

Wellheads

Prefabricated wellheads are used to regulate vacuum applied from the LFG header and lateral systems to vertical extraction wells, horizontal downslope and toe drain collectors, as well as leachate cleanout risers. Wellheads consist of gate or needle-type valves and provide the system operator with a means to regulate vacuum to the well, thereby controlling LFG flow rates, well pressure, and LFG quality. Sampling ports at various locations in the wellhead allow for monitoring collected LFG for the following:

- gas quality (i.e., % O_2, % CH_4, etc.);
- static pressure (vacuum pressure at the well);
- system pressure (available vacuum in the lateral or header);
- differential pressure;
- flow; and
- temperature.

LFG flow rates are calculated from the differential pressure as measured by pitot tubes or orifice plates within the wellhead. A flexible hose will be used to connect each wellhead to the gas transmission lines. Each wellhead will also be equipped with a valve assembly to adjust flow from the extraction well to the transmission piping.

Gas Transmission Piping

The gas transmission piping consists of smooth-walled HDPE piping with dimension ratios (DR), (i.e., outside diameter / wall thickness) ranging from 11 to 17, with 11 being the thicker DR. The transmission piping is designed based on low velocity (<2,400 FPM) constraints. All piping is fusion welded with the exception of valves and connections to the wellheads which may be fusion welded or mechanically connected. All piping within the limits of waste disposal areas is installed at minimum slope of 3% to account for anticipated differential settlement of the waste.

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Condensate collection points are included at low points in the transmission piping to remove condensate from the system. The collection points include condensate traps within the waste boundary, and condensate pumping stations outside the waste boundary. Condensate traps, located within the waste, are designed to allow collected condensate to seep back into the waste. Condensate pumping stations collect the condensate and, in turn, pump the condensate to either a leachate collection system cleanout or to the leachate storage tanks. In addition to the collection points, condensate knockouts are included at the utility flares and LFG treatment station. Condensate collected at the knockout pot drains, via gravity, to the condensate pumping station.

Condensate and leachate may collect in vertical extraction wells due to moisture in the system and/or leachate recirculation. In this event, pneumatic or hydraulic pumps may be used to remove the collected liquid and discharge into the transmission lines for ultimate flow to a condensate collection point. The pumps are typically top head drive positive displacement piston or air double diaphragm pumps ideal for low flow leachate, gas well dewatering and condensate recovery applications. Control motors at surface grade compress air or hydraulic fluid used to operate the pump. Neither air nor hydraulic fluid would come into contact with the liquid being pumped.

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LFG collected in the GCCS is controlled by one (1) elevated open utility flare rated at 3,000 SCFM. Two (2) 1500 SCFM blowers located at the flare station route the LFG to the flare. The flare includes temperature sensing thermocouples that automatically shut down gas flow from the system in the event that temperature falls below design temperature set points. Flare operational and monitoring components include:

- Condensate knockout;
- Hand-Off-Auto controls via Programmable Logic Control (PLC);
- Pressure valves;
- Vacuum gauges;
- Flare pilot fuel system for automatic start and re-start;
- Air compressor for fail-safe shutoff valve;
- Flow meter; and
- Flame arrester.

Operational performance data are collected and recorded on the SCADA system installed with the LFG treatment system. Recorded data include:

- LFG temperature;
- Flare temperature;
- LFG flow rate; and
- LFG methane content (among other parameters).

The flare system is designed to comply with the requirements contained in 40 CFR 60.18 to reduce NMOCs by at least 98 weight-percent when operated within the design flow rate.

The flare system is located along the northern boundary of Module 3, as shown on the **Attached** drawings. Access to the flare will be controlled by a gated and locked security fence.

Inactive areas of the landfill are covered with a minimum of 12 inches of intermediate cover soil, with final cover to be placed incrementally as areas reach the final design grades. Final cover will be placed over the landfill as it reaches final grades. The final cover system consists of a geomembrane, a drainage composite, and two (2) feet of vegetative soil. The final cover system is anticipated to improve collection efficiency of the system and reduce surface emissions. Therefore, it is considered as an element of the GCCS system. Each wellhead will include a geomembrane boot to seal penetrations through the final cover system.

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Due to the harsh nature of operating landfills and the extreme conditions that GCCS components operate within, the GCCS requires routine monitoring and maintenance, in addition to periodic unscheduled maintenance and repair. In addition to meeting regulatory requirements, these activities are required to meet the following objectives:

- maximize system operational efficiencies;
- minimize ambient air infiltration;
- minimize surface emissions from the landfill area;
- prevent subsurface migration; and
- minimize odors.

Key monitoring parameters and maintenance activities are discussed below.

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The following monitoring requirements are used to determine compliance with §60.763 of **Reference 1** for wells and collectors located in areas that have solid waste in place for:

- Five (5) years or more if active; or
- Two (2) years or more if closed or at final grade.

At each wellhead, monitoring will be performed on a monthly basis in accordance with §60.766(a) for the following parameters (at a minimum) to demonstrate compliance with the applicable thresholds:

- Gauge pressure in the gas collection header will be negative;
- Balance Gas (assumed to be nitrogen) will be less than 20%, or Oxygen will be less than 5% concentration; and
- Temperature will not exceed 55°C (131°F), unless an alternate threshold is approved by EPA.

Industry standard infrared meters such as those manufactured by Landtec™ and Elkins Earthworks™ may be used to conduct field monitoring. All meters will be calibrated and operated in accordance with §60.763(c)(1) and (2) except that balance gas is monitored in lieu of nitrogen.

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Surface emissions monitoring is performed in accordance with §60.755(c)(1) on a quarterly basis. Monitored locations include areas with waste in place for five (5) years if active, or two (2) years if closed or at final grade, as defined above, and with collection system components installed. Monitoring is performed along the perimeter of the collection area, and along a pattern that traverses the landfill at 30 meters. Industry standard flame or photo ionization detectors such as the ThermoFisher Scientific® TVA-2020 or Thermo® MicroFID may be used, provided an extension wand allows for

monitoring within 5 to 10 centimeters of the ground surface. Any readings of 500 parts per million (ppm) above background trigger re-monitoring and compliance provisions contained in §60.755(c)(4).

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As previously discussed, LFG flow and quality parameters are monitored by and recorded by a SCADA system. This system monitors LFG collected by the blower, and measures LFG quality via a panel-mounted infrared meter. Flow meters measure LFG flow to the flare well as the LFGTE plant. Data recorded by the SCADA system include:

- System operating hours;
- System operating vacuum;
- LFG temperature;
- Flare flame temperature;
- LFG flow rates; and
- LFG quality (i.e. $\%O_2$ & $\%CH_4$).

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As required by solid waste management regulations, routine monitoring is performed to detect subsurface migration of methane. This monitoring will be performed by East Regional Landfill personnel, and is discussed in more detail in Section 6.0

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In addition to system monitoring, periodic maintenance will be conducted in accordance with the manufacturer's recommendations for each of the system components and in accordance with the facility closure and post-closure plan. Information from the various manufacturers of the system components will be maintained on site in operations and maintenance manuals. The information will include, but not necessarily be limited to, suppliers and recommended maintenance for flare and/or blower components such as the flow meter, flow recorder, thermocouple, or other items. Additional maintenance is to be expected at the condensate traps, which will require periodic inspection and re-filling with water. Piping repairs may be required due to damage by equipment or because of localized settlement that causes condensate to accumulate in low-points of the system, potentially restricting or blocking the flow of LFG.

It is expected that, at various times during the life of the system, condensate blockages will develop due to settlement in pipes installed at small slopes over waste. In such cases, the affected pipes need to be excavated and low spots need to be identified and raised to provide continuous slope toward a condensate removal feature.

It is recommended that the Operator be trained in the operations and management of landfill gas systems and consult such references as Landfill Gas Operation & Maintenance Manual of Practice prepared by the Solid Waste Association of North America (SWANA) or other service firms specifically qualified in the operation of landfill gas systems.

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At the East Regional Landfill, state and federal rules require actions to monitor, control, and prevent the migration of subsurface LFG beyond the property line. At a minimum, these standards require landfill owners to ensure that the facility does not exceed the following limits:

- *25% of the lower explosive limit (LEL)* (equivalent to 1.25% methane) *by volume in on -site structures; and*
- *100% of the LEL* (equivalent to 5% methane) *by volume at the facility property line.*

The Engineer has used the best available site data, practices, experience, and judgment to develop this plan. However, the program may require modifications and maintenance over time to accommodate changing landfill conditions, changing receptors in areas adjacent and around the landfill, or other conditions that cannot be fully anticipated. Maintenance suggestions are also included to assist in the identification of secondary conditions that may require updates to this Plan. GCCS operations and maintenance activities are carried out in part to prevent subsurface LFG migration.

Uncontrolled migration of LFG can result in loss of property, loss of life, injury, vegetative damage and intolerable odors. The monitoring of landfills includes exposure to explosive gases. All operational and/or monitoring staff should be specifically trained in the management and response for situations such as fire or explosion, confined space, drilling, and overhead hazards, and possess and awareness of changing conditions around these sites.

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LFG monitoring wells, or probes, are distinguished from LFG extraction wells in that LFG monitoring wells serve solely as a point for detection and monitoring of vertical and/or horizontal migration of LFG beyond the (lined) limits of waste.

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Monitoring and reporting of LFG concentrations will be performed as outlined below.

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Routine LFG monitoring will be conducted on a quarterly basis, unless otherwise directed by the HMWMD

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LFG monitoring will be performed by personnel who are familiar with the requirements of this plan and who are trained in LFG hazards and explosive gas meter use. As practical, a designated technician will be assigned to regular LFG monitoring duty.

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A Landtec® QED GEM-5000 infrared portable gas analyzer (or equivalent) will be used to measure readings at LFG monitoring wells, as well as LFGCCS extraction wells and other GCCS components. This analyzer, which is calibrated to methane (CH_4), operates using the infrared spectral property of methane to measure concentrations in air. Measurements of oxygen (O_2) and carbon dioxide (CO_2) will also be made with this meter. This meter may be used in oxygen deficient areas (less than 10% O_2) since oxygen is not required for a chemical combustion of flammable gases within the meter.

On the day of monitoring, prior to monitoring activities, this meter will be field calibrated. Additionally, all monitoring equipment should be regularly calibrated in accordance with manufacturer's specifications and operated only as instructed.

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Prior to each quarterly monitoring event, the portable gas analyzer will be calibrated with a known calibration standard in accordance with manufacturer's recommendations. General information related to the monitoring event, equipment used, calibration procedures, weather conditions, and results for each monitoring event will be recorded on the landfill gas monitoring data form.

The following steps outline the procedure for the monitoring of LFG wells and facility structures:

- Check calibration date on the meter and calibrate according to manufacturer's instructions; allowing equipment to warm up properly prior to use, per manufacturers direction. **If meter is past factory calibration date, contact manufacturer to set up recalibration and obtain a calibrated replacement meter.**
- Purge sample tube for at least one (1) minute before monitoring.

  LFG Monitoring Wells:

  - Connect instrument tubing to sample port on the monitoring well without removing the cap.
  - Open the valve and record both the initial and stabilized methane concentrations. A stabilized concentration will not vary more than 0.5

percent by volume on the instrument's scale. Also record the oxygen concentration and the carbon dioxide concentration.

- o Close the valve and disconnect the tubing.
- o Record monitoring data on the LFG monitoring data form.
- o If any methane concentration is **greater than 50% of the LEL (2.5% CH_4)**, monitoring personnel should implement the Precautionary Action Plan (see **Section 6.3.6**).
- o If both initial and stabilized methane concentrations are less than 50% of the LEL (2.5% CH_4), move to next LFG monitoring well.

Structures:

- o Walk through the facility structure with a methane analyzer and monitor the perimeter wall interface of the structure, the floor to wall interface in hallways and rooms, and any floor penetrations in the structure. Record the initial and stabilized methane concentrations, oxygen concentration, and carbon dioxide concentration.
- o Record monitoring data on the LFG monitoring data form.
- o Notify the Landfill Manager and the Engineer for any methane concentration greater than 0% of the LEL.

IF A STABILIZED METHANE CONCENTRATION IS GREATER THAN 100% OF THE LEL IN A LFG MONITORING WELL OR GREATER THAN 25% OF THE LEL IN A FACILITY STRUCTURE, THE FOLLOWING ACTIONS WILL BE IMPLEMENTED:

1) Recalibrate monitoring equipment and confirm results.
2) If results are confirmed, **IMMEDIATELY** contact the Landfill Manager and the Engineer.
3) Implement the Contingency Plan located in **Section 7**.

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If an initial or stabilized methane concentration is equal to or greater than 50% of the LEL in a LFG monitoring well, monitoring personnel should perform the following additional steps at this location:

- Measure gas pressure in the well head (in inches of water) using magnehelic gauge or other appropriate metering device.
- Record at least one (1) additional methane concentration measurement, inside the well just below the top of casing.
- Evaluate the surrounding area for potential receptors to or signs of LFG migration. LFG can stress vegetation and can kill trees and grass by root asphyxiation. Note stressed/dead vegetation areas on the monitoring form.
- Notify the Landfill Manager and the Engineer for further evaluation.

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Routine LFG monitoring events will be documented on the LFG monitoring data form. Completed forms will be placed in the landfill operating record located at the landfill office. These forms will be available for review by CDPHE personnel on request.

Documentation of any contingency plan actions (see **Section 7**) will also be kept in the operating record.

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Periodic maintenance and site observations will be conducted routinely to address monitoring program components (at a minimum):

- Maintain access to LFG monitoring locations.
- Perform LFG monitoring well maintenance (maintain well locks, steel casing, concrete pad, etc.).
- Observe landfill cover conditions, areas of dead vegetation, leachate seeps, odors, etc. as indications of potential LFG-related problems.

Note deficiencies on the monitoring form and report to the Landfill Manager for repair or replacement as necessary.

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If a stabilized methane concentration is **greater than 100% of the LEL in a LFG monitoring well or greater than 25% of the LEL in a facility structure**, East Regional Landfill personnel will perform both an immediate action and plan and a remediation plan as described below.

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The Landfill Manager will perform the following actions for the protection of human health and safety:

1) **Evacuate affected facility structures and the immediately surrounding area. Do not re-enter the structure(s) until ambient air has been lowered to less than 25% LEL through ventilation or other measures.**
2) Determine nearby potential receptors (facility and off-site structures).
3) Perform monitoring in any other facility structure near the monitored location triggering the contingency plan.
4) Verbally notify the HMWMD (see **Section 1.2**) as soon as practical.
5) Investigate and identify the potential source(s) and conduit(s) for LFG migration that may have caused the high concentration (i.e. the path that the LFG may be taking to the monitoring location).
6) Identify the LFG extent using bar hole punch sampling methodology or other applicable alternative method as practical.
7) As appropriate, begin corrective action to control methane concentrations in structures surrounding the landfill site.

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Within **seven (7) days** of a detection of a landfill gas concentration that exceeds the thresholds, East Regional landfill personnel will complete the Environmental Monitoring Reporting Form with the results of the monitoring event and place it in the facility operating record, along with a description of the actions performed to protect human health. This information will also be submitted to the HMWMD.

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Within sixty (60) days of the detection of a landfill gas exceedance, the facility shall implement an approved remediation plan to address the exceedance. The remediation plan shall describe the nature and extent of the landfill gas exceedance and proposed remedy will be prepared and placed in the operating record. A copy of the plan will also be submitted to CDPHE for approval. The HMWMD will then be notified upon completion of implementation of the plan. An extension may be granted by the HMWMD on written request and depending on severity of the situation.

1. Standards of Performance for Municipal Solid Waste Landfills that Commenced Construction, Reconstruction, or Modification after May 30, 1991, but before July 18, 2014; Federal Register Vol. 61, p. 9905, February 25, 1996, United States Environmental Protection Agency (EPA).

2. Federal Plan Requirements for Municipal Solid Waste Landfill that Commenced Construction on or Before July 17, 2014 and Have Not Been Modified or Reconstructed Since July 17, 2014; Federal Register Vol. 86, p. 27756, May 21, 2021, EPA.

3. Adams County Solid Waste Certificate of Designation Case No EXG2009-00001 issued September 1, 2010 by the Adams County Board of County Commissioners.

4. Mandatory Greenhouse Gas Reporting Rule; Federal Register Vol. 74, p. 56259, October 30, 2009, EPA

5. Criteria for Municipal Solid Waste Landfills, Federal Register Vol.56, p. 51016, October 9, 1991, EPA.

6. Colorado Department of Public Health and the Environment, Air Quality Control Commission, Code of Colorado Regulations, Rule 5 CCR 1001.

7. Adams County Development Standards and Regulations Solid and Hazardous Waste Disposal Section §4-11-02-03-02 amended December 8, 2020.

8. Colorado Department of Public Health and the Environment, Hazardous Materials and Waste Management Division, Code of Colorado Regulations, Rule 6 CCR 1007.

9. Five Part Disposal Facility Design and Operations Plan dated June 1, 2006.

10. East Regional Landfill Title V Operation Permit No. 10OPAD353 issued August 1, 2016 by the CDPHE Air Pollution Control Division.

11. Landfill Gas Operations & Maintenance Manual of Practice, Solid Waste Association of North America, funded by US> Dept. of Energy through National Renewable Energy Laboratory, March 1997

12. Landfill Gas System Engineering Design - A Practical Approach - Based on a Decade of Experience, CES-LANDTEC Company, 2002, Colton, California.

13. GEM™ Gas Analyzer & Extraction Monitor Operation Manual, CES-LANDTEC Company, 2001, Colton, California.

14. State of the Art of Landfill Gas Recovery, Emcon Associates, Argonne National Laboratory, 1981

15. Compilation of Air Pollutant Emission Factors, Document AP-42, Fifth Edition, Section 2.4, Municipal Solid Waste Landfills, revised November 1998, EPA.

16. Landfill Gas Emissions Model (LandGEM), V. 3.02, EPA, May 2005.

17. Pipe 2020, (Modeling Software for fluid flow in pipe networks), KY Pipe, LLC, Lexington, KY.

18. Landfill Gas Energy Model (LFGCost), Version 1.2, Landfill Methane Outreach Program, United State Environmental Protection Agency (EPA), June 2003.

TABLE 1
Federal Air Regulations Compliance Matrix

Regulatory Citation	Regulatory Requirement	Plan Reference
40 CFR Part 60 Subpart WWW (**Reference 1**)		
§60.752(b)(2)(i)	Submit a collection and control system design plan prepared by a professional engineer to the Administrator within 1 year [of the calculated NMOC emission rate equaling or exceeding 50 megagrams per year].	Section 1.4 – Regulatory Review Plan conforms
§60.752(b)(2)(i)(A)	The collection and control system shall meet the design requirements of paragraph (b)(2)(ii) of this section.	Section 2.0 - Design Guidelines & Procedures Plan conforms.
§60.752(b)(2)(i)(B)	The collection and control system design plan shall include any alternatives to the operational standards, test methods, procedures, compliance measures, monitoring, recordkeeping or reporting provisions of §60.753 through §60.758 proposed by the owner or operator.	Section 2.3 - Variances from Design and Operational Guidelines Plan conforms.
§60.752(b)(2)(i)(C)	The collection and control system design plan shall either conform with specifications for active collection systems in §60.759 or include a demonstration to the Administrators satisfaction of the sufficiency of the alternative provisions to §60.759.	Section 2.3 - Variances from Design and Operational Guidelines Plan conforms.
§60.752(b)(2)(i)(D)	The Administrator shall review the information submitted under paragraphs (b)(2)(i) (A),(B) and (C) of this section and either approve it, disapprove it, or request that additional information be submitted. Because of the many site-specific factors involved with landfill gas system design, alternative systems may be necessary. A wide variety of system designs are possible, such as vertical wells, combination vertical and horizontal collection systems, or horizontal trenches only, leachate collection components, and passive systems.	Section 2.3 - Variances from Design and Operational Guidelines, and; Section 4.2 – System Components Plan conforms.
§60.752(b)(2)(ii)	Install a collection and control system that captures the gas generated within the landfill as required by paragraphs (b)(2)(ii)(A) or (B) and (b)(2)(iii) of this section within 30 months after the first annual report in which the emission rate equals or exceeds 50 megagrams per year, unless Tier 2 or Tier 3 sampling demonstrates that the emission rate is less than 50 megagrams per year, as specified in §60.757(c)(1) or (2).	Section 1.4 – Regulatory Review Plan conforms.
§60.752(b)(2)(ii)(A)(1)	An active collection system shall be designed to handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control or treatment system equipment;	Section 3.0 – Landfill Gas Generation; and Section 4.1 – System Design Approach Plan conforms.
§60.752(b)(2)(ii)(A)(2)	[An active collection system shall] collect gas from each area, cell, or group of cells in the landfill in which the initial solid waste has been placed for a period of: (i) 5 years or more if active; or (ii) 2 years or more if closed or at final grade.	Section 4.1 – System Design Approach Plan conforms.
§60.752(b)(2)(ii)(A)(3)	[An active collection system shall] collect gas at a sufficient extraction rate.	Section 3.0 – Landfill Gas Generation; and Section 4.1 – System Design Approach Plan conforms.

TABLE 1
Federal Air Regulations Compliance Matrix

Regulatory Citation	Regulatory Requirement	Plan Reference
§60.752(b)(2)(ii)(A)(4)	[An active collection system shall] be designed to minimize off-site migration of subsurface gas.	Section 1.4 – Regulatory Review; Section 4.1 – System Design Approach; and Section 6.0 – Subsurface Monitoring Program Plan conforms.
§60.752(b)(2)(iii)(A)	[Route all the collected gas to] an open flare designed and operated in accordance with §60.18;	Section 4.2.7 - Flare System Plan conforms.
§60.752(b)(2)(iii)(B)	[Route all the collected gas to] A control system designed and operated to reduce NMOC by 98 weight-percent, or, when an enclosed combustion device is used for control, to either reduce NMOC by 98 weight percent or reduce the outlet NMOC concentration to less than 20 parts per million by volume, dry basis as hexane at 3 percent oxygen. The reduction efficiency or parts per million by volume shall be established by an initial performance test to be completed no later than 180 days after the initial startup of the approved control system using the test methods specified in §60.754(d).	S Section 1.4 – Regulatory Review; Section 4.2.7 - Flare System Plan conforms
§60.752(b)(2)(iii)(B)(1)	If a boiler or process heater is used as the control device, the landfill gas stream shall be introduced into the flame zone.	Not Applicable.
§60.752(b)(2)(iii)(B)(2)	The control device shall be operated within the parameter ranges established during the initial or most recent performance test. The operating parameters to be monitored are specified in §60.756.	Section 1.4 – Regulatory Review; and Section 5.2 – LFG System Monitoring Plan conforms
§60.752(b)(2)(iii)(C)	Route the collected gas to a treatment system that processes the collected gas for subsequent sale or use. All emissions from any atmospheric vent from the gas treatment system shall be subject to the requirements of paragraph (b)(2)(iii) (A) or (B) of this section.	Section 4.2.8 – Treatment and Conditioning System Plan conforms.
§60.759(a)	Each owner or operator seeking to comply with §60.752(b)(2)(i) shall site active collection wells, horizontal collectors, surface collectors, or other extraction devices at a sufficient density throughout all gas producing areas using the following procedures unless alternative procedures have been approved by the Administrator as provided in §60.752(b)(2)(i)(C) and (D):	Section 2.3.3 – Manifold Monitoring Points; Section 3.0 – Landfill Gas Generation; and Section 4.0 – Landfill Gas Collection and Control System Plan conforms.
§60.759(a)(1)	The collection devices within the interior and along the perimeter areas shall be certified to achieve comprehensive control of surface gas emissions by a professional engineer. The following issues shall be addressed in the design:	Section 3.0 - Landfill Gas Generation; and Section 4.2 – System Components Plan conforms and is certified by a professional engineer
	Depths of refuse;	Section 4.2.1 – Extraction Wells Plan conforms
	Refuse gas generation rates and flow characteristics;	Section 3.0 - Landfill Gas Generation: Plan conforms.

TABLE 1
Federal Air Regulations Compliance Matrix

Regulatory Citation	Regulatory Requirement	Plan Reference
§60.759(a)(1) *continued*	Cover properties;	Section 4.2.10 - Final Cover: Plan conforms.
	Gas system expandability;	Section 4.0 - Landfill Gas Collection System: Plan conforms.
	Leachate and condensate management;	Section 4.2.3 – Leachate Cleanout Pipes; and Section 4.2.6 – Condensate Management Plan conforms.
	Accessibility; compatibility with filling operations; and integration with closure end use;	Section 5.0 - Monitoring and Maintenance: Plan conforms.
	Air intrusion control;	Section 4.2.1 - Extraction Wells; Section 4.2.2 - Downslope/Toe drain Collectors; Section 4.2.3 - Leachate Cleanout Pipes; Section 4.2.10 - Final Cover: Section 5.1 - Wellhead Monitoring; and Section 5.4 - GCCS Maintenance Plan conforms.
	Corrosion resistance;	Section 4.2 – System Components Plan conforms.
	Fill settlement; and	Section 4.2.5 - Transmission Piping Plan conforms.
	Resistance to the refuse decomposition heat.	Section 4.2 - System Components Plan conforms.
§60.759(a)(2)	The sufficient density of gas collection devices determined in paragraph (a)(1) of this section shall address landfill gas migration issues and augmentation of the collection system through the use of active or passive systems at the landfill perimeter or exterior.	Section 5.3 - Subsurface Migration Monitoring; and Section 6.0 – Subsurface LFG Monitoring Program Plan conforms.
§60.759(a)(3)	The placement of gas collection devices determined in paragraph (a)(1) of this section shall control all gas producing areas, except as provided by paragraphs (a)(3)(i) and (a)(3) (ii) of this section.	Section 1.4 - Existing Site Conditions; and Section 4.1 – System Design Approach Plan conforms.
§60.759(a)(3)(i)	Any segregated area of asbestos or nondegradable material may be excluded from collection if documented as provided under §60.758(d). The documentation shall provide the nature, date of deposition, location and amount of asbestos or nondegradable material deposited in the area, and shall be provided to the Administrator upon request.	Section 1.4 - Existing Site Conditions Plan conforms.

TABLE 1
Federal Air Regulations Compliance Matrix

Regulatory Citation	Regulatory Requirement	Plan Reference
§60.759(a)(3)(ii)	Any nonproductive area of the landfill may be excluded from control, provided that the total of all excluded areas can be shown to contribute less than 1 percent of the total amount of NMOC emissions from the landfill.	Not Applicable.
§60.759(b)	Each owner or operator seeking to comply with §60.752(b)(2)(i)(A) shall construct the gas collection devices using the following equipment or procedures:	See the following:
§60.759(b)(1)	The landfill gas extraction components shall be constructed of polyvinyl chloride (PVC), high density polyethylene (HDPE) pipe, fiberglass, stainless steel, or other nonporous corrosion resistant material of suitable dimensions to: convey projected amounts of gases; withstand installation, static, and settlement forces; and withstand planned overburden or traffic loads. The collection system shall extend as necessary to comply with emission and migration standards. Collection devices such as wells and horizontal collectors shall be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control. Perforations shall be situated with regard to the need to prevent excessive air infiltration.	Section 4.2.1 - Extraction Wells; Section 4.2.2 - Downslope/Toe drain Collectors; Section 4.2.3 - Leachate Cleanout Pipes; Section 4.2.4 – Wellheads; Section 4.2.5 – Transmission Piping; Section 4.2.6 - Condensate Management; and Section 4.2.7 - Flare System Plan conforms.
§60.759(b)(2)	Vertical wells shall be placed so as not to endanger underlying liners and shall address the occurrence of water within the landfill. Holes and trenches constructed for piped wells and horizontal collectors shall be of sufficient cross-section so as to allow for their proper construction and completion including, for example, centering of pipes and placement of gravel backfill. Collection devices shall be designed so as not to allow indirect short circuiting of air into the cover or refuse into the collection system or gas into the air. Any gravel used around pipe perforations should be of a dimension so as not to penetrate or block perforations.	Section 4.2.1 - Extraction Wells; and Section 4.2.10 - Final Cover: Plan conforms.
§60.759(b)(3)	Collection devices may be connected to the collection header pipes below or above the landfill surface. The connector assembly shall include a positive closing throttle valve, any necessary seals and couplings, access couplings, and at least one sampling port. The collection devices shall be constructed of PVC, HDPE, fiberglass, stainless steel, or other nonporous material of suitable thickness.	Section 4.2.1 - Extraction Wells; Section 4.2.2 - Downslope/Toe drain Collectors; Section 4.2.3 - Leachate Cleanout Pipes; Section 4.2.4 – Wellheads; and Section 4.2.5 – Transmission Piping Plan conforms.
§60.759(c)	Each owner or operator seeking to comply with §60.752(b)(2)(i)(A) shall convey the landfill gas to a control system in compliance with §60.752(b)(2)(iii) through the collection header pipe(s). The gas mover equipment shall be sized to handle the maximum gas generation flow rate expected over the intended use period of the gas moving equipment using the following procedures:	Section 4.2.3 = Transmission Piping; Section 4.2.7 - Flare System; and 4.2.8 - Treatment and Conditioning System Plan conforms.

TABLE 1
Federal Air Regulations Compliance Matrix

Regulatory Citation	Regulatory Requirement	Plan Reference
§60.759(c)(1)	For existing collection systems, the flow data shall be used to project the maximum flow rate. If no flow data exists, the procedures in paragraph (c)(2) of this section shall be used.	Section 5.2 – LFG System Monitoring Plan confirms.
§60.759(c)(2)	For new collection systems, the maximum flow rate shall be in accordance with §60.755(a)(1).	Not applicable
40 CFR Part 62 Subpart OOO (**Reference 2**)		
§62.16714(b)	Install a gas collection and control system meeting the requirements in paragraphs (b)(1) through (3) and (c) of this section at each MSW landfill meeting the conditions in paragraph (a) of this section.	Section 1.4 – Regulatory Review Plan conforms
§62.16714(b)(1)	Collection system. Install and start up a collection and control system that captures the gas generated within the landfill within 30 months after:	Section 1.4 – Regulatory Review Plan conforms
§62.16714(b)(1)(i)	The first annual report in which the NMOC emission rate equals or exceeds 34 megagrams per year, unless Tier 2 or Tier 3 sampling demonstrates that the NMOC emission rate is less than 34 megagrams per year, as specified in §62.16724(d)(4), or	Section 1.4 – Regulatory Review Plan conforms
§62.16714(b)(1)(ii)	The first annual report in which the NMOC emission rate equals or exceeds 50 megagrams per year submitted under previously applicable regulations 40 CFR part 60, subpart WWW, 40 CFR part 62, subpart GGG, or a state plan implementing 40 CFR part 60, subpart Cc for a legacy controlled landfill or landfill in the closed landfill subcategory, or	Section 1.4 – Regulatory Review Plan conforms
§62.16714(b)(1)(iii)	The most recent NMOC emission rate report in which the NMOC emission rate equals or exceeds 34 megagrams per year based on Tier 2, if the Tier 4 SEM shows a surface methane emission concentration of 500 parts per million methane or greater as specified in §62.16724 (d)(4)(iii).	Section 1.4 – Regulatory Review Plan conforms
§62.16714(b)(2)(i)	[An active collection system must] be designed to handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control system equipment.	Section 3.0 – Landfill Gas Generation; and Section 4.1 – System Design Approach Plan conforms
§62.16714(b)(2)(ii)	[An active collection system must] collect gas from each area, cell, or group of cells in the landfill in which the initial solid waste has been placed for a period of 5 years or more if active; or 2 years or more if closed or at final grade.	Section 4.1 – System Design Approach Plan conforms.
§62.16714(b)(2)(iii)	[An active collection system must] collect gas at a sufficient extraction rate	Section 3.0 – Landfill Gas Generation; and Section 4.1 – System Design Approach Plan conforms.
§62.16714(b)(2)(iv)	[An active collection system must] be designed to minimize off-site migration of subsurface gas.	Section 1.4 – Regulatory Review; Section 4.1 – System Design Approach; and Section 6.0 – Subsurface Monitoring Program Plan conforms.

TABLE 1
Federal Air Regulations Compliance Matrix

Regulatory Citation	Regulatory Requirement	Plan Reference
§62.16714(c)	Control the gas collected from within the landfill through the use of control devices meeting the following requirements, except as provided in 40 CFR 60.24.	Section 4.2.7 - Flare System Plan conforms.
§62.16714(c)(1)	A non-enclosed flare designed and operated in accordance with the parameters established in 40 CFR 60.18 except as noted in §62.16722(d); or	Section 4.2.7 - Flare System Plan conforms.
§62.16714(c)(2)	A control system designed and operated to reduce NMOC by 98 weight percent; or when an enclosed combustion device is used for control, to either reduce NMOC by 98 weight percent or reduce the outlet NMOC concentration to less than 20 parts-per-million by volume, dry basis as hexane at 3-percent oxygen or less. The reduction efficiency or concentration in parts-per-million by volume must be established by an initial performance test to be completed no later than 180 days after the initial startup of the approved control system using the test methods specified in §62.16718(d). The performance test is not required for boilers and process heaters with design heat input capacities equal to or greater than 44 megawatts that burn landfill gas for compliance with this subpart.	S Section 1.4 – Regulatory Review; Section 4.2.7 - Flare System Plan conforms
§62.16714(c)(2)(i)	If a boiler or process heater is used as the control device, the landfill gas stream must be introduced into the flame zone.	Not Applicable.
§62.16714(c)(2)(ii)	The control device must be operated within the parameter ranges established during the initial or most recent performance test. The operating parameters to be monitored are specified in §62.16722.	Section 1.4 – Regulatory Review; and Section 5.2 – LFG System Monitoring Plan conforms
§62.16714(c)(2)(iii)	Legacy controlled landfills or landfills in the closed landfill subcategory that have already installed control systems and completed initial or subsequent performance tests may comply with this subpart using the initial or most recent performance test conducted to comply with 40 CFR part 60, subpart WWW; subpart GGG of this part; or a state plan implementing subpart Cc of part 60, is sufficient for compliance with this subpart.	Not Applicable.
§62.16714(c)(3)	Route the collected gas to a treatment system that processes the collected gas for subsequent sale or beneficial use such as fuel for combustion, production of vehicle fuel, production of high-Btu gas for pipeline injection, or use as a raw material in a chemical manufacturing process. Venting of treated landfill gas to the ambient air is not allowed. If the treated landfill gas cannot be routed for subsequent sale or beneficial use, then the treated landfill gas must be controlled according to either paragraph (c)(1) or (2) of this section.	Section 4.2.8 – Treatment and Conditioning System Plan conforms.
§62.16714(c)(4)	All emissions from any atmospheric vent from the gas treatment system are subject to the requirements of paragraph (b) or (c) of this section. For purposes of this subpart, atmospheric vents located on the condensate storage tank are not part of the treatment system and are exempt from the requirements of paragraph (b) or (c) of this section.	Section 1.4 – Regulatory Review; and Section 5.2 – LFG System Monitoring Plan conforms

TABLE 1
Federal Air Regulations Compliance Matrix

Regulatory Citation	Regulatory Requirement	Plan Reference
§62.16728(a)	Each owner or operator seeking to comply with §62.16714(b) must site active collection wells, horizontal collectors, surface collectors, or other extraction devices at a sufficient density throughout all gas producing areas using the following procedures unless alternative procedures have been approved by the Administrator.	Section 2.3.3 – Manifold Monitoring Points; Section 3.0 – Landfill Gas Generation; and Section 4.0 – Landfill Gas Collection and Control System Plan conforms.
§62.16728(a)(1)	The collection devices within the interior must be certified to achieve comprehensive control of surface gas emissions by a professional engineer. The following issues must be addressed in the design: Depths of refuse, refuse gas generation rates and flow characteristics, cover properties, gas system expandability, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, resistance to the refuse decomposition heat, and ability to isolate individual components or sections for repair or troubleshooting without shutting down entire collection system.	Section 3.0 - Landfill Gas Generation; and Section 4.2 – System Components Plan conforms and is certified by a professional engineer
§62.16728(a)(2)	The sufficient density of gas collection devices determined in paragraph (a)(1) of this section must address landfill gas migration issues and augmentation of the collection system through the use of active or passive systems at the landfill perimeter or exterior.	Section 5.3 - Subsurface Migration Monitoring; and Section 6.0 – Subsurface LFG Monitoring Program Plan conforms.
§62.16728(a)(3)	The placement of gas collection devices determined in paragraph (a)(1) of this section must control all gas producing areas, except as provided by paragraphs (a)(3)(i) and (ii) of this section.	Section 1.4 - Existing Site Conditions; and Section 4.1 – System Design Approach Plan conforms.
§62.16728(a)(3)(i)	Any segregated area of asbestos or nondegradable material may be excluded from collection if documented as provided under §62.16726(d). The documentation must provide the nature, date of deposition, location and amount of asbestos or nondegradable material deposited in the area, and must be provided to the Administrator upon request.	Section 1.4 - Existing Site Conditions Plan conforms.
§62.16728(a)(3)(ii)	Any nonproductive area of the landfill may be excluded from control, provided that the total of all excluded areas can be shown to contribute less than 1 percent of the total amount of NMOC emissions from the landfill. The amount, location, and age of the material must be documented and provided to the Administrator upon request. A separate NMOC emissions estimate must be made for each section proposed for exclusion, and the sum of all such sections must be compared to the NMOC emissions estimate for the entire landfill.	Not Applicable.
§62.16728(b)	Each owner or operator seeking to comply with §62.16714(b) must construct the gas collection devices using the following equipment or procedures:	See the following:

TABLE 1
Federal Air Regulations Compliance Matrix

Regulatory Citation	Regulatory Requirement	Plan Reference
§62.16728(b)(1)	The landfill gas extraction components must be constructed of polyvinyl chloride (PVC), high density polyethylene (HDPE) pipe, fiberglass, stainless steel, or other nonporous corrosion resistant material of suitable dimensions to: Convey projected amounts of gases; withstand installation, static, and settlement forces; and withstand planned overburden or traffic loads. The collection system must extend as necessary to comply with emission and migration standards. Collection devices such as wells and horizontal collectors must be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control. Perforations must be situated with regard to the need to prevent excessive air infiltration.	Section 4.2.1 - Extraction Wells; Section 4.2.2 - Downslope/Toe drain Collectors; Section 4.2.3 - Leachate Cleanout Pipes; Section 4.2.4 – Wellheads; Section 4.2.5 – Transmission Piping; Section 4.2.6 - Condensate Management; and Section 4.2.7 - Flare System Plan conforms.
§62.16728(b)(2)	Vertical wells must be placed so as not to endanger underlying liners and must address the occurrence of water within the landfill. Holes and trenches constructed for piped wells and horizontal collectors must be of sufficient cross-section so as to allow for their proper construction and completion including, for example, centering of pipes and placement of gravel backfill. Collection devices must be designed so as not to allow indirect short circuiting of air into the cover or refuse into the collection system or gas into the air. Any gravel used around pipe perforations should be of a dimension so as not to penetrate or block perforations.	Section 4.2.1 - Extraction Wells; and Section 4.2.10 - Final Cover: Plan conforms.
§62.16728(b)(3)	Collection devices may be connected to the collection header pipes below or above the landfill surface. The connector assembly must include a positive closing throttle valve, any necessary seals and couplings, access couplings and at least one sampling port. The collection devices must be constructed of PVC, HDPE, fiberglass, stainless steel, or other nonporous material of suitable thickness.	Section 4.2.1 - Extraction Wells; Section 4.2.2 - Downslope/Toe drain Collectors; Section 4.2.3 - Leachate Cleanout Pipes; Section 4.2.4 – Wellheads; and Section 4.2.5 – Transmission Piping Plan conforms.
§62.16728(c)	Each owner or operator seeking to comply with §62.16714(c) must convey the landfill gas to a control system in compliance with §62.16714(c) through the collection header pipe(s). The gas mover equipment must be sized to handle the maximum gas generation flow rate expected over the intended use period of the gas moving equipment using the following procedures:	Section 4.2.3 = Transmission Piping; Section 4.2.7 - Flare System; and 4.2.8 - Treatment and Conditioning System Plan conforms.
§62.16728(c)(1)	For existing collection systems, the flow data must be used to project the maximum flow rate. If no flow data exist, the procedures in paragraph (c)(2) of this section must be used.	Section 5.2 – LFG System Monitoring Plan conforms.
§62.16728(c)(2)	For new collection systems, the maximum flow rate must be in accordance with §62.16720(a)(1).	Section 3.0 - Landfill Gas Generation Plan conforms

TABLE 2
Colorado Air and Solid Waste Regulations Compliance Matrix

Regulatory Citation	Regulatory Requirement	Plan Reference
6 CCR 1007 (**Reference 9**)		
6 CCR 1007-2.3	The owners or operators of all solid waste disposal sites and facilities which may generate explosive gases shall monitor for explosive gases.	Section 5.3 - Subsurface Migration Monitoring; and Section 6.0 – Subsurface LFG Monitoring Program Plan conforms.
6 CCR 1007-2.3.1(A)	[The concentration of explosive gases generated by the facility for solid waste disposal shall not exceed] Twenty-five percent [25%] of the lower explosive limit (LEL) (one percent [1%] by volume in air for methane) within facility structures (excluding gas control or recovery systems); and	Section 5.3 - Subsurface Migration Monitoring; and Section 6.0 – Subsurface LFG Monitoring Program Plan conforms.
6 CCR 1007-2.3.1(A)	[The concentration of explosive gases generated by the facility for solid waste disposal shall not exceed] At the boundary, the lower explosive limit which is five percent (5%) by volume in air for methane.	Section 5.3 - Subsurface Migration Monitoring; and Section 6.0 – Subsurface LFG Monitoring Program Plan conforms.
6 CCR 1007-2.3.2	Owners or operators shall implement a routine monitoring program for explosive gases. The type and frequency of monitoring must be determined based on the following factors: (A) Soil conditions; (B) The hydrogeologic conditions surrounding the facility; (C) The hydraulic conditions surrounding the facility; and (D) The location of facility structures and property boundaries. (E) The minimum frequency of monitoring shall be quarterly.	Section 5.3 - Subsurface Migration Monitoring; and Section 6.0 – Subsurface LFG Monitoring Program Plan conforms.
6 CCR 1007-2.3.3	If explosive gas levels are detected exceeding the limits specified in Section 2.3.1, the owner or operator shall notify the Department and the local governing body having jurisdiction and:	Section 5.3 - Subsurface Migration Monitoring; and Section 6.0 – Subsurface LFG Monitoring Program Plan conforms.
6 CCR 1007-2.3.3(A)	Immediately take all necessary steps to ensure protection of human health	Section 5.3 - Subsurface Migration Monitoring; and Section 6.0 – Subsurface LFG Monitoring Program Plan conforms.
6 CCR 1007-2.3.3(B)	Within seven (7) days of detection, place in the operating record documentation of the explosive gas levels detected and a description of the actions taken	Section 5.3 - Subsurface Migration Monitoring; and Section 6.0 – Subsurface LFG Monitoring Program Plan conforms.
6 CCR 1007-2.3.3(C)	Within sixty (60) days of detection, implement an approved remediation plan, place an approved copy of the plan in the operating record, and notify the Department and the local governing body having jurisdiction that the plan has been implemented. The plan shall describe the nature and extent of the problem and the proposed remedy.	Section 5.3 - Subsurface Migration Monitoring; and Section 6.0 – Subsurface LFG Monitoring Program Plan conforms.
6 CCR 1007-2.3.3(D)	The Department after consultation with the local governing body having jurisdiction may establish alternative schedules for demonstrating compliance with Subsection 2.3.1 (A) and (B) of this section.	Section 5.3 - Subsurface Migration Monitoring; and Section 6.0 – Subsurface LFG Monitoring Program Plan conforms.

TABLE 2
Colorado Air and Solid Waste Regulations Compliance Matrix

Regulatory Citation	Regulatory Requirement	Plan Reference
6 CCR 1007-2.3.4	All explosive gas monitoring points shall be installed in accordance with applicable rules and regulations of the "Water Well and Pump Installation Contractor's Act" , Title 37, Article 91, Part 1, CRS as amended.	Section 5.3 - Subsurface Migration Monitoring; and Section 6.0 – Subsurface LFG Monitoring Program Plan conforms.
5 CCR 1001 (**Reference 5**)		
5 CCR 1001-3 II.A.5	No owner or operator of a smokeless flare or other flare for the combustion of waste gases shall allow or cause emissions into the atmosphere of any air pollutant which is in excess of 30% opacity for a period or periods aggregating more than six minutes in any sixty consecutive minutes.	Section 2.0 – Design Guidelines & Procedures; Section 4.2.7 – Flare System Plan Conforms
5 CCR 1001-3 III.D.1.a.(i)	Every owner or operator of a source or activity that is subject to this Section III.D. shall employ such control measures and operating procedures as are necessary to minimize fugitive particulate emissions into the atmosphere through the use of all available practical methods which are technologically feasible and economically reasonable and which reduce, prevent and control emissions so as to facilitate the achievement of the maximum practical degree of air purity in every portion of the State.	Section 2.0 – Design Guidelines & Procedures; Section 4.2.7 – Flare System Plan Conforms
5 CCR 1001-4 IX.A.2	All solid waste and process wastewater held in process wastewater collection, storage and treatment systems, including waste impoundments and anaerobic and aerobic impoundments and vessels, must be stored, treated, and handled in a manner to minimize odor emissions.	Section 5.0 – Monitoring & Maintenance Plan Conforms
5 CCR 1001-5 III.D.1.a.(i).	Every owner or operator of a source or activity that is subject to this Section III.D. shall employ such control measures and operating procedures as are necessary to minimize fugitive particulate emissions into the atmosphere through the use of all available practical methods which are technologically feasible and economically reasonable and which reduce, prevent and control emissions so as to facilitate the achievement of the maximum practical degree of air purity in every portion of the State	Section 4.2.7 – Flare System Plan Conforms
5-CCR 1001-8	Adaptation of the Federal New Source Performance Standards (NSPS) Regulations detailed in Table 1	See Table 1 for specific sections.

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REC'D FEB 16 2010

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

FEB 10 2010

Keith Overcash
Director
Division of Air Quality
North Carolina Department of Environment
& Natural Resources
1641 Mail Service Center
Raleigh, North Carolina 27699-1641

Dear Mr. Overcash:

The purpose of this letter is to provide you with a determination regarding a gas collection and control system (GCCS) design plan change proposed for the Sampson County Disposal (SCD) Municipal Solid Waste Landfill located in Roseboro, North Carolina. This site is subject to 40 Code of Federal Regulations (CFR) Part 60, Subpart WWW (Standards of Performance for Municipal Solid Waste Landfills) and the proposed design plan change involves using a manifold to link vertical wells when waste is placed on top of them during a vertical expansion. This proposal was submitted to the U.S. Environmental Protection Agency (EPA) Region 4 and the North Carolina Department of Environment and Natural Resources (NC DENR) in a letter dated January 7, 2010. Based upon our review, the proposed change in the GCCS design plan for SCD is acceptable. Details regarding the proposal and the basis for our determination are provided in the remainder of this letter.

Under Subpart WWW, owners and operators of affected landfills that have a nonmethane organic compound (NMOC) emission rate of 50 megagrams per year or more are required to install a GCCS. Provisions in 40 CFR 60.752(b)(2)(ii)(A)(2), require that landfill gas be collected from each area, cell, or group of cells that has held waste for five years or more if active or that has held waste for two years or more if closed or at final grade. Provisions in 40 CFR 60.757(c) require that owners and operators submit a design plan for their GCCS. According to the request submitted for SCD, the original GCCS design plan for the site was submitted on December 2, 2004, and was approved by the NC DENR on January 26, 2005. Consistent with this plan, SCD currently has 27 vertical wells in its gas collection system. The proposed revisions to the design plan were submitted in order to request approval for a method of collecting landfill gas where new waste will be placed on top of wells in areas that have held waste for five years or more.

Under the proposal for SCD, vertical wells installed in areas that are temporarily inactive would be connected to a manifold with a single header across and under the working face when the areas become active again. The header pipe would be equipped with sampling ports and throttling valves on each end in accordance with provisions in 40 CFR 60.759(b)(3). Once final grade is reached, new vertical wells would be installed and the original vertical wells and associated manifold would either be abandoned or used to supplement the landfill gas collection achieved with the new wells. According to 40 CFR 60.759(a)(1), GCCS design plans must

address the depth of the waste, refuse gas generation rates and flow characteristics, cover properties, gas system expandability, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, and resistance to refuse decomposition heat.

The proposed design plan change for SCD included a detailed evaluation of how three potential gas collection options would address the design considerations listed in 40 CFR 60.759(a)(1). The options evaluated included the proposal to use a manifold to connect vertical wells when new waste is placed on top of them (Option1), the use of vertical wells (Option 2), and the use of horizontal collection trenches (Option 3). According to the analysis presented in the letter, Option 1 would be the best overall choice when new waste is placed in temporarily inactive areas that have held waste for five years or longer.

Based upon our review, the proposed change to the GCCS design plan for SCD is acceptable. One basis for this conclusion is that the proposed change does not conflict with any of the design requirements in Subpart WWW. Under provisions in 40 CFR 60.759(a), owners and operators may capture landfill gas using a variety of devices (active collection wells, horizontal collectors, surface collectors). In addition, 40 CFR 60.759(b)(3) allows the use of header pipes to connect wells that are located below the landfill surface. Based upon the flexibility allowed under Subpart WWW, the proposed system for collecting landfill gas when new waste is placed in a temporarily inactive area is consistent with requirements in the rule. A second basis for our conclusion regarding the acceptability of the GCCS design plan change for SCD is that, based upon the analysis provided in the January 7 letter, Option 1 will be more effective than either of the other control options considered.

Although the proposed design plan change for SCD is acceptable, we do want to clarify that operational monitoring requirements under Subpart WWW will still apply to the manifold system's headers once final grade has been reached and new vertical wells are installed. The proposed GCCS design plan indicates that the manifold system will be considered supplemental or abandoned once new vertical wells are installed. Based upon this statement, it is unclear whether SCD intends to monitor the manifold system's headers for compliance with the operational requirements for temperature, pressure, and gas quality (i.e., nitrogen or oxygen content) under Subpart WWW. Since the rule does not contain provisions for exempting gas collection wells from operational parameter monitoring, existing vertical wells and associated manifolds that remain in service after new waste is placed in the landfill would be subject to the operational monitoring requirements in Subpart WWW.

One final issue that we want to mention is the delegation of authority for approving design plan changes similar to those submitted for SCD. Based upon our review of Subpart WWW, the NC DENR has the authority to approve changes of this type. The basis for this conclusion is that, under 40 CFR 60.750(b), the only authority in Subpart WWW that cannot be delegated to a State Agency is the one in 40 CFR 60.754(a)(5). This provision involves the use of alternative methods to determine site-specific factors used for calculating a landfill's NMOC emission rate. Since the Administrator is not prohibited from delegating provisions involving design plan requirements in Subpart WWW, the NC DENR has the authority to approve or deny proposed GCCS deign plan changes such as those outlined in the January 7 proposal for SCD.

Because the SCD submittal was the first of its type in North Carolina, we are providing formal comments based upon a request from your staff. In the future, the NC DENR can process Subpart WWW requests of this type without seeking Region 4 input. However, on an as-needed basis, we can provide assistance with the review of submittals that involve unique or difficult issues.

If you have any questions about the determination provided in this letter, please contact David McNeal of the EPA Region 4 staff at (404) 562-9102.

Sincerely,

Kenneth R. Lapierre
Acting Director
Air, Pesticides and Toxics
Management Division

cc: Mr. Booker Pullen
Division of Air Quality
North Carolina Department of Environment
& Natural Resources

Mr. Matthew S. Lamb
Project Scientist
Richardson Smith Gardner & Associates

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U.S. Environmental Protection Agency
Applicability Determination Index

Control Number: 0800040

Category:	NSPS
EPA Office:	Region 5
Date:	04/04/2008
Title:	Alternative Standards/ Procedures for Oxygen/Pressure
Recipient:	Niemann, Laura L.
Author:	Czerniak, George T.
Comments:	

Part 60, WWW Municipal Solid Waste Landfills

References: 60.753
60.755

Abstract:

Q: Does EPA approve alternative operational standards and procedures under 40 CFR part 60, subpart WWW, for oxygen/pressure for six low gas producing wells at Veolia Environmental Services' Zion Landfill in Zion, Illinois?

A: Yes. EPA approves adjusted standards and procedures under NSPS subpart WWW for oxygen and pressure for low gas producing extraction points where gas flows are so low that applying even minimal vacuum results in exceedances of the applicable oxygen concentration limit and the persistent oxygen/pressure exceedances are not due to operational or maintenance issues. Instead of decommissioning or permanently disconnecting such extraction locations, which would result in no gas control, it is better to keep operating them and allow the locations to remain shut off, under positive pressure, with monthly monitoring and periodic adjustment to vacuum to remove accumulated landfill gas.

Letter:

(AE-17J)

Laura L. Niemann, P.E.
Project Engineer
Environmental Information Logistics, LLC
130 E. Main Street
Caledonia, Michigan 49316

Re: Veolia Environmental Services' Zion Landfill

Dear Ms. Niemann:

Thank you for your February 29, 2008 and April 3, 2008 letters to the U. S. Environmental Protection Agency, requesting adjusted standards for pressure and oxygen for six permanent and interim gas extraction locations at the Veolia Environmental Services' Zion Landfill (VES-Zion Landfill), located in Zion, Illinois. VES-Zion is subject to the New Source Performance Standards (NSPS) for Municipal

Solid Waste Landfills (40 CFR Part 60, Subpart WWW or the Landfill NSPS). The regulation at 40 CFR § 60.753(b) requires the owner or operator to operate the collection system with negative pressure at each wellhead except under certain situations, one being a decommissioned well. 40 CFR § 60.753(c) requires the owner or operator to operate each interior wellhead in the collection system with a landfill gas temperature of less than 131 degrees Fahrenheit and with either a nitrogen level less than 20 percent or an oxygen level less than 5 percent. The owner or operator may establish a higher temperature, nitrogen or oxygen value at a particular well.

VES-Zion's request for approval of alternate standards for pressure and oxygen pertains to extraction locations where gas flows are so low that applying even minimal vacuum results in air infiltration that causes exceedances of the applicable oxygen concentration limit. Shutting down such wells will prevent the air infiltration that leads to the oxygen exceedances, but shutting down a well may cause positive pressure in the wellhead as landfill gas builds up. Therefore, simultaneously complying with both the pressure and oxygen concentration limits in 40 CFR § 60.753 can be difficult for wells where gas flow rates are low.

The extraction locations that VES-Zion wants covered by these alternative standards and procedures are extraction locations: EW01, EW12A, EW164, CEW1W, CEW5, and CEW5E:

EW01 is a vertical gas extraction well located in one of the oldest areas of the landfill where gas flow rates have been steadily declining. However, since the well will occasionally show decent gas quality, VES-Zion does not want to decommission the well.

EW12A is another vertical gas extraction well located in the same area as EW01 but EW12A is shallow and located at the edge of waste. The facility does not want to decommission this well since it is useful for controlling subsurface migration.

EW164 is a vertical gas extraction well installed in a newer area of waste. Since the waste is still fairly young, gas production is not yet firmly established. It is likely when gas production is well underway that alternate standards/procedures will no longer be required.

CEW1W, CEW5 and CEW5E are leachate cleanout risers. Because of the design of these systems, there is often air intrusion. In addition, if the leachate pipe perforations are submerged with leachate, very little landfill gas can enter the piping for collection. The site does not want to disconnect the cleanout risers from the gas control system since they periodically do contain large quantities of gas and are a key tool for odor control.

According to VES-Zion, the persistent exceedances of oxygen and pressure at the above extraction locations are not due to operational or maintenance issues but are the result of declining gas quality and flow rates. Instead of decommissioning or permanently disconnecting such extraction locations, which would result in no gas control, VES-Zion wants to keep operating them and allow the locations to remain shut off, under positive pressure, with monthly monitoring and periodic adjustment to vacuum to remove accumulated landfill gas.

EPA's Determination

EPA agrees and has already determined that the procedures outlined below have the potential to lower overall non-methane organic compound (NMOC) emissions from the extraction points in comparison to decommissioning. The potential increase in NMOC control system efficiency stems from the ability of the facility to quickly resume gas collection if there are improvements in gas quality or increases in the gas production rate at the extraction points. If extraction locations in a nonproductive area are only intermittently shut off as opposed to decommissioned (physically disconnected from the collection and control system), there is greater NMOC emission control.

Therefore, EPA approves the below described alternate procedures for extraction points EW01, EW12A, EW164, CEW1W, CEW5, and CEW5E. These procedures are generally the same as those proposed by VES-Zion, except for additional reporting requirements and a requirement that the alternate procedures be terminated if gas quality improvements can be maintained. 1. When the oxygen concentration at the extraction location does not decline to acceptable levels after more than one hour of reduced vacuum, the location may be shut off until the gas quality recovers.

2. The monthly monitoring required by 40 CFR Part 60, Subpart WWW will be conducted for these

locations, but positive pressure or elevated oxygen concentrations will not be considered as exceedances of the operating limits in 40 CFR § 60.753. However, the monthly monitoring results must be reported to the Illinois Environmental Protection Agency (IEPA). The reports to IEPA shall note if and when the extraction points are shut off in accordance with this letter.

3. If monthly monitoring indicates that pressure has built up in the extraction point and the oxygen concentration still exceeds 5 percent, the location will be briefly opened to relieve the pressure and may then be shut down until it is monitored the following month.

4. The surface monitoring required by 40 CFR Part 60, Subpart WWW will continue to be conducted in this area. Standard remediation steps, including evaluating the need to return the extraction location to full-time service, must be followed if exceedances of the 500 ppm methane surface concentration limits are detected in the immediate vicinity.

5. If the monthly monitoring indicates that gas quality has improved (i.e., the oxygen concentration has dropped below 5 percent), the extraction location will be brought back on line until the gas quality declines again. If the oxygen levels can be maintained below the regulatory limit of 5 percent, this alternate operating procedure is terminated and the well shall be operated in accordance with the regulatory requirements.

In addition, you should submit this information to IEPA as part of a design plan change. IEPA must be made aware that the above six extraction points are low gas-producing wells and that they are subject to alternative limits/procedures. IEPA will periodically review the wells' status to ensure that if higher gas quality can be maintained, this alternate operating procedure should be terminated and the extraction points shall be operated in accordance with the regulatory requirements.

This response has been coordinated with Yasmine Keppner of IEPA. If you have any questions regarding this letter, feel free to contact Linda H. Rosen, of my staff, at (312) 886-6810.

Sincerely yours,

George T. Czerniak, Chief
Air Enforcement and Compliance Assurance Branch

cc: Ray Pilapil, Manager
Bureau of Air Compliance and Enforcement Section
Illinois Environmental Protection Agency

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PROJECT	**East Regional Landfill**	SHEET 1 OF 7		DATE	8/2/2021
				COMPUTED BY	MMJ
SUBJECT	**LFGCCS Design Calculations**	JOB #	ERLGCCS-21-1	CHECKED BY	SWH

Objective: Design Landfill Gas Collection and Control System (LFGCCS) for management of landfill gas.

Shaded cells require user entry of values.

Given:

1.	Current LFG Generation Rate (2021):	970 SCFM	Ref. 3	(Current calculated from LandGEM software)
2.	Maximum LFG Generation Rate, Q_{max}:	2,155 SCFM	Ref. 4	("Maximum" calculated from LandGEM software)
3.	Minimum Flow Velocity:	2 FPM	Minimum to maintain turbulent flow conditions.	
4.	Maximum Flow Velocity:	2,400 FPM	Ref. 11	
			(1200 FPM for current flow and 2400 FPM with concurrent flow)	

Reference:

1. Design and As-Built Drawings for East Regional Landfill.
2. Driscopipe Design Manual
3. LFG Inventory Calculation dated 06/30/2021
4. Landfill Gas Generation Calculations dated 06/30/2021 (filename: ERL GCCS Design landgem-v302.xls)
5. "Landfill Gas System Engineering Design - A Practical Approach - Based on a Decade of Experience" by LANDTEC
6. Fluid Mechanics, Streeter and Wylie, 1985, McGraw Hill Publishing.
7. "Air Emissions from Municipal Solid Waste Landfills - Background Information for Proposed Standards and Guidelines," Document EPA-450/3-90-011a, USEPA, March 1991.
8. "Flow of Fluids - Through Valves, Fittings, and Pipe", Crane Technical Paper No. 410, Crane Valves, 1988.
9. "Design Manual for Lateral Drainage Systems, Richardson, Giroud, and Zhao, Tenax Corporation, 2000.
10. "The Hydrologic Evaluation of Landfill Performance (HELP) Model - Engineering Documentation for Version 3", Document EPA/600/R-94/168b, USEPA, September 1994
11. "Landfill Gas Collection and Treatment Systems" - United States Army Corps of Engineers, 2013.

Calculations: The blowers will be designed for critical elements as follows:

1.0 Piping Requirements
2.0 Gas Density
3.0 Flow Requirments
4.0 Well Spacing
5.0 Condensate Management

1.0 Piping Requirements

1.1 Determine Nominal Header Piping Size

The Header Piping Size is sized for peak conditions for total Landfill Gas (LFG).

Estimated maximum collection efficiency, h = ***85%*** -----> Upon Final cover system completion

Therefore, @ Peak Conditions, Qreq = 1,832 CFM

Nominal Blower Rate: 2,107 SCFM -----> 15% above max. expected collection rate of 1,832 CFM

Atmospheric pressure at project location: 12 PSI (atm) (based on site elev. of 5,500 ft)
Design Blower Inlet Pressure: -30 IN of H_2O -----> 10.92 PSI (atm)
-1.08 PSI (gauge)

1.2 Convert Standard Cubic Feet per Minute (SCFM) to Actual Cubic Feet per Minute (ACFM) and determine Design Flow Rate, Q_{DES}

Water Saturation Pressure at Actual T: 1.0 PSI (atm)

Standard temp.:	68	°F	Actual temperature:	100	°F
Standard pressure:	14.7	PSI (atm)	Actual pressure:	10.92	PSI (atm)
Standard RH:	36%		Actual RH:	99%	
SCFM:	2,107	----->	ACFM:	3,308	

Design System Flow Rate, Q_{DES}: 3,308 ACFM

2.0 Gas Density

Determine gas vapor density at anticipated field conditions as follows:

Vapor Density, $r = (M_{air} * P_{gas})/(10.732 * T_{gas})$ where:
r = vapor density, PCF
M_{air} = molecular weight of air
P_{gas} = gas pressure, PSI-A
T_{gas} = temperature of gas, rankine (= temp °F +420)

Molecular weight of air, M_{air} = 29 Appendix A-8 for Air at 68°F and at atmospheric pressure., Ref. 8
Pressure of LFG, P_{gas} = 10.92 PSI-A
Temperature of LFG, T_{gas} = 100 °F
Vapor density, r = 5.27E-02 PCF

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PROJECT East Regional Landfill | SHEET 3 OF 7 | DATE 8/2/2021

COMPUTED BY MMJ

SUBJECT LFGCCS Design Calculations | JOB # ERLGCCS-21-1 | CHECKED BY SWH

3.0 Flow Requirements

Gas flow is desired in fully turbulent conditions. Therefore, minimum flow velocities will be determined by the Reynolds number, R. The Reynolds, R, number is used to verify this condition in the main header pipe as follows:

3.1 Reynolds Number, $R_e = V*D*\rho / \mu$

Where: V = velocity, FPS
D = pipe inside diameter, FT
ρ = density of LFG, PCF
μ = absolute viscosity, lbs(mass)/ft-sec

Minimum velocity, V =	0.034	FPS	-----> **2.0 FPM**
Pipe Inside Diameter (I.D.) =	21.007	IN (diameter of header pipe)	
density of LFG, ρ =	8.15E-02	PCF ----> Density of LFG = .0815 PCF (55% CO_2 & 45% CH_4) - Richardson, Giroud, & Zhao, Ref. 9	
absolute viscosity LFG, μ =	2.68E-07	lbs(force)/ft-sec	-----> Appendix A-5 for Air @ 70°F, Ref. 8

Reynolds Number, Re = 17,860 > 10,000 OK -----> Full turbulent flow conditions exists if velocity is greater than 0.034 FPS

Density calculations assume compressibility is equal to 1. This is considered negligible at low (near ambient) temperatures and pressures with low Mach numbers (< 0.3) . Therefore, the Mach, M, number is used to verify this condition as follows:

3.2 Mach Number, $M_A = V / sqrt(kRT)$

Where: V = velocity, FPS
k = specific heat ratio (c_p/c_v)
R = specific gas constant
T = absolute temperature for a perfect gas

Velocity, V =	347.99	FPS --->	**20,880 FPM -----> Flow is incompressible, use 1200 & 2400 FPM (Ref. 11)**
Specific heat ratio, k =	1.40	---->	Appendix A-8 for Air at 68°F and atmospheric pressure, Ref. 8
specific gas constant, R_{AIR} =	1716.26	ft - lbs/lbs(force) - °R	-----> Appendix A-8 for Air at 68°F and atmospheric pressure, Ref. 8
absolute temperature for a gas, T =	5.60E+02	°R	

Mach Number, Ma = 0.300 < 0.3 OK -----> Flow is incompressible at velocity less than than 348 FPS

Therefore, the requirement for both turbulent and incompressible flow is achieved within velocities between 2 and 20,880 FPM. For optimal design, use guidance for maximum flow velocities from Ref. 11 of 1200 FPM for current flow and 2400 FPM for concurrent flow.

3.3 Determine Header Pipe Size:

Pipes are sized to keep flow velocities and pressure drops within GIVEN ranges.

Use the Continuity Equation for incompressible steady flow to determine flow velocity, Q = V*A

Where: Q = Flowrate (cfs)
V = Velocity (fps)
A = Area (square feet)

Example Calculation:	24	inch main at flare station			
Number of Pipes:	1	Flow Direction:	Concurrent		
Standard Pipe Diameter (I.D.) =	21.007	inches	----->	SDR =	17
Nominal Pumping Rate, Q =	3,308	ACFM			
Area, A =	2.407	SF			
Velocity, V =	1374	FPM	< 2,400 FPM -----> OK!		

4.0 Well Spacing

The well spacing is determined by the radius of influence for a corresponding design vacuum at the well.
Well spacing should generally not exceed twice the calculated radius of influence.

4.1 Calculate required radius of influence and number of wells.

Radius of influence, R, is calculated according the following equation:

$$R = \sqrt{\frac{Q_{well} M}{\pi L \rho_{waste} Q_{max}}}$$

Where: Q_{max} = maximum gas generation rate, CFS
M = landfill design capacity, lbs
L = well depth, FT
r_{waste} = density of waste, PCF
Q_{well} = gas flow per well, CFS
Collection Efficiency: 85% (operating conditions)

Q_{max} =	2155	SCFM (maximum generation rate)
Area of collection =	132.6	AC -----> Site Plan, Ref. 1
Number of wells =	79	-----> Adjusted for ROI and offset from perimeter, incl. wells and clean-outs)
Gas flow per well, Q_{well} =	0.39	SCFS -----> (Q_{max} / Number of wells)*Collection Efficiency
Density of waste, r_{waste} =	0.65	TCY
Maximum LFG collection rate, Q_{max} =	30.53	SCFS 1,832 SCFM
Landfill design capacity, M =	6.66E+06	TN -----> Ref. 4
Average Well depth, L =	40	FT Average length of perforated casing.
Minimum radius of influence, R =	**167**	**FT**

Compare minimum required radius of influence with design radius of influence based on permeability and vacuum at each well.

4.2 Calculate intrinsic permeability of waste.

Intrinsic permeability, K_{waste}, of waste is calculated by the following equation:

K = km/g Where: k = horizontal hydraulic conductivity of waste
m = dynamic viscosity of water, N-sec/m^2
g = unit weight of water, N/m^3

Horizontal hydraulic conductivity, k =	1.00E-03	cm/sec -----> Table 4 for Municipal Waste, Ref. 10
Dynamic or absolute viscosity of water, m =	1.00E-03	N-sec/m^2 -----> Table C.1 for water at 20°C, Ref. 6
Unit weight of water, g =	998.2	N/m^3 -----> Table C.1 for water at 20°C, Ref. 6
Intrinsic permeability of waste, K =	1.00E-11	m^2 -----> **1.08E-10 ft^2**

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PROJECT	**East Regional Landfill**	SHEET 5	OF 7	DATE	8/2/2021
				COMPUTED BY	MMJ
SUBJECT	**LFGCCS Design Calculations**	JOB #	ERLGCCS-21-1	CHECKED BY	SWH

4.0 cont. Well Spacing

4.3 Calculate radius of influence of a well based on pressure.

Radius of influence is determined by the following equation (Ref. 7):

$$\frac{P_{landfill}^2 - P^2_{vac}}{P_{vac}} = \frac{R^2 \mu_{LFG} \rho_{waste} Q_{max}}{M K_{waste} (L/D)} \ln\left(\frac{R}{r}\right)$$

Where:
- $P_{landfill}$ = allowable internal pressure in landfill, PSF-A
- P_{vacuum} = pressure in gas well, PSF-A
- R = radius of influence, FT
- m_{LFG} = dynamic viscosity of landfill gas, lbs-sec/SF
- r_{waste} = density of waste, PCF
- Q_{max} = maximum gas generation rate, CFS
- M = landfill design capacity, lbs
- K_{waste} = intrinsic permeability of waste, SF
- L = well depth, FT
- D = depth of waste, FT
- r = radius of well, FT

Allowable internal pressure in landfill, $P_{landfill}$ =	12	PSI -----> Atmospheric Pressure	
Vacuum applied at gas well, P_{well} =	5.21	IN of H_2O	0.1883 PSI
Pressure in gas well, P_{vacuum} =	11.81	PSI	
dynamic or absolute viscosity of landfill gas, m_{LFG} =	2.68E-07	lbs-sec/SF	
Density of waste, r_{waste} =	0.65	TCY	

Maximum gas collection rate, Q_{max} =	30.53	SCFS	
Landfill design capacity, M =	6.66E+06	TN	
Intrinsic permeability of waste, K_{waste} =	1.08E-10	SF	
Average Well depth, L =	40	FT	
Average Depth of waste, D =	60	FT	
Radius of collection well, r =	1.41	FT	
R = radius of influence, FT	**167**	**FT**	
S = Optimal Well Spacing, = 1.7 * radius of influence, FT	**289**	**FT**	(Factor of 1.732 from Ref. 7, Fig. 4-5)
>284 FT (1.7*minimum ROI) -----> OK			

Use the solver function below to vary the required vacuum applied at the gas well (P_{well}) and satisfy both sides of the equation.

$$\frac{P_{landfill}^2 - P^2_{vac}}{P_{vac}} = 54.65$$

$$\frac{R^2 \mu_{LFG} \rho_{waste} Q_{max}}{M K_{waste} (L/D)} \ln\left(\frac{R}{r}\right) = 54.65$$

0.000 *to solve, set equal to zero*

5.0 Condensate Management

The condensate volume is determined to provide a BASIS for condensate trap and pump station design. Condensate production is production is highly variable depending on weather/atmospheric conditions. Therefore, the following considered as a worst case.

5.1 Calculate anticipated volume of condensate.

Volume of condensate, V_{COND}, is calculated according to Antoine's Equation as follows (Ref. 5) :

$$V_{COND} = 5{,}694\left(\frac{10^{\beta}}{P_s}\right)$$

Where: V_{COND} = volume of condensate, Gallons (per million CF of LFG)
b = 6.32-(3081/(T+385))
T = Maximum gas temperature, °F
r_{waste} = density of waste, PCF
P_S = system pressure, PSIA

Maximum Gas Temperature, T =	110	°F	-----> Typical observations by RSG
b =	0.10		
System Pressure, P_S =	10.92	PSIA	-----> Flare Station and Blower Design Table
Maximum Gas Collection Rate, Q_{max}:	1,832	CFM	-----> at peak generation.
Volume of Condensate, V_{COND} =	**1.19**	**GPM**	-----> Worst Case.

5.2 Determine Condensate Pipe Size (Pressure System):

Pipes are sized to keep flow velocities within turbulent flow ranges.

Use the Continuity Equation for incompressible steady flow to determine flow velocity, Q = V*A

Where: Q = Flowrate (cfs)
V = Velocity (fps)
A = Area (square feet)

Standard Pipe Diameter (I.D.) =	1.062	inches	----->	SDR =	11
Nominal Pumping Rate, Q =	0.018	cfs	----->	Q=	8 gpm
Area, A =	0.006	square feet			
Velocity, V =	2.90	fps	-----> OK!		

Therefore, 1 Inch - SDR 11 Pipe is OK for Pressure System

5.3 Check Condensate Pipe Size (Under Gravity Conditions):

Pipes are sized to maintain flow under minimum slope conditions and within self-cleaning velocities.

Use a reformulation of the Manning Equation for pipes just flowing full, D = 16 {(Q*n)/sqrt(s)}^(3/8)

Where: Q = Flowrate (cfs)
n = Manning roughness coefficient
s = longitudinal slope (ft/ft)

Manning's roughness coefficient, n =	0.009				
Pipe slope, s =	2	%			
Required Pipe Diameter, D =	0.616	inches	----->	Standard Pipe Diameter =	2.864 Inches
Velocity, V =	3.561	fps	`	SDR =	11

Therefore, 3 Inch - SDR 11 Pipe is OK for Gravity Pipe

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						COMPUTED BY	MMJ
SUBJECT	**LFGCCS Design Calculations**	JOB #	ERLGCCS-21-1			CHECKED BY	SWH

5.0 cont. Condensate Management

5.4 Condensate Trap Dimensions

Traps are sized to maintain condensate within the trap at 125% of the maximum vacuum conditions and are constructed based on minimum pipe diameter as determined in Section 5.

The condensate level will rise in the trap on the vacuum side a total of 1/2 the vacuum pressure and will have a differential pressure between the vaccum and the drain side equal to the vacuum pressure at that point (conservatively assumed as the maximum vacuum at the blower).

Maximum vacuum on the system, P_{VAC} = 50 inches of H_20

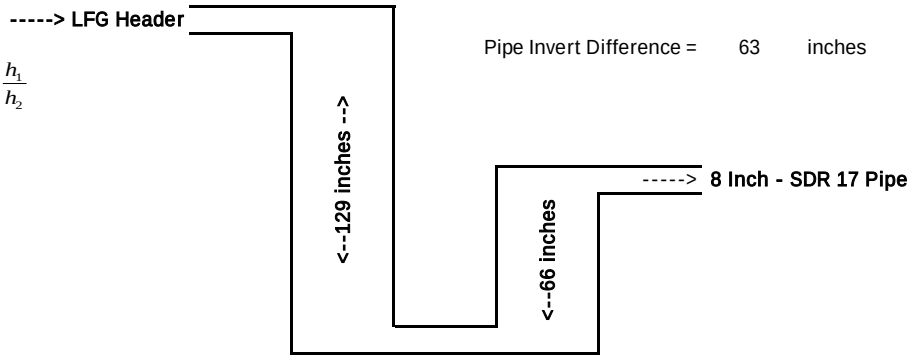
Condensate Pipe Size, D = 7.549 inches -----> SDR = 17

Minimum freeboard at the vacuum header, H_{FREE} = 12.500 inches of H_20

Therefore, the drain side, H_{DRAIN}, of the trap should equal to P_{VAC} + H_{FREE} + 1/2D and the vacuum side of the trap should equal H_{DRAIN} +P_{VAC} + H_{FREE}.

The resulting trap should be as follows:

$$\Delta t = \frac{aL}{Ak} \ln \frac{h_1}{h_2}$$



Provide multiple traps in the system to collect approximately 1.2 GPM per trap. All other condensate will be collected at pump stations.

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	Closed Class I Areas D&E C&D over MSW		
	Pre-closure Collection Efficiency =	75%	
	Post-closure Collection Efficiency =	85%	
Year	1 Generated LFG	Generated LFG	Collected LFG
	cf/yr	cfm	cfm
2010	0	0	0
2011	12,882,850	25	18
2012	47,805,264	91	68
2013	92,288,315	176	132
2014	143,659,977	273	205
2015	197,481,123	376	282
2016	258,024,580	491	368
2017	315,007,124	599	449
2018	361,667,348	688	516
2019	409,254,928	779	584
2020	462,063,378	879	659
2021	509,929,181	970	728
2022	556,734,191	1059	794
2023	602,612,400	1147	860
2024	647,582,160	1232	924
2025	691,661,458	1316	987
2026	734,867,928	1398	1049
2027	777,218,853	1479	1109
2028	818,731,173	1558	1168
2029	859,421,494	1635	1226
2030	899,306,092	1711	1283
2031	938,400,923	1785	1339
2032	976,721,624	1858	1394
2033	1,014,283,525	1930	1447
2034	1,051,101,650	2000	1500
2035	1,087,190,727	2068	1551
2036	1,122,565,193	2136	1602
2037	1,132,857,546	2155	1832
2038	1,110,425,464	2113	1796
2039	1,088,437,566	2071	1760
2040	1,066,885,058	2030	1725
2041	1,045,759,319	1990	1691
2042	1,025,051,897	1950	1658
2043	1,004,754,509	1912	1625
2044	984,859,037	1874	1593
2045	965,357,522	1837	1561
2046	946,242,162	1800	1530
2047	927,505,312	1765	1500
2048	909,139,476	1730	1470
2049	891,137,308	1695	1441
2050	873,491,607	1662	1413
2051	856,195,315	1629	1385
2052	839,241,511	1597	1357
2053	822,623,416	1565	1330
2054	806,334,381	1534	1304
2055	790,367,891	1504	1278
2056	774,717,558	1474	1253
2057	759,377,122	1445	1228
2058	744,340,448	1416	1204
2059	729,601,519	1388	1180
2060	715,154,441	1361	1157
2061	700,993,435	1334	1134
2062	687,112,835	1307	1111
2063	673,507,089	1281	1089
2064	660,170,755	1256	1068
2065	647,098,498	1231	1046

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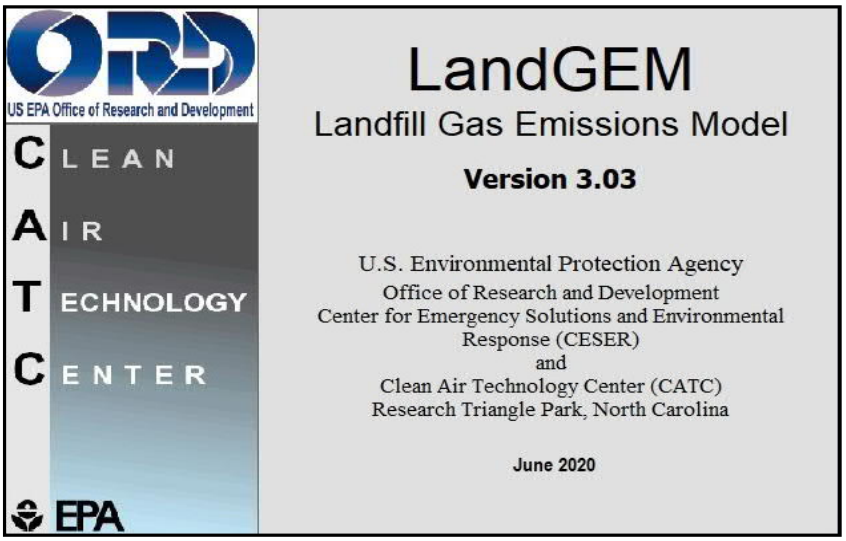
	Closed Class I Areas D&E C&D over MSW		
	Pre-closure Collection Efficiency =	75%	
	Post-closure Collection Efficiency =	85%	
Year	1 Generated LFG	Generated LFG	Collected LFG
2066	634,285,089	1207	1026
2067	621,725,403	1183	1005
2068	609,414,415	1159	986
2069	597,347,201	1137	966
2070	585,518,934	1114	947
2071	573,924,883	1092	928
2072	562,560,409	1070	910
2073	551,420,966	1049	892
2074	540,502,099	1028	874
2075	529,799,441	1008	857
2076	519,308,709	988	840
2077	509,025,708	968	823
2078	498,946,323	949	807
2079	489,066,524	930	791
2080	479,382,358	912	775
2081	469,889,951	894	760
2082	460,585,507	876	745
2083	451,465,303	859	730
2084	442,525,691	842	716
2085	433,763,095	825	701
2086	425,174,010	809	688
2087	416,755,001	793	674
2088	408,502,699	777	661
2089	400,413,804	762	648
2090	392,485,079	747	635
2091	384,713,354	732	622
2092	377,095,519	717	610
2093	369,628,527	703	598
2094	362,309,392	689	586
2095	355,135,186	676	574
2096	348,103,038	662	563
2097	341,210,136	649	552
2098	334,453,722	636	541
2099	327,831,095	624	530
2100	321,339,604	611	520
2101	314,976,654	599	509
2102	308,739,698	587	499
2103	302,626,243	576	489
2104	296,633,842	564	480
2105	290,760,098	553	470
2106	285,002,662	542	461
2107	279,359,231	532	452
2108	273,827,548	521	443
2109	268,405,399	511	434
2110	263,090,616	501	425
2111	257,881,073	491	417
2112	252,774,686	481	409
2113	247,769,412	471	401
2114	242,863,248	462	393
2115	238,054,234	453	385



Summary Report

Landfill Name or Identifier: ERL - Landfill Gas Management Plan

Date: Thursday, July 15, 2021

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10} \right) e^{-kt_{ij}}$$

Where,

Q_{CH4} = annual methane generation in the year of the calculation ($m^3/year$)
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate ($year^{-1}$)
L_0 = potential methane generation capacity (m^3/Mg)
M_i = mass of waste accepted in the i^{th} year (Mg)
t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**2010**	
Landfill Closure Year (with 80-year limit)	**2036**	
Actual Closure Year (without limit)	***2036***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**6,662,691**	*short tons*

MODEL PARAMETERS

Methane Generation Rate, k	**0.020**	*year $^{-1}$*
Potential Methane Generation Capacity, L_0	**170**	*m^3/Mg*
NMOC Concentration	**1,131**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**NMOC**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**Methane**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2010	54,131	59,544	0	0
2011	147,808	162,589	54,131	59,544
2012	190,885	209,974	201,939	222,133
2013	223,531	245,884	392,825	432,107
2014	238,097	261,907	616,355	677,991
2015	270,821	297,903	854,453	939,898
2016	260,896	286,986	1,125,274	1,237,801
2017	222,265	244,491	1,386,170	1,524,787
2018	230,044	253,048	1,608,435	1,769,278
2019	255,940	281,534	1,838,478	2,022,326
2020	239,566	263,522	2,094,418	2,303,860
2021	239,091	263,000	2,333,984	2,567,382
2022	239,091	263,000	2,573,075	2,830,382
2023	239,091	263,000	2,812,165	3,093,382
2024	239,091	263,000	3,051,256	3,356,382
2025	239,091	263,000	3,290,347	3,619,382
2026	239,091	263,000	3,529,438	3,882,382
2027	239,091	263,000	3,768,529	4,145,382
2028	239,091	263,000	4,007,620	4,408,382
2029	239,091	263,000	4,246,711	4,671,382
2030	239,091	263,000	4,485,802	4,934,382
2031	239,091	263,000	4,724,893	5,197,382
2032	239,091	263,000	4,963,984	5,460,382
2033	239,091	263,000	5,203,075	5,723,382
2034	239,091	263,000	5,442,165	5,986,382
2035	239,091	263,000	5,681,256	6,249,382
2036	136,645	150,309	5,920,347	6,512,382
2037	0	0	6,056,992	6,662,691
2038	0	0	6,056,992	6,662,691
2039	0	0	6,056,992	6,662,691
2040	0	0	6,056,992	6,662,691
2041	0	0	6,056,992	6,662,691
2042	0	0	6,056,992	6,662,691
2043	0	0	6,056,992	6,662,691
2044	0	0	6,056,992	6,662,691
2045	0	0	6,056,992	6,662,691
2046	0	0	6,056,992	6,662,691
2047	0	0	6,056,992	6,662,691
2048	0	0	6,056,992	6,662,691
2049	0	0	6,056,992	6,662,691

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2050	0	0	6,056,992	6,662,691
2051	0	0	6,056,992	6,662,691
2052	0	0	6,056,992	6,662,691
2053	0	0	6,056,992	6,662,691
2054	0	0	6,056,992	6,662,691
2055	0	0	6,056,992	6,662,691
2056	0	0	6,056,992	6,662,691
2057	0	0	6,056,992	6,662,691
2058	0	0	6,056,992	6,662,691
2059	0	0	6,056,992	6,662,691
2060	0	0	6,056,992	6,662,691
2061	0	0	6,056,992	6,662,691
2062	0	0	6,056,992	6,662,691
2063	0	0	6,056,992	6,662,691
2064	0	0	6,056,992	6,662,691
2065	0	0	6,056,992	6,662,691
2066	0	0	6,056,992	6,662,691
2067	0	0	6,056,992	6,662,691
2068	0	0	6,056,992	6,662,691
2069	0	0	6,056,992	6,662,691
2070	0	0	6,056,992	6,662,691
2071	0	0	6,056,992	6,662,691
2072	0	0	6,056,992	6,662,691
2073	0	0	6,056,992	6,662,691
2074	0	0	6,056,992	6,662,691
2075	0	0	6,056,992	6,662,691
2076	0	0	6,056,992	6,662,691
2077	0	0	6,056,992	6,662,691
2078	0	0	6,056,992	6,662,691
2079	0	0	6,056,992	6,662,691
2080	0	0	6,056,992	6,662,691
2081	0	0	6,056,992	6,662,691
2082	0	0	6,056,992	6,662,691
2083	0	0	6,056,992	6,662,691
2084	0	0	6,056,992	6,662,691
2085	0	0	6,056,992	6,662,691
2086	0	0	6,056,992	6,662,691
2087	0	0	6,056,992	6,662,691
2088	0	0	6,056,992	6,662,691
2089	0	0	6,056,992	6,662,691

Pollutant Parameters

		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

Pollutant Parameters (Continued)

		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Results

Year	Total landfill gas			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2010	0	0	0	0	0	0
2011	4.556E+02	3.648E+05	2.451E+01	1.479E+00	4.126E+02	2.772E-02
2012	1.691E+03	1.354E+06	9.095E+01	5.488E+00	1.531E+03	1.029E-01
2013	3.264E+03	2.613E+06	1.756E+02	1.059E+01	2.956E+03	1.986E-01
2014	5.080E+03	4.068E+06	2.733E+02	1.649E+01	4.601E+03	3.091E-01
2015	6.983E+03	5.592E+06	3.757E+02	2.267E+01	6.325E+03	4.249E-01
2016	9.124E+03	7.306E+06	4.909E+02	2.962E+01	8.264E+03	5.552E-01
2017	1.114E+04	8.920E+06	5.993E+02	3.616E+01	1.009E+04	6.778E-01
2018	1.279E+04	1.024E+07	6.881E+02	4.152E+01	1.158E+04	7.782E-01
2019	1.447E+04	1.159E+07	7.786E+02	4.698E+01	1.311E+04	8.806E-01
2020	1.634E+04	1.308E+07	8.791E+02	5.304E+01	1.480E+04	9.943E-01
2021	1.803E+04	1.444E+07	9.702E+02	5.854E+01	1.633E+04	1.097E+00
2022	1.969E+04	1.576E+07	1.059E+03	6.391E+01	1.783E+04	1.198E+00
2023	2.131E+04	1.706E+07	1.147E+03	6.918E+01	1.930E+04	1.297E+00
2024	2.290E+04	1.834E+07	1.232E+03	7.434E+01	2.074E+04	1.393E+00
2025	2.446E+04	1.959E+07	1.316E+03	7.940E+01	2.215E+04	1.488E+00
2026	2.599E+04	2.081E+07	1.398E+03	8.436E+01	2.353E+04	1.581E+00
2027	2.748E+04	2.201E+07	1.479E+03	8.922E+01	2.489E+04	1.672E+00
2028	2.895E+04	2.318E+07	1.558E+03	9.399E+01	2.622E+04	1.762E+00
2029	3.039E+04	2.434E+07	1.635E+03	9.866E+01	2.752E+04	1.849E+00
2030	3.180E+04	2.547E+07	1.711E+03	1.032E+02	2.880E+04	1.935E+00
2031	3.318E+04	2.657E+07	1.785E+03	1.077E+02	3.005E+04	2.019E+00
2032	3.454E+04	2.766E+07	1.858E+03	1.121E+02	3.128E+04	2.102E+00
2033	3.587E+04	2.872E+07	1.930E+03	1.164E+02	3.248E+04	2.183E+00
2034	3.717E+04	2.976E+07	2.000E+03	1.207E+02	3.366E+04	2.262E+00
2035	3.845E+04	3.079E+07	2.068E+03	1.248E+02	3.482E+04	2.339E+00
2036	3.970E+04	3.179E+07	2.136E+03	1.289E+02	3.595E+04	2.416E+00
2037	4.006E+04	3.208E+07	2.155E+03	1.300E+02	3.628E+04	2.438E+00
2038	3.927E+04	3.144E+07	2.113E+03	1.275E+02	3.556E+04	2.389E+00
2039	3.849E+04	3.082E+07	2.071E+03	1.249E+02	3.486E+04	2.342E+00
2040	3.773E+04	3.021E+07	2.030E+03	1.225E+02	3.417E+04	2.296E+00
2041	3.698E+04	2.961E+07	1.990E+03	1.200E+02	3.349E+04	2.250E+00
2042	3.625E+04	2.903E+07	1.950E+03	1.177E+02	3.283E+04	2.206E+00
2043	3.553E+04	2.845E+07	1.912E+03	1.153E+02	3.218E+04	2.162E+00
2044	3.483E+04	2.789E+07	1.874E+03	1.131E+02	3.154E+04	2.119E+00
2045	3.414E+04	2.734E+07	1.837E+03	1.108E+02	3.092E+04	2.077E+00
2046	3.346E+04	2.679E+07	1.800E+03	1.086E+02	3.030E+04	2.036E+00
2047	3.280E+04	2.626E+07	1.765E+03	1.065E+02	2.970E+04	1.996E+00
2048	3.215E+04	2.574E+07	1.730E+03	1.044E+02	2.912E+04	1.956E+00
2049	3.151E+04	2.523E+07	1.695E+03	1.023E+02	2.854E+04	1.918E+00
2050	3.089E+04	2.473E+07	1.662E+03	1.003E+02	2.797E+04	1.880E+00
2051	3.028E+04	2.424E+07	1.629E+03	9.829E+01	2.742E+04	1.842E+00
2052	2.968E+04	2.376E+07	1.597E+03	9.634E+01	2.688E+04	1.806E+00
2053	2.909E+04	2.329E+07	1.565E+03	9.443E+01	2.635E+04	1.770E+00
2054	2.851E+04	2.283E+07	1.534E+03	9.256E+01	2.582E+04	1.735E+00
2055	2.795E+04	2.238E+07	1.504E+03	9.073E+01	2.531E+04	1.701E+00
2056	2.740E+04	2.194E+07	1.474E+03	8.893E+01	2.481E+04	1.667E+00
2057	2.685E+04	2.150E+07	1.445E+03	8.717E+01	2.432E+04	1.634E+00
2058	2.632E+04	2.108E+07	1.416E+03	8.545E+01	2.384E+04	1.602E+00
2059	2.580E+04	2.066E+07	1.388E+03	8.376E+01	2.337E+04	1.570E+00

Results (Continued)

Year	Total landfill gas			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2060	2.529E+04	2.025E+07	1.361E+03	8.210E+01	2.290E+04	1.539E+00
2061	2.479E+04	1.985E+07	1.334E+03	8.047E+01	2.245E+04	1.508E+00
2062	2.430E+04	1.946E+07	1.307E+03	7.888E+01	2.201E+04	1.479E+00
2063	2.382E+04	1.907E+07	1.281E+03	7.732E+01	2.157E+04	1.449E+00
2064	2.335E+04	1.869E+07	1.256E+03	7.579E+01	2.114E+04	1.421E+00
2065	2.288E+04	1.832E+07	1.231E+03	7.428E+01	2.072E+04	1.392E+00
2066	2.243E+04	1.796E+07	1.207E+03	7.281E+01	2.031E+04	1.365E+00
2067	2.199E+04	1.761E+07	1.183E+03	7.137E+01	1.991E+04	1.338E+00
2068	2.155E+04	1.726E+07	1.159E+03	6.996E+01	1.952E+04	1.311E+00
2069	2.112E+04	1.691E+07	1.137E+03	6.857E+01	1.913E+04	1.285E+00
2070	2.071E+04	1.658E+07	1.114E+03	6.722E+01	1.875E+04	1.260E+00
2071	2.030E+04	1.625E+07	1.092E+03	6.588E+01	1.838E+04	1.235E+00
2072	1.989E+04	1.593E+07	1.070E+03	6.458E+01	1.802E+04	1.211E+00
2073	1.950E+04	1.561E+07	1.049E+03	6.330E+01	1.766E+04	1.187E+00
2074	1.911E+04	1.531E+07	1.028E+03	6.205E+01	1.731E+04	1.163E+00
2075	1.873E+04	1.500E+07	1.008E+03	6.082E+01	1.697E+04	1.140E+00
2076	1.836E+04	1.471E+07	9.880E+02	5.961E+01	1.663E+04	1.117E+00
2077	1.800E+04	1.441E+07	9.685E+02	5.843E+01	1.630E+04	1.095E+00
2078	1.764E+04	1.413E+07	9.493E+02	5.728E+01	1.598E+04	1.074E+00
2079	1.729E+04	1.385E+07	9.305E+02	5.614E+01	1.566E+04	1.052E+00
2080	1.695E+04	1.357E+07	9.121E+02	5.503E+01	1.535E+04	1.032E+00
2081	1.662E+04	1.331E+07	8.940E+02	5.394E+01	1.505E+04	1.011E+00
2082	1.629E+04	1.304E+07	8.763E+02	5.287E+01	1.475E+04	9.911E-01
2083	1.596E+04	1.278E+07	8.590E+02	5.183E+01	1.446E+04	9.715E-01
2084	1.565E+04	1.253E+07	8.419E+02	5.080E+01	1.417E+04	9.522E-01
2085	1.534E+04	1.228E+07	8.253E+02	4.979E+01	1.389E+04	9.334E-01
2086	1.504E+04	1.204E+07	8.089E+02	4.881E+01	1.362E+04	9.149E-01
2087	1.474E+04	1.180E+07	7.929E+02	4.784E+01	1.335E+04	8.968E-01
2088	1.445E+04	1.157E+07	7.772E+02	4.689E+01	1.308E+04	8.790E-01
2089	1.416E+04	1.134E+07	7.618E+02	4.597E+01	1.282E+04	8.616E-01
2090	1.388E+04	1.111E+07	7.467E+02	4.506E+01	1.257E+04	8.446E-01
2091	1.360E+04	1.089E+07	7.320E+02	4.416E+01	1.232E+04	8.278E-01
2092	1.334E+04	1.068E+07	7.175E+02	4.329E+01	1.208E+04	8.114E-01
2093	1.307E+04	1.047E+07	7.033E+02	4.243E+01	1.184E+04	7.954E-01
2094	1.281E+04	1.026E+07	6.893E+02	4.159E+01	1.160E+04	7.796E-01
2095	1.256E+04	1.006E+07	6.757E+02	4.077E+01	1.137E+04	7.642E-01
2096	1.231E+04	9.857E+06	6.623E+02	3.996E+01	1.115E+04	7.491E-01
2097	1.207E+04	9.662E+06	6.492E+02	3.917E+01	1.093E+04	7.342E-01
2098	1.183E+04	9.471E+06	6.363E+02	3.839E+01	1.071E+04	7.197E-01
2099	1.159E+04	9.283E+06	6.237E+02	3.763E+01	1.050E+04	7.054E-01
2100	1.136E+04	9.099E+06	6.114E+02	3.689E+01	1.029E+04	6.915E-01
2101	1.114E+04	8.919E+06	5.993E+02	3.616E+01	1.009E+04	6.778E-01
2102	1.092E+04	8.742E+06	5.874E+02	3.544E+01	9.888E+03	6.644E-01
2103	1.070E+04	8.569E+06	5.758E+02	3.474E+01	9.692E+03	6.512E-01
2104	1.049E+04	8.400E+06	5.644E+02	3.405E+01	9.500E+03	6.383E-01
2105	1.028E+04	8.233E+06	5.532E+02	3.338E+01	9.312E+03	6.257E-01
2106	1.008E+04	8.070E+06	5.422E+02	3.272E+01	9.128E+03	6.133E-01
2107	9.879E+03	7.910E+06	5.315E+02	3.207E+01	8.947E+03	6.011E-01
2108	9.683E+03	7.754E+06	5.210E+02	3.143E+01	8.770E+03	5.892E-01
2109	9.491E+03	7.600E+06	5.107E+02	3.081E+01	8.596E+03	5.776E-01
2110	9.304E+03	7.450E+06	5.006E+02	3.020E+01	8.426E+03	5.661E-01

Results (Continued)

Year	Total landfill gas			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2111	9.119E+03	7.302E+06	4.906E+02	2.960E+01	8.259E+03	5.549E-01
2112	8.939E+03	7.158E+06	4.809E+02	2.902E+01	8.095E+03	5.439E-01
2113	8.762E+03	7.016E+06	4.714E+02	2.844E+01	7.935E+03	5.332E-01
2114	8.588E+03	6.877E+06	4.621E+02	2.788E+01	7.778E+03	5.226E-01
2115	8.418E+03	6.741E+06	4.529E+02	2.733E+01	7.624E+03	5.123E-01
2116	8.251E+03	6.607E+06	4.440E+02	2.679E+01	7.473E+03	5.021E-01
2117	8.088E+03	6.477E+06	4.352E+02	2.626E+01	7.325E+03	4.922E-01
2118	7.928E+03	6.348E+06	4.265E+02	2.574E+01	7.180E+03	4.824E-01
2119	7.771E+03	6.223E+06	4.181E+02	2.523E+01	7.038E+03	4.729E-01
2120	7.617E+03	6.099E+06	4.098E+02	2.473E+01	6.898E+03	4.635E-01
2121	7.466E+03	5.979E+06	4.017E+02	2.424E+01	6.762E+03	4.543E-01
2122	7.318E+03	5.860E+06	3.937E+02	2.376E+01	6.628E+03	4.453E-01
2123	7.173E+03	5.744E+06	3.860E+02	2.329E+01	6.497E+03	4.365E-01
2124	7.031E+03	5.630E+06	3.783E+02	2.283E+01	6.368E+03	4.279E-01
2125	6.892E+03	5.519E+06	3.708E+02	2.237E+01	6.242E+03	4.194E-01
2126	6.756E+03	5.410E+06	3.635E+02	2.193E+01	6.118E+03	4.111E-01
2127	6.622E+03	5.303E+06	3.563E+02	2.150E+01	5.997E+03	4.030E-01
2128	6.491E+03	5.198E+06	3.492E+02	2.107E+01	5.878E+03	3.950E-01
2129	6.362E+03	5.095E+06	3.423E+02	2.065E+01	5.762E+03	3.872E-01
2130	6.236E+03	4.994E+06	3.355E+02	2.024E+01	5.648E+03	3.795E-01
2131	6.113E+03	4.895E+06	3.289E+02	1.984E+01	5.536E+03	3.720E-01
2132	5.992E+03	4.798E+06	3.224E+02	1.945E+01	5.426E+03	3.646E-01
2133	5.873E+03	4.703E+06	3.160E+02	1.907E+01	5.319E+03	3.574E-01
2134	5.757E+03	4.610E+06	3.097E+02	1.869E+01	5.214E+03	3.503E-01
2135	5.643E+03	4.519E+06	3.036E+02	1.832E+01	5.110E+03	3.434E-01
2136	5.531E+03	4.429E+06	2.976E+02	1.796E+01	5.009E+03	3.366E-01
2137	5.422E+03	4.341E+06	2.917E+02	1.760E+01	4.910E+03	3.299E-01
2138	5.314E+03	4.255E+06	2.859E+02	1.725E+01	4.813E+03	3.234E-01
2139	5.209E+03	4.171E+06	2.803E+02	1.691E+01	4.718E+03	3.170E-01
2140	5.106E+03	4.089E+06	2.747E+02	1.658E+01	4.624E+03	3.107E-01
2141	5.005E+03	4.008E+06	2.693E+02	1.625E+01	4.533E+03	3.045E-01
2142	4.906E+03	3.928E+06	2.639E+02	1.593E+01	4.443E+03	2.985E-01
2143	4.809E+03	3.850E+06	2.587E+02	1.561E+01	4.355E+03	2.926E-01
2144	4.713E+03	3.774E+06	2.536E+02	1.530E+01	4.269E+03	2.868E-01
2145	4.620E+03	3.699E+06	2.486E+02	1.500E+01	4.184E+03	2.811E-01
2146	4.529E+03	3.626E+06	2.436E+02	1.470E+01	4.101E+03	2.756E-01
2147	4.439E+03	3.554E+06	2.388E+02	1.441E+01	4.020E+03	2.701E-01
2148	4.351E+03	3.484E+06	2.341E+02	1.412E+01	3.940E+03	2.648E-01
2149	4.265E+03	3.415E+06	2.295E+02	1.384E+01	3.862E+03	2.595E-01
2150	4.180E+03	3.347E+06	2.249E+02	1.357E+01	3.786E+03	2.544E-01

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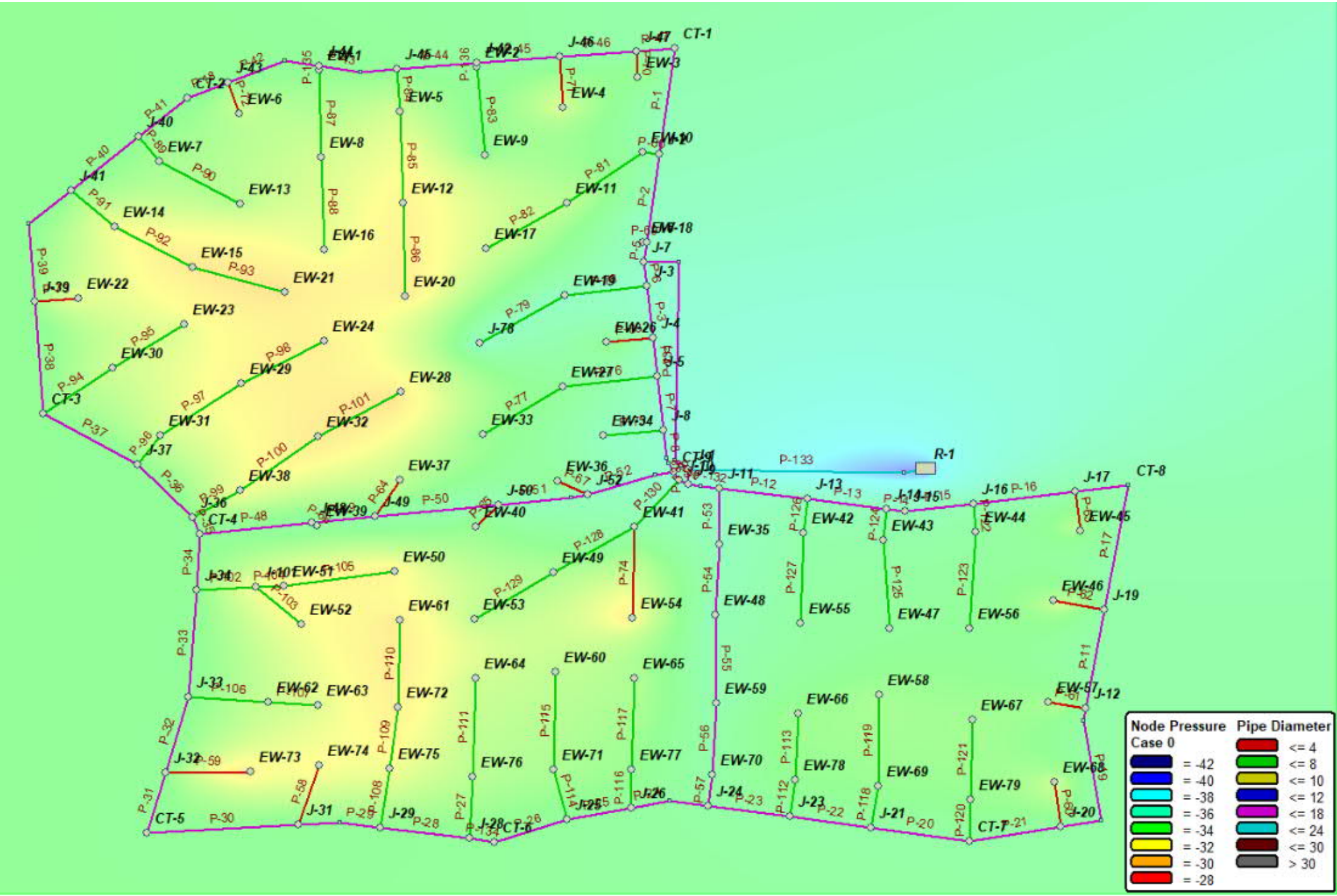
Node Pressure
Case 0
= -42
= -40
= -38
= -36
= -34
= -32
= -30
= -28
Pipe Diameter
<= 4
<= 8
<= 10
<= 12
<= 18
<= 24
<= 30
> 30

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*                                                             *
*  Gas Network Analysis Software                              *
*                                                             *
*  CopyRighted by KYPIPE LLC (www.kypipe.com)                 *
*  Version: 10.009  10/01/2019                                *
*  Company:  SMGAENG       Serial #:  580244                  *
*  Interface:  KYnetic                                        *
*  Licensed for Pipe2020                                      *
*                                                             *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
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INPUT DATA FILE NAME FOR THIS SIMULATION = h:\projects\WCIBN1~A\0VNSQ8~K\0504BD~A\LO83Y2~0\kypipe\ELTV8H~8\EGK30X~M.KYP\erlgccs_.DAT
OUTPUT DATA FILE NAME FOR THIS SIMULATION = h:\projects\WCIBN1~A\0VNSQ8~K\0504BD~A\LO83Y2~0\kypipe\ELTV8H~8\EGK30X~M.KYP\erlgccs_.OT2

DATE FOR THIS COMPUTER RUN   : 8-04-2021
START TIME FOR THIS COMPUTER RUN : 11: 0:51:40

SUMMARY OF DISTRIBUTION SYSTEM CHARACTERISTICS:

NUMBER OF PIPES   =   139
NUMBER OF JUNCTION NODES =   135

UNITS SPECIFIED   = ENGLISH

A CONSTANT DENSITY FLUID IS SPECIFIED - DENSITY =   .08POUNDS/CUBIC FOOT

ABSOLUTE VISCOSITY   =   .270E-06 POUND SECONDS/SQUARE FOOT

USER SPEC. FLOW UNITS (USFU)   = SCF / MIN.
USER SPEC. PRESSURE UNITS(USPU) = INCHES OF WATER (GAUGE)

------- SUMMARY OF PIPE NETWORK GEOMETRIC AND OPERATING DATA -------

PIPE NAME	NODE #1	NODE #2	LENGTH (FT.)	DIAM. (IN.)	ROUGHNESS (MILLIFEET)	SUM-M FACT.	PUMP ID	ELEVATION CHANGE
P-1	CT-1	J-2	332.5	15.8	******	.0	0	.0
P-2	J-2	J-6	279.6	15.8	******	.0	0	.0
P-3	J-3	J-4	162.6	15.8	******	.0	0	.0

P-4	J-4	J-5	118.6	15.8	******	.0	0	.0
P-5	J-6	J-7	59.7	15.8	******	.0	0	.0
P-6	J-7	J-3	77.2	15.8	******	.0	0	.0
P-7	J-5	J-8	171.9	15.8	******	.0	0	.0
P-8	J-8	CT-9	134.4	15.8	******	.0	0	.0
P-9	CT-9	J-10	30.5	15.8	******	.0	0	.0
P-10	J-10	J-9	31.9	15.8	******	.0	0	.0
P-11	J-19	J-12	315.9	15.8	******	.0	0	.0
P-12	J-11	J-13	277.4	15.8	******	.0	0	.0
P-13	J-13	J-14	249.2	15.8	******	.0	0	.0
P-14	J-14	J-15	58.3	15.8	******	.0	0	.0
P-15	J-15	J-16	212.9	15.8	******	.0	0	.0
P-16	J-16	J-17	321.1	15.8	******	.0	0	.0
P-17	J-17	J-19	557.4	15.8	******	.0	0	.0
P-18	CT-2	J-43	136.9	15.8	******	.0	0	.0
P-19	J-12	J-20	479.8	15.8	******	.0	0	.0
P-20	CT-7	J-21	311.1	15.8	******	.0	0	.0
P-21	J-20	CT-7	287.9	15.8	******	.0	0	.0
P-22	J-21	J-23	257.0	15.8	******	.0	0	.0
P-23	J-23	J-24	257.5	15.8	******	.0	0	.0
P-24	J-24	J-26	241.8	15.8	******	.0	0	.0
P-25	J-26	J-25	203.4	15.8	******	.0	0	.0
P-26	J-25	CT-6	237.0	15.8	******	.0	0	.0
P-27	J-28	EW-76	191.9	5.8	******	.0	0	.0
P-28	J-28	J-29	280.7	15.8	******	.0	0	.0
P-29	J-29	J-31	254.1	15.8	******	.0	0	.0
P-30	J-31	CT-5	474.8	15.8	******	.0	0	.0
P-31	CT-5	J-32	198.6	15.8	******	.0	0	.0
P-32	J-32	J-33	244.4	15.8	******	.0	0	.0
P-33	J-33	J-34	336.5	15.8	******	.0	0	.0
P-34	J-34	CT-4	176.1	15.8	******	.0	0	.0
P-35	CT-4	J-36	56.2	15.8	******	.0	0	.0
P-36	J-36	J-37	238.5	15.8	******	.0	0	.0
P-37	J-37	CT-3	334.1	15.8	******	.0	0	.0
P-38	CT-3	J-39	351.2	15.8	******	.0	0	.0
P-39	J-39	J-41	410.1	15.8	******	.0	0	.0
P-40	J-41	J-40	271.5	15.8	******	.0	0	.0
P-41	J-40	CT-2	192.3	15.8	******	.0	0	.0
P-42	J-43	J-44	298.4	15.8	******	.0	0	.0
P-43	J-44	J-45	245.3	15.8	******	.0	0	.0
P-44	J-45	J-42	248.2	15.8	******	.0	0	.0
P-45	J-42	J-46	258.6	15.8	******	.0	0	.0
P-46	J-46	J-47	240.6	15.8	******	.0	0	.0
P-47	J-47	CT-1	119.6	15.8	******	.0	0	.0
P-48	CT-4	J-48	348.8	15.8	******	.0	0	.0
P-49	J-48	J-49	198.5	15.8	******	.0	0	.0
P-50	J-49	J-50	387.9	15.8	******	.0	0	.0
P-51	J-50	J-52	280.0	15.8	******	.0	0	.0
P-52	J-52	CT-9	278.2	15.8	******	.0	0	.0
P-53	J-11	EW-35	176.6	15.8	******	.0	0	.0
P-54	EW-35	EW-48	219.2	15.8	******	.0	0	.0

P-55	EW-48	EW-59	275.2	15.8	******	.0	0	.0
P-56	EW-59	EW-70	226.0	15.8	******	.0	0	.0
P-57	EW-70	J-24	96.8	15.8	******	.0	0	.0
P-58	J-31	EW-74	193.8	3.9	******	.0	0	.0
P-59	J-32	EW-73	266.5	3.9	******	.0	0	.0
P-60	J-20	EW-68	141.8	3.9	******	.0	0	.0
P-61	J-12	EW-57	118.9	3.9	******	.0	0	.0
P-62	J-19	EW-46	163.2	3.9	******	.0	0	.0
P-63	J-17	EW-45	124.8	3.9	******	.0	0	.0
P-64	J-49	EW-37	136.0	3.9	******	.0	0	.0
P-65	J-50	EW-40	100.1	3.9	******	.0	0	.0
P-66	J-48	EW-39	20.8	3.9	******	.0	0	.0
P-67	J-52	EW-36	102.5	3.9	******	.0	0	.0
P-68	J-4	EW-26	145.0	3.9	******	.0	0	.0
P-69	J-6	EW-18	12.3	3.9	******	.0	0	.0
P-70	J-47	EW-3	81.6	3.9	******	.0	0	.0
P-71	J-46	EW-4	158.3	3.9	******	.0	0	.0
P-72	J-43	EW-6	102.0	3.9	******	.0	0	.0
P-73	J-39	EW-22	137.5	3.9	******	.0	0	.0
P-74	EW-54	EW-41	284.4	3.9	******	.0	0	.0
P-75	J-8	EW-34	189.6	5.8	******	.0	0	.0
P-76	J-5	EW-27	297.4	5.8	******	.0	0	.0
P-77	EW-27	EW-33	290.3	5.8	******	.0	0	.0
P-78	J-3	EW-19	257.8	5.8	******	.0	0	.0
P-79	EW-19	J-78	302.9	5.8	******	.0	0	.0
P-80	J-2	EW-10	50.6	5.8	******	.0	0	.0
P-81	EW-10	EW-11	288.5	5.8	******	.0	0	.0
P-82	EW-11	EW-17	289.1	5.8	******	.0	0	.0
P-83	EW-9	EW-2	277.8	5.8	******	.0	0	.0
P-84	J-45	EW-5	132.4	5.8	******	.0	0	.0
P-85	EW-5	EW-12	284.9	5.8	******	.0	0	.0
P-86	EW-12	EW-20	290.9	5.8	******	.0	0	.0
P-87	EW-8	EW-1	274.1	5.8	******	.0	0	.0
P-88	EW-8	EW-16	286.0	5.8	******	.0	0	.0
P-89	J-40	EW-7	101.2	5.8	******	.0	0	.0
P-90	EW-7	EW-13	283.7	5.8	******	.0	0	.0
P-91	J-41	EW-14	178.3	5.8	******	.0	0	.0
P-92	EW-14	EW-15	273.2	5.8	******	.0	0	.0
P-93	EW-15	EW-21	298.4	5.8	******	.0	0	.0
P-94	CT-3	EW-30	261.0	5.8	******	.0	0	.0
P-95	EW-30	EW-23	261.9	5.8	******	.0	0	.0
P-96	J-37	EW-31	114.0	5.8	******	.0	0	.0
P-97	EW-31	EW-29	301.3	5.8	******	.0	0	.0
P-98	EW-29	EW-24	291.8	5.8	******	.0	0	.0
P-99	J-36	EW-38	169.9	5.8	******	.0	0	.0
P-100	EW-38	EW-32	297.9	5.8	******	.0	0	.0
P-101	EW-32	EW-28	291.9	5.8	******	.0	0	.0
P-102	J-34	J-101	184.4	5.8	******	.0	0	.0
P-103	J-101	EW-52	185.6	5.8	******	.0	0	.0
P-104	J-101	EW-51	89.1	5.8	******	.0	0	.0
P-105	EW-51	EW-50	348.2	5.8	******	.0	0	.0

P-106	J-33	EW-62	249.4	5.8	******	.0	0	.0
P-107	EW-62	EW-63	154.5	5.8	******	.0	0	.0
P-108	J-29	EW-75	185.7	5.8	******	.0	0	.0
P-109	EW-75	EW-72	192.9	5.8	******	.0	0	.0
P-110	EW-72	EW-61	271.3	5.8	******	.0	0	.0
P-111	EW-76	EW-64	309.4	5.8	******	.0	0	.0
P-112	J-23	EW-78	115.3	5.8	******	.0	0	.0
P-113	EW-78	EW-66	209.7	5.8	******	.0	0	.0
P-114	J-25	EW-71	162.8	5.8	******	.0	0	.0
P-115	EW-71	EW-60	303.2	5.8	******	.0	0	.0
P-116	J-26	EW-77	118.4	5.8	******	.0	0	.0
P-117	EW-77	EW-65	285.5	5.8	******	.0	0	.0
P-118	J-21	EW-69	131.0	5.8	******	.0	0	.0
P-119	EW-69	EW-58	284.9	5.8	******	.0	0	.0
P-120	CT-7	EW-79	127.4	5.8	******	.0	0	.0
P-121	EW-79	EW-67	249.7	5.8	******	.0	0	.0
P-122	J-16	EW-44	88.5	5.8	******	.0	0	.0
P-123	EW-44	EW-56	300.7	5.8	******	.0	0	.0
P-124	J-14	EW-43	98.1	5.8	******	.0	0	.0
P-125	EW-43	EW-47	276.4	5.8	******	.0	0	.0
P-126	J-13	EW-42	104.6	5.8	******	.0	0	.0
P-127	EW-42	EW-55	283.0	5.8	******	.0	0	.0
P-128	EW-41	EW-49	290.8	5.8	******	.0	0	.0
P-129	EW-49	EW-53	284.9	5.8	******	.0	0	.0
P-130	J-10	EW-41	202.0	7.5	******	.0	0	.0
P-131	J-7	J-1	780.7	15.8	******	.0	0	.0
P-132	J-9	J-11	97.4	15.8	******	.0	0	.0
P-133	J-129	R-1	68.4	21.0	******	.0	0	.0
P-134	CT-6	J-28	80.6	15.8	******	.0	0	.0
P-135	EW-1	J-44	11.6	5.8	******	.0	0	.0
P-136	EW-2	J-42	11.9	5.8	******	.0	0	.0
P-137	J-1	J-129	672.3	21.0	******	.0	0	.0
P-138	J-1	J-9	44.1	15.8	******	.0	0	.0

JUNCTION NAME	NODE TITLE	ELEV	DEMAND (USFU)	FPN PRESSURE
CT-1		.00	.00	
CT-2		.00	.00	
CT-3		.00	.00	
CT-4		.00	.00	
CT-5		.00	.00	
CT-6		.00	.00	
CT-7		.00	.00	
CT-9		.00	.00	
EW-1		.00	-38.00	
EW-2		.00	-38.00	
EW-3		.00	-38.00	
EW-4		.00	-38.00	
EW-5		.00	-38.00	

EW-6	.00	-38.00
EW-7	.00	-38.00
EW-8	.00	-38.00
EW-9	.00	-38.00
EW-10	.00	-38.00
EW-11	.00	-38.00
EW-12	.00	-38.00
EW-13	.00	-38.00
EW-14	.00	-38.00
EW-15	.00	-38.00
EW-16	.00	-38.00
EW-17	.00	-38.00
EW-18	.00	-38.00
EW-19	.00	-38.00
EW-20	.00	-38.00
EW-21	.00	-38.00
EW-22	.00	-38.00
EW-23	.00	-38.00
EW-24	.00	-38.00
EW-26	.00	-38.00
EW-27	.00	-38.00
EW-28	.00	-38.00
EW-29	.00	-38.00
EW-30	.00	-38.00
EW-31	.00	-38.00
EW-32	.00	-38.00
EW-33	.00	-38.00
EW-34	.00	-38.00
EW-35	.00	-38.00
EW-36	.00	-38.00
EW-37	.00	-38.00
EW-38	.00	-38.00
EW-39	.00	-38.00
EW-40	.00	-38.00
EW-41	.00	-38.00
EW-42	.00	-38.00
EW-43	.00	-38.00
EW-44	.00	-38.00
EW-45	.00	-38.00
EW-46	.00	-38.00
EW-47	.00	-38.00
EW-48	.00	-38.00
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EW-59	.00	-38.00
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EW-63	.00	-38.00
EW-64	.00	-38.00
EW-65	.00	-38.00
EW-66	.00	-38.00
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EW-70	.00	-38.00
EW-71	.00	-38.00
EW-72	.00	-38.00
EW-73	.00	-38.00
EW-74	.00	-38.00
EW-75	.00	-38.00
EW-76	.00	-38.00
EW-77	.00	-38.00
EW-78	.00	-38.00
EW-79	.00	-38.00
J-1	.00	.00
J-2	.00	.00
J-3	.00	.00
J-4	.00	.00
J-5	.00	.00
J-6	.00	.00
J-7	.00	.00
J-8	.00	.00
J-9	.00	.00
J-10	.00	.00
J-11	.00	.00
J-12	.00	.00
J-13	.00	.00
J-14	.00	.00
J-15	.00	.00
J-16	.00	.00
J-17	.00	.00
J-19	.00	.00
J-20	.00	.00
J-21	.00	.00
J-23	.00	.00
J-24	.00	.00
J-25	.00	.00
J-26	.00	.00
J-28	.00	.00
J-29	.00	.00
J-31	.00	.00
J-32	.00	.00
J-33	.00	.00

J-34	.00	.00	
J-36	.00	.00	
J-37	.00	.00	
J-39	.00	.00	
J-40	.00	.00	
J-41	.00	.00	
J-42	.00	.00	
J-43	.00	.00	
J-44	.00	.00	
J-45	.00	.00	
J-46	.00	.00	
J-47	.00	.00	
J-48	.00	.00	
J-49	.00	.00	
J-50	.00	.00	
J-52	.00	.00	
J-78	.00	.00	
J-101	.00	.00	
J-129	.00	.00	
R-1	.00	.00	-40.00

==========

Set = 0

========== RESULTS FOR THIS SIMULATION FOLLOW ==========

Solution was obtained in 11 trials
Flow Accuracy = .1425E-03[< .500E-02]
RV Accuracy = .0000E+00[< .100E-02]

PIPE NO.	NODE #1	NODE #2	FLOW (USFU)	LOSS (USPU)	VELOCITY (FT/S)	DENSITY (#/CF)	FRICTION FACTOR	AREA RATIO
P-1	CT-1	J-2	579.414	.30	6.65	.082	.1099	
P-2	J-2	J-6	693.414	.36	7.96	.082	.1098	
P-3	J-3	J-4	121.430	.01	1.39	.082	.1112	
P-4	J-4	J-5	159.430	.01	1.83	.082	.1108	
P-5	J-6	J-7	731.414	.09	8.40	.082	.1098	
P-6	J-7	J-3	83.430	.00	.96	.082	.1119	
P-7	J-5	J-8	235.430	.03	2.70	.082	.1104	
P-8	J-8	CT-9	273.430	.03	3.14	.082	.1103	
P-9	CT-9	J-10	949.751	.07	10.91	.082	.1097	
P-10	J-10	J-9	1101.751	.10	12.65	.082	.1097	

P-11	J-19	J-12	-259.478	.06	2.98	.082	.1103
P-12	J-11	J-13	-563.478	.24	6.47	.082	.1099
P-13	J-13	J-14	-487.478	.16	5.60	.082	.1099
P-14	J-14	J-15	-411.478	.03	4.73	.082	.1100
P-15	J-15	J-16	-411.478	.10	4.73	.082	.1100
P-16	J-16	J-17	-335.478	.10	3.85	.082	.1101
P-17	J-17	J-19	-297.478	.13	3.42	.082	.1102
P-18	CT-2	J-43	161.414	.01	1.85	.082	.1108
P-19	J-12	J-20	-221.478	.06	2.54	.082	.1105
P-20	CT-7	J-21	-107.478	.01	1.23	.082	.1114
P-21	J-20	CT-7	-183.478	.03	2.11	.082	.1107
P-22	J-21	J-23	-31.478	.00	.36	.082	.1155
P-23	J-23	J-24	44.522	.00	.51	.082	.1138
P-24	J-24	J-26	-454.266	.13	5.22	.082	.1100
P-25	J-26	J-25	-378.266	.08	4.34	.082	.1101
P-26	J-25	CT-6	-302.266	.06	3.47	.082	.1102
P-27	J-28	EW-76	-76.000	.88	6.48	.082	.2169
P-28	J-28	J-29	-226.266	.04	2.60	.082	.1104
P-29	J-29	J-31	-112.266	.01	1.29	.082	.1113
P-30	J-31	CT-5	-74.266	.01	.85	.082	.1122
P-31	CT-5	J-32	-74.266	.00	.85	.082	.1122
P-32	J-32	J-33	-36.266	.00	.42	.082	.1147
P-33	J-33	J-34	39.734	.00	.46	.082	.1143
P-34	J-34	CT-4	153.734	.01	1.77	.082	.1109
P-35	CT-4	J-36	-370.586	.02	4.26	.082	.1101
P-36	J-36	J-37	-256.586	.04	2.95	.082	.1103
P-37	J-37	CT-3	-142.586	.02	1.64	.082	.1110
P-38	CT-3	J-39	-66.586	.00	.76	.082	.1125
P-39	J-39	J-41	-28.586	.00	.33	.082	.1160
P-40	J-41	J-40	85.414	.01	.98	.082	.1119
P-41	J-40	CT-2	161.414	.01	1.85	.082	.1108
P-42	J-43	J-44	199.414	.03	2.29	.082	.1106
P-43	J-44	J-45	313.414	.06	3.60	.082	.1102
P-44	J-45	J-42	427.414	.12	4.91	.082	.1100
P-45	J-42	J-46	503.414	.18	5.78	.082	.1099
P-46	J-46	J-47	541.414	.19	6.22	.082	.1099
P-47	J-47	CT-1	579.414	.11	6.65	.082	.1099
P-48	CT-4	J-48	524.320	.26	6.02	.082	.1099
P-49	J-48	J-49	562.320	.17	6.46	.082	.1099
P-50	J-49	J-50	600.320	.37	6.90	.082	.1098
P-51	J-50	J-52	638.320	.31	7.33	.082	.1098
P-52	J-52	CT-9	676.321	.34	7.77	.082	.1098
P-53	J-11	EW-35	-650.788	.20	7.47	.082	.1098
P-54	EW-35	EW-48	-612.788	.22	7.04	.082	.1098
P-55	EW-48	EW-59	-574.788	.24	6.60	.082	.1099
P-56	EW-59	EW-70	-536.788	.17	6.17	.082	.1099
P-57	EW-70	J-24	-498.788	.06	5.73	.082	.1099
P-58	J-31	EW-74	-38.000	2.29	7.16	.082	.3076
P-59	J-32	EW-73	-38.000	3.15	7.16	.082	.3076
P-60	J-20	EW-68	-38.000	1.68	7.16	.082	.3076
P-61	J-12	EW-57	-38.000	1.41	7.16	.082	.3076

P-62	J-19	EW-46	-38.000	1.93	7.16	.082	.3076
P-63	J-17	EW-45	-38.000	1.48	7.16	.082	.3076
P-64	J-49	EW-37	-38.000	1.61	7.16	.082	.3076
P-65	J-50	EW-40	-38.000	1.18	7.16	.082	.3076
P-66	J-48	EW-39	-38.000	.25	7.16	.082	.3076
P-67	J-52	EW-36	-38.000	1.21	7.16	.082	.3076
P-68	J-4	EW-26	-38.000	1.72	7.16	.082	.3076
P-69	J-6	EW-18	-38.000	.15	7.16	.082	.3076
P-70	J-47	EW-3	-38.000	.97	7.16	.082	.3076
P-71	J-46	EW-4	-38.000	1.87	7.16	.082	.3076
P-72	J-43	EW-6	-38.000	1.21	7.16	.082	.3076
P-73	J-39	EW-22	-38.000	1.63	7.16	.082	.3076
P-74	EW-54	EW-41	38.000	3.36	7.16	.082	.3076
P-75	J-8	EW-34	-38.000	.22	3.24	.082	.2179
P-76	J-5	EW-27	-76.000	1.36	6.48	.082	.2169
P-77	EW-27	EW-33	-38.000	.33	3.24	.082	.2179
P-78	J-3	EW-19	-38.000	.30	3.24	.082	.2179
P-79	EW-19	J-78	.000	.00	.00	.082	.0000
P-80	J-2	EW-10	-114.000	.52	9.72	.082	.2166
P-81	EW-10	EW-11	-76.000	1.32	6.48	.082	.2169
P-82	EW-11	EW-17	-38.000	.33	3.24	.082	.2179
P-83	EW-9	EW-2	38.000	.32	3.24	.082	.2179
P-84	J-45	EW-5	-114.000	1.36	9.72	.082	.2166
P-85	EW-5	EW-12	-76.000	1.31	6.48	.082	.2169
P-86	EW-12	EW-20	-38.000	.34	3.24	.082	.2179
P-87	EW-8	EW-1	76.000	1.26	6.48	.082	.2169
P-88	EW-8	EW-16	-38.000	.33	3.24	.082	.2179
P-89	J-40	EW-7	-76.000	.46	6.48	.082	.2169
P-90	EW-7	EW-13	-38.000	.33	3.24	.082	.2179
P-91	J-41	EW-14	-114.000	1.84	9.72	.082	.2166
P-92	EW-14	EW-15	-76.000	1.25	6.48	.082	.2169
P-93	EW-15	EW-21	-38.000	.34	3.24	.082	.2179
P-94	CT-3	EW-30	-76.000	1.20	6.48	.082	.2169
P-95	EW-30	EW-23	-38.000	.30	3.24	.082	.2179
P-96	J-37	EW-31	-114.000	1.17	9.72	.082	.2166
P-97	EW-31	EW-29	-76.000	1.38	6.48	.082	.2169
P-98	EW-29	EW-24	-38.000	.34	3.24	.082	.2179
P-99	J-36	EW-38	-114.000	1.75	9.72	.082	.2166
P-100	EW-38	EW-32	-76.000	1.37	6.48	.082	.2169
P-101	EW-32	EW-28	-38.000	.34	3.24	.082	.2179
P-102	J-34	J-101	-114.000	1.90	9.72	.082	.2166
P-103	J-101	EW-52	-38.000	.21	3.24	.082	.2179
P-104	J-101	EW-51	-76.000	.41	6.48	.082	.2169
P-105	EW-51	EW-50	-38.000	.40	3.24	.082	.2179
P-106	J-33	EW-62	-76.000	1.14	6.48	.082	.2169
P-107	EW-62	EW-63	-38.000	.18	3.24	.082	.2179
P-108	J-29	EW-75	-114.000	1.91	9.72	.082	.2166
P-109	EW-75	EW-72	-76.000	.88	6.48	.082	.2169
P-110	EW-72	EW-61	-38.000	.31	3.24	.082	.2179
P-111	EW-76	EW-64	-38.000	.36	3.24	.082	.2179
P-112	J-23	EW-78	-76.000	.53	6.48	.082	.2169

P-113	EW-78	EW-66	-38.000	.24	3.24	.082	.2179
P-114	J-25	EW-71	-76.000	.75	6.48	.082	.2169
P-115	EW-71	EW-60	-38.000	.35	3.24	.082	.2179
P-116	J-26	EW-77	-76.000	.54	6.48	.082	.2169
P-117	EW-77	EW-65	-38.000	.33	3.24	.082	.2179
P-118	J-21	EW-69	-76.000	.60	6.48	.082	.2169
P-119	EW-69	EW-58	-38.000	.33	3.24	.082	.2179
P-120	CT-7	EW-79	-76.000	.58	6.48	.082	.2169
P-121	EW-79	EW-67	-38.000	.29	3.24	.082	.2179
P-122	J-16	EW-44	-76.000	.41	6.48	.082	.2169
P-123	EW-44	EW-56	-38.000	.35	3.24	.082	.2179
P-124	J-14	EW-43	-76.000	.45	6.48	.082	.2169
P-125	EW-43	EW-47	-38.000	.32	3.24	.082	.2179
P-126	J-13	EW-42	-76.000	.48	6.48	.082	.2169
P-127	EW-42	EW-55	-38.000	.33	3.24	.082	.2179
P-128	EW-41	EW-49	-76.000	1.33	6.48	.082	.2169
P-129	EW-49	EW-53	-38.000	.33	3.24	.082	.2179
P-130	J-10	EW-41	-152.000	.84	7.75	.082	.1779
P-131	J-7	J-1	647.984	.88	7.44	.082	.1098
P-132	J-9	J-11	-1214.266	.38	13.95	.082	.1096
P-133	J-129	R-1	2964.000	.33	19.26	.082	.0936
P-134	CT-6	J-28	-302.266	.02	3.47	.082	.1102
P-135	EW-1	J-44	114.000	.12	9.72	.082	.2166
P-136	EW-2	J-42	76.000	.05	6.48	.082	.2169
P-137	J-1	J-129	2964.000	3.25	19.26	.082	.0936
P-138	J-1	J-9	-2316.017	.63	26.60	.082	.1095
R-1	R-1	R-1	-2964.000	.00	.01	.082	.0348

JUNCTION NAME	NODE TITLE	DEMAND (USFU)	PRESSURE (USPU)	PRESSURE (PSIA)	PRESSURE (PSIG)	DENSITY #/CF
CT-1		.00	-34.80	13.44	-1.26	.082
CT-2		.00	-34.10	13.47	-1.23	.082
CT-3		.00	-34.08	13.47	-1.23	.082
CT-4		.00	-34.17	13.46	-1.23	.082
CT-5		.00	-34.16	13.46	-1.23	.082
CT-6		.00	-34.23	13.46	-1.23	.082
CT-7		.00	-34.51	13.45	-1.24	.082
CT-9		.00	-35.61	13.41	-1.28	.082
EW-1		-38.00	-34.02	13.47	-1.23	.082
EW-2		-38.00	-34.27	13.46	-1.24	.082
EW-3		-38.00	-33.73	13.48	-1.22	.082
EW-4		-38.00	-32.63	13.52	-1.18	.082
EW-5		-38.00	-32.84	13.51	-1.18	.082
EW-6		-38.00	-32.90	13.51	-1.19	.082
EW-7		-38.00	-33.62	13.48	-1.21	.082
EW-8		-38.00	-32.76	13.51	-1.18	.082
EW-9		-38.00	-33.95	13.47	-1.22	.082

EW-10	-38.00	-34.58	13.45	-1.25	.082
EW-11	-38.00	-33.25	13.50	-1.20	.082
EW-12	-38.00	-31.53	13.56	-1.14	.082
EW-13	-38.00	-33.29	13.49	-1.20	.082
EW-14	-38.00	-32.24	13.53	-1.16	.082
EW-15	-38.00	-30.99	13.58	-1.12	.082
EW-16	-38.00	-32.43	13.53	-1.17	.082
EW-17	-38.00	-32.92	13.51	-1.19	.082
EW-18	-38.00	-35.31	13.42	-1.27	.082
EW-19	-38.00	-35.25	13.42	-1.27	.082
EW-20	-38.00	-31.20	13.57	-1.13	.082
EW-21	-38.00	-30.64	13.59	-1.11	.082
EW-22	-38.00	-32.45	13.53	-1.17	.082
EW-23	-38.00	-32.59	13.52	-1.18	.082
EW-24	-38.00	-31.21	13.57	-1.13	.082
EW-26	-38.00	-33.84	13.48	-1.22	.082
EW-27	-38.00	-34.20	13.46	-1.23	.082
EW-28	-38.00	-30.69	13.59	-1.11	.082
EW-29	-38.00	-31.55	13.56	-1.14	.082
EW-30	-38.00	-32.89	13.51	-1.19	.082
EW-31	-38.00	-32.93	13.51	-1.19	.082
EW-32	-38.00	-31.03	13.58	-1.12	.082
EW-33	-38.00	-33.86	13.47	-1.22	.082
EW-34	-38.00	-35.37	13.42	-1.28	.082
EW-35	-38.00	-35.20	13.43	-1.27	.082
EW-36	-38.00	-34.06	13.47	-1.23	.082
EW-37	-38.00	-32.98	13.51	-1.19	.082
EW-38	-38.00	-32.39	13.53	-1.17	.082
EW-39	-38.00	-34.18	13.46	-1.23	.082
EW-40	-38.00	-33.78	13.48	-1.22	.082
EW-41	-38.00	-34.85	13.44	-1.26	.082
EW-42	-38.00	-34.69	13.44	-1.25	.082
EW-43	-38.00	-34.56	13.45	-1.25	.082
EW-44	-38.00	-34.48	13.45	-1.24	.082
EW-45	-38.00	-33.31	13.49	-1.20	.082
EW-46	-38.00	-32.73	13.52	-1.18	.082
EW-47	-38.00	-34.24	13.46	-1.24	.082
EW-48	-38.00	-34.98	13.43	-1.26	.082
EW-49	-38.00	-33.51	13.49	-1.21	.082
EW-50	-38.00	-31.44	13.56	-1.13	.082
EW-51	-38.00	-31.85	13.55	-1.15	.082
EW-52	-38.00	-32.04	13.54	-1.16	.082
EW-53	-38.00	-33.18	13.50	-1.20	.082
EW-54	-38.00	-31.48	13.56	-1.14	.082
EW-55	-38.00	-34.36	13.46	-1.24	.082
EW-56	-38.00	-34.13	13.46	-1.23	.082
EW-57	-38.00	-33.19	13.50	-1.20	.082
EW-58	-38.00	-33.57	13.48	-1.21	.082
EW-59	-38.00	-34.74	13.44	-1.25	.082
EW-60	-38.00	-33.19	13.50	-1.20	.082
EW-61	-38.00	-31.06	13.58	-1.12	.082

EW-62	-38.00	-33.01	13.51	-1.19	.082
EW-63	-38.00	-32.83	13.51	-1.18	.082
EW-64	-38.00	-32.97	13.51	-1.19	.082
EW-65	-38.00	-33.50	13.49	-1.21	.082
EW-66	-38.00	-33.73	13.48	-1.22	.082
EW-67	-38.00	-33.64	13.48	-1.21	.082
EW-68	-38.00	-32.86	13.51	-1.19	.082
EW-69	-38.00	-33.90	13.47	-1.22	.082
EW-70	-38.00	-34.57	13.45	-1.25	.082
EW-71	-38.00	-33.54	13.49	-1.21	.082
EW-72	-38.00	-31.37	13.56	-1.13	.082
EW-73	-38.00	-31.00	13.58	-1.12	.082
EW-74	-38.00	-31.87	13.55	-1.15	.082
EW-75	-38.00	-32.26	13.53	-1.16	.082
EW-76	-38.00	-33.33	13.49	-1.20	.082
EW-77	-38.00	-33.82	13.48	-1.22	.082
EW-78	-38.00	-33.97	13.47	-1.23	.082
EW-79	-38.00	-33.93	13.47	-1.22	.082
J-1	.00	-36.42	13.38	-1.31	.082
J-2	.00	-35.10	13.43	-1.27	.082
J-3	.00	-35.54	13.41	-1.28	.082
J-4	.00	-35.55	13.41	-1.28	.082
J-5	.00	-35.56	13.41	-1.28	.082
J-6	.00	-35.46	13.42	-1.28	.082
J-7	.00	-35.54	13.41	-1.28	.082
J-8	.00	-35.59	13.41	-1.28	.082
J-9	.00	-35.79	13.40	-1.29	.082
J-10	.00	-35.69	13.41	-1.29	.082
J-11	.00	-35.41	13.42	-1.28	.082
J-12	.00	-34.60	13.45	-1.25	.082
J-13	.00	-35.17	13.43	-1.27	.082
J-14	.00	-35.01	13.43	-1.26	.082
J-15	.00	-34.98	13.43	-1.26	.082
J-16	.00	-34.89	13.44	-1.26	.082
J-17	.00	-34.79	13.44	-1.26	.082
J-19	.00	-34.66	13.45	-1.25	.082
J-20	.00	-34.54	13.45	-1.25	.082
J-21	.00	-34.50	13.45	-1.24	.082
J-23	.00	-34.50	13.45	-1.24	.082
J-24	.00	-34.50	13.45	-1.24	.082
J-25	.00	-34.29	13.46	-1.24	.082
J-26	.00	-34.37	13.46	-1.24	.082
J-28	.00	-34.21	13.46	-1.23	.082
J-29	.00	-34.17	13.46	-1.23	.082
J-31	.00	-34.16	13.46	-1.23	.082
J-32	.00	-34.15	13.46	-1.23	.082
J-33	.00	-34.15	13.46	-1.23	.082
J-34	.00	-34.15	13.46	-1.23	.082
J-36	.00	-34.14	13.46	-1.23	.082
J-37	.00	-34.10	13.47	-1.23	.082
J-39	.00	-34.08	13.47	-1.23	.082

J-40	.00	-34.08	13.47	-1.23	.082
J-41	.00	-34.08	13.47	-1.23	.082
J-42	.00	-34.33	13.46	-1.24	.082
J-43	.00	-34.11	13.47	-1.23	.082
J-44	.00	-34.14	13.46	-1.23	.082
J-45	.00	-34.20	13.46	-1.23	.082
J-46	.00	-34.50	13.45	-1.24	.082
J-47	.00	-34.69	13.44	-1.25	.082
J-48	.00	-34.42	13.45	-1.24	.082
J-49	.00	-34.59	13.45	-1.25	.082
J-50	.00	-34.97	13.43	-1.26	.082
J-52	.00	-35.27	13.42	-1.27	.082
J-78	.00	-35.25	13.42	-1.27	.082
J-101	.00	-32.25	13.53	-1.16	.082
J-129	.00	-39.67	13.26	-1.43	.082
R-1	.00	-40.00	13.25	-1.44	.082

* This designates the use of default density in a low pressure region

THE NET SYSTEM DEMAND (USFU) = -2964.000

SUMMARY OF INFLOWS(+).AND.OUTFLOWS(-) :

NAME	FLOW (USFU)	FPN TITLE
R-1	-2964.0	R-1

SUMMARY OF MINIMUM.AND.MAXIMUM VELOCITIES (FT/S)

	MINIMUM		MAXIMUM
R-1	.01	P-138	26.60
P-39	.33	P-137	19.26
P-22	.36	P-132	13.95
P-32	.42	P-10	12.65
P-33	.46	P-9	10.91

SUMMARY OF MINIMUM.AND.MAXIMUM LOSS/1000. (PSI)

	MINIMUM		MAXIMUM
R-1	.00	P-138	.52
P-39	.00	P-74	.43
P-22	.00	P-72	.43
P-32	.00	P-108	.37

P-33 .00 P-135 .37

SUMMARY OF MINIMUM.AND.MAXIMUM PRESSURES (USPU)

	MINIMUM		MAXIMUM
R-1	-40.00	EW-21	-30.64
J-129	-39.67	EW-28	-30.69
J-1	-36.42	EW-15	-30.99
J-9	-35.79	EW-73	-31.00
J-10	-35.69	EW-32	-31.03

********** END OF KYGAS SIMULATION **********

DATE FOR THIS COMPUTER RUN : 8-04-2021
START TIME FOR THIS COMPUTER RUN : 11: 0:51:49

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02223	Embankment
02614	HDPE Pipe
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11321	Condensate Pump Station and Controls
11910	Prefabricated Flare System - Open
13252	Landfill Gas Wells
13254	Vertical Wellheads
13255	Landfill Gas Collection Trenches
15880	Compressed Air System

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Excavation: Excavation includes excavating, sealing, hauling, scraping, undercutting, removal of accumulated surface water or ground water, stockpiling, and all necessary and incidental items as required for bringing the landfill and related structures to the specified lines and grades.

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1. General:

   The Contractor shall furnish all labor, material, and equipment required to complete Excavation of the project area in accordance with the Contract Drawings and these Specifications, except as noted below:

   a. Clearing and grubbing and removal of topsoil is addressed in Section 02110, Site Preparation, of these Specifications.

2. Related Work:

   Related Contract Work is described in the following sections of the Specifications:

Work	Section
Site Preparation	02110
Dewatering	02140
Embankment	02223
Erosion and Sedimentation Control	02270
CQA Manual	Attached

3. Quality Assurance:

   Quality Assurance during Excavation will be provided by the Owner as described in the accompanying Project CQA Manual.

4. Definitions:

   a. Excavation: shall consist of the removal and satisfactory disposal and/or stockpiling of all materials (borrow and/or unsuitable materials included) located with the limits of construction including widening cuts and shaping of slopes necessary for the preparation of roadbeds, slope areas, cutting of any ditches, channels, waterways, entrances, and other work incidental thereto.

   b. Borrow: shall consist of approved on-site material required for the construction of embankments/fills or for other portions of the work.

   c. Select Borrow (Where Applicable): shall consist of approved off-site material required for the construction of embankments/fills, roadway subgrade,

backfilling, or for other portions of the work as shown on Contract Drawings or in these Specifications. The Contractor shall make their own arrangements for obtaining select borrow and pay all costs involved.

d. Unsuitable Material: is any in-place or excavated material which contains undesirable materials or is in a state which is not appropriate, in the opinion of the CQA Engineer, for the intended use or support of planned structures, embankment, or excavation. This may include but not be limited to organic material, waste/refuse, soft, or wet material not meeting required specifications, etc.

e. Unsuitable Material Overexcavation: shall consist of the removal and satisfactory disposal of all unsuitable material located within the limits of construction and below subgrade elevations shown or indicated on the Contract Drawings. Where excavation to the subgrade elevations results in a subgrade or slopes of unsuitable material, the Contractor shall overexcavate such material to below the grades shown or indicated on the Contract Drawings or as otherwise directed by the Engineer and CQA Engineer.

[illegible]

Excavation shall include the removal of all soil, weathered rock, boulders, conduits, pipe, unsuitable material, and all other obstacles encountered and shown or indicated on the Contract Drawings and/or specified herein.

[illegible]

The Contractor shall submit the following to the CQA Engineer:

1. Information on Excavation equipment to be used.

2. Not used.

3. Not Used

4. Survey Results:

   Survey results from the Owner's Surveyor of the completed landfill subgrade shall be submitted for review and approval prior placing overlying materials.

[illegible]

1. The Contractor shall conduct Excavation activities in such a manner that erosion of disturbed areas and off site sedimentation is absolutely minimized as outlined in Section 02270, Erosion and Sedimentation Control, of these Specifications.

2. The Contractor shall excavate to the lines and grades shown on the Contract Drawings and stockpile all suitable excavated materials. As the excavation is made, the materials will be examined and identified to the CQA Engineer.

The Contractor will perform all surveys necessary to establish and verify lines and grades for all Excavation, including pipe excavations, soil overexcavation, and anchor trenches.

3. Stockpiling:

   The Contractor shall stockpile the materials in appropriate stockpiles as approved by the CQA Engineer. The Contractor shall use equipment and methods as necessary to maintain the moisture content of soils stockpiled (excluding topsoil) at or near their optimum moisture content.

   Stockpiles shall be properly sloped and the surfaces sealed by the Contractor at the end of each working day, or during the day in the event of heavy rain, to the satisfaction of the Engineer.

4. The Contractor shall protect all existing facilities and structures including, but not limited to, existing utilities, monitoring wells, signs, grade stakes, etc. during the grading and stockpiling operations.

5. All excavations shall be made in the dry and in such a manner and to such widths as will give ample room for properly constructing and inspecting the structures and/or piping they are to contain and for such sheeting, timbering, pumping, and drainage as may be required.

6. The Contractor shall be responsible for Dewatering as described in Section 02140, Dewatering, of these Specifications (OR the control of surface and subsurface water,) when necessary. Except for certain erosion and sedimentation control measures and other areas designated to impound water, all areas shall be graded to drain.

7. Excavation slopes shall be flat enough to avoid sloughs and slides that will cause disturbance of the subgrade or damage of adjacent areas. Slides and overbreaks which occur due to negligence, carelessness, or improper construction techniques on the part of the Contractor shall be removed and disposed of by the Contractor as directed by the Engineer at no additional cost to the Owner.

8. The intersection of slopes with natural ground surfaces, including the beginning and ending of cut slopes, shall be uniformly rounded. All protruding roots and other vegetation shall be removed from slopes.

9. The bottom of all excavations for structures and pipes shall be examined by the CQA Engineer for bearing value and the presence of unsuitable material. If, in the opinion of the CQA Engineer, additional Excavation is required due to the low bearing value of the subgrade material, or if the in-place materials are soft, yielding, pumping and wet, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted structural fill, or material directed by the CQA Engineer. No payment will be made for subgrade disturbance caused by inadequate Dewatering or improper construction methods.

10. Any areas excavated below design subgrade elevations by the Contractor, unless directed by the CQA Engineer, shall be brought back to design elevations at no cost to the Owner. The Contractor shall place and compact such material in accordance with Section 02223, Embankment, of these Specifications.

11. The Contractor shall dispose of excess or unsuitable excavation materials on-site at location(s) approved by the Owner.

12. The Contractor shall properly level-off bottoms of all excavations. Proof-rolling shall be conducted with appropriate equipment.

13. Upon reaching subgrade elevations shown in excavation areas, the Contractor shall scarify subgrade soils to a minimum depth of 6" and obtain the CQA Engineer's approval of quality. If unsuitable materials are encountered at the subgrade elevation, perform additional excavations as approved by the CQA Engineer to remove unsuitable materials.

14. Overexcavation and Backfill:

    a. Where subgrade materials are determined to be unsuitable, such materials shall be removed by the Contractor to the lengths, widths, and depths approved by the Engineer and CQA Engineer in advance and backfilled with compacted Embankment in accordance with Section 02223, Embankment, of these Specifications.

    b. No additional payment will be made for such overexcavation and backfill 1 foot or less than the finished subgrade (or pre-existing grades where pre-existing grades are lower than finished subgrade) as this is considered superficial.

    c. Where overexcavation of unsuitable material is greater than 1 foot beneath the finished subgrade (or pre-existing grades where pre-existing grades are lower than finished subgrade), payment shall be made on a unit price basis for overexcavation and backfill and the measured quantity shall include the entire excavation quantity below the finished subgrade (or pre-existing grades where pre-existing grades are lower than finished subgrade) elevations. The unit price for overexcavation and backfill shall include disposal of unsuitable materials.

15. All cuts shall be brought to the grade and cross section shown or indicated on the Contract Drawings, or established by the Engineer, prior to final inspection.

16. The Contractor shall protect finished lines and grades of completed excavation against excessive erosion, damage from trafficking, or other causes and shall repair any damage at no additional cost to the Owner.

17. Trench Excavation:

    a. All pipe Excavation and trenching shall be done in strict accordance with these Specifications, all applicable parts of the OSHA Regulations, 29 CFR 1926, Subpart P, and other applicable regulations. In the event of any conflicts in this information, safe working conditions as established by the appropriate OSHA guidelines shall govern.

b. The minimum trench widths shall be as indicated on the Contract Drawings. Enlargements of the trench shall be made as needed to give ample space for operations at pipe joints. The width of the trench shall be limited to the maximum dimensions shown on the Contract Drawings, except where a wider trench is needed for the installation of and work within sheeting and bracing.

c. Except where otherwise specified, excavation slopes shall be flat enough to avoid slides which will cause disturbance of the subgrade, damage to adjacent areas, or endanger the lives or safety of persons in the vicinity.

d. Hand excavation shall be employed wherever, in the opinion of the Engineer, it is necessary for the protection of existing utilities, poles, trees, pavements, obstructions, or structures.

e. No greater length of trench in any location shall be left open, in advance of pipe laying, than shall be authorized or directed by the Engineer and, in general, such length shall be limited to approximately one hundred (100) feet.

f. Pipe Bedding: All pipe bedding shall be as shown on the Contract Drawings, unless otherwise specified herein, or shall be approved by the Engineer.

18. Sheeting and Bracing:

a. The Contractor shall furnish, place, and maintain such sheeting and bracing which may be required to support sides of Excavation or to protect pipes and structures from possible damage and to provide safe working conditions in accordance with current OSHA requirements. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he may order additional supports put in at the sole expense of the Contractor. The Contractor shall be responsible for the adequacy of all sheeting and bracing used and for all damage resulting from sheeting and bracing failure or from placing, maintaining, and removing it.

b. The Contractor shall exercise caution in the installation and removal of sheeting to insure that excessive or unusual loadings are not transmitted to any new or existing structure. The Contractor shall promptly repair at their expense any and all damage that can be reasonably attributed to sheeting installation or removal.

c. All sheeting and bracing shall be removed upon completion of the work.

19. If grading operations are suspended for any reason whatsoever, partially completed cut and fill slopes shall be brought to the required slope and the work of seeding and mulching or other required erosion and sedimentation control operations shall be performed at the Contractor's sole expense.

20. Excavations into Waste:

The Contractor shall use caution when making excavations into waste. Any exposed waste shall be tarped or covered in some fashion (as approved by the Engineer) at the end of each day to prevent exposure to vectors.

21. Surveying:

Upon completion of the landfill subgrade, the subgrade shall be surveyed on 100 foot centers and at slope breaks (including all tops and toes of slope, points of grade change, etc.) to ensure the top of the subgrade meets the grades specified on the Contract Drawings.

END OF SECTION

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Embankment: Embankment is the on-site compacted fill that provides the foundation and the berms for the containment area, the subgrade for some access roadways and structures, and backfill around structures and piping.

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1. General:

The Contractor shall furnish all labor, material, and equipment to complete Embankment including borrowing, hauling, screening, discing, drying, compaction, control of surface and subsurface water, final grading, sealing, and all necessary and incidental items as detailed or required to complete the Embankment, all in accordance with the Contract Drawings and these Specifications.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

Work	Section
Excavation	02222

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these Specifications.

ASTM D 698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3).
ASTM D 1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
ASTM D 2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
ASTM D 2216	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
ASTM D 2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
ASTM D 2488	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

ASTM D 2937	Standard Test Method for Density of Soil in Place by the Drive Cylinder Method.
ASTM D 2974	Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
ASTM D 4643	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.
ASTM D 4959	Standard Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method.
ASTM D 6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

4. Quality Assurance:

Quality Assurance during placement of Embankment will be provided by the Owner as described in the accompanying Project CQA Manual.

5. Definitions:

a Embankment: Shall include construction of all site earthwork including roadways, subgrade, perimeter berm embankments, including preparation of the areas upon which materials are to be placed. Embankment may also be referred to as structural and/or controlled fill. All Embankment materials may be either (off-site) Select Borrow or (on-site) Borrow unless otherwise noted on Contract Drawings or specified by the Engineer.

b. Prepared Subgrade: The ground surface after clearing, grubbing, stripping, excavation, scarification, and/or compaction, and/or proof rolling to the satisfaction of the CQA Engineer.

c. Well-Graded: A mixture of particle sizes that has no specific concentration or lack thereof of one or more sizes. Well-graded does not define any numerical value that must be placed on the coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters. Well-graded is used to define a material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

d. Unclassified Fill: The nature of materials to be used is not identified or described herein but must be approved by the Engineer prior to use.

NRB M-21Ya-eT

1. Embankment materials shall consist of clean well-graded natural soil classified as SP, SW, SM, SC, ML, or CL (ASTM D 2487) containing no topsoil or other deleterious material. Additionally, for the upper 3 feet beneath the final wearing surface of roadways including shoulders, Embankment materials shall have a liquid limit less than 50%, a plasticity index less than 20% (ASTM D 2487) and have a maximum standard Proctor dry density of at least 100 pounds per cubic foot (ASTM D 698).

   Other material classifications may be approved by the Engineer.

2. Stones or rock fragments shall not exceed one half the maximum lift thickness as compacted in any dimension. Isolated rocks shall be a maximum of 24-inches in any dimension.

3. Embankment materials shall have a 12% maximum loss on ignition (ASTM D 2974).

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The Contractor shall submit the following to the CQA Engineer:

1. Information on equipment to be used for construction of Embankment.

2. Descriptive information on the location and source of any off-site borrow material to be used for Embankment, where applicable. Information shall include Standard Proctor curves (ASTM D698) for each borrow material.

3. Survey Results:

   Survey results for the completed landfill subgrade shall be submitted for review prior to placement of overlying materials.

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1. The Contractor shall conduct Embankment activities in such a manner that erosion of disturbed areas and off-site sedimentation is absolutely minimized as outlined in Section 02270, Erosion and Sedimentation Control, of these Specifications.

2. All placement and compaction of Embankment shall be performed only when the CQA Engineer is informed by the Contractor of intent to perform such work.

3. Embankment shall be placed and compacted to the lines and grades shown on the Contract Drawings. Placement of Embankment outside the construction limits shall occur only as directed and approved by the Engineer.

   The Contractor will perform all surveys necessary to establish and verify lines and grades for all Embankment.

4. The Contractor shall protect all existing facilities including, but not limited to, utilities and monitoring wells.

5. Subgrade Preparation:

   a. The CQA Engineer shall inspect the exposed subgrade prior to placement of Embankment to assure that all rocks, topsoil, vegetation, roots, debris, or other deleterious materials have been removed.

   b. Prior to placement of Embankment, the exposed subgrade shall be proofrolled using a static smooth-drum roller, loaded tandem axle dump truck, or other suitable equipment in the presence of the CQA Engineer. Any soft or unsuitable materials revealed before or during the in-place compaction shall be removed as directed by the CQA Engineer and replaced with suitable Embankment.

6. Surfaces on which Embankment is to be placed, shall be scarified or stepped in a manner which will permit bonding of the Embankment with the existing surface.

7. The Contractor shall be responsible for preparing the materials for the Embankment, including but not limited to, in-place drying or wetting of the soil necessary to achieve the compaction criteria of these Specifications.

8. The Contractor shall be responsible for the control of surface and subsurface water, when necessary. Except for certain erosion and sedimentation control measures and other areas designated to impound water, all areas shall be graded to drain.

9. Embankment materials shall be placed in a manner permitting drainage and in continuous, approximately horizontal layers.

10. Compaction Requirements:

    a. The Contractor shall compact Embankment in accordance with the requirements shown in Table 1 of this section. If Embankment does not meet the specified requirements, the Contractor shall rework the material, as may be necessary and continue compaction to achieve these requirements, or remove and replace the material to achieve the specified requirements, at Contractor's expense.

    b. Each lift shall be compacted prior to placement of succeeding lifts. In confined areas, mechanical equipment, suitable for small areas and capable of achieving the density requirements, shall be required.

    c. Lift compaction shall be performed with an appropriately heavy, properly ballasted, penetrating-foot or smooth-drum vibratory compactor depending on soil type. Compaction equipment shall be subject to approval by the CQA Engineer.

11. Embankment that becomes excessively eroded, soft, or otherwise unsuitable shall be removed or repaired by the Contractor as directed by the CQA Engineer, at no cost to the Owner.

12. The exposed surface of Embankment shall be rolled with a smooth-drum roller at the end of each work day to protect from adverse weather conditions.

13. Where Embankment is to be placed and compacted on slopes that are steeper than 3H:1V, the subgrade shall be benched to a minimum depth of 6 inches and the Embankment shall be placed in horizontal lifts.

14. Backfilling for Structures and Piping:

    a. All structures, including manholes and pipes shall be backfilled with Embankment as shown in the Contract Drawings and as described in these Specifications.

    b. Where sheeting is used, the Contractor shall take all reasonable measures to prevent loss of support beneath and adjacent to pipes and existing structures when sheeting is removed. If significant volumes of soil cannot be prevented from clinging to the extracted sheets, the voids shall be continuously backfilled as rapidly as possible. The Contractor shall thereafter limit the depth below subgrade that sheeting will be driven in similar soil conditions or employ other appropriate means to prevent loss of support.

    c. When backfilling around structures, do not backfill until concrete has sufficiently cured (as determined by the CQA Engineer) and is properly supported. Place backfill in a manner to avoid displacement or damage of structures.

15. Surveying:

    Upon completion of the landfill subgrade, the subgrade shall be surveyed on 100 foot centers and at slope breaks (including all tops and toes of slope, points of grade change, etc.) to ensure the top of the subgrade meets the grades specified on the Contract Drawings.

Table 1: Required Embankment Properties

Item	Required % Standard Proctor (ASTM D698)[2]	Required Moisture Content[3]	Maximum Lift Thickness (Compacted) (inches)
Embankment Beneath Structures and Roads[1]	100	+/- 2% of Optimum (std. Proctor)	8
Embankment	95	As Required for Compaction	8
Backfill Around Structures	95		8
Backfill in Pipe Trenches	95		6
Unclassified Fill	N/A	N/A	N/A

Notes:

1. Embankment beneath structures shall be considered to include a zone 10 feet out from the foundation of the structure extending down to the natural ground on a 45° slope. Embankment beneath roads shall be considered to include all embankment placed within 3 vertical feet of the final wearing surface and shall also include shoulders.
2. Determine field density using ASTM D 6938, ASTM D 1556, ASTM D 2167, or ASTM D 2937.
3. Determine field moisture content using ASTM D 6938, ASTM D 2216, ASTM D 4643, or ASTM D 4959.
4. The Engineer may allow exceptions to the above criteria for areas outside of the containment area which are not subject to significant long-term loads.

END OF SECTION

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High Density Polyethylene (HDPE) Pipe: HDPE Pipe is used in the LFG collection and control system.

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1. General:

The Contractor shall furnish all labor, material, and equipment to complete installation of HDPE Pipe in accordance with the Contract Drawings and these Specifications. The Contractor shall also clean and test pipelines where required.

2. Related Work:

Related Contract Work is described in the following sections of the Specifications:

Work	Section
Excavation	02222
Embankment	02223
Valves	02640
Drainage Aggregate (Leachate Management)	02710
Drainage Geocomposite	02712
HDPE Geomembrane	02775
CQA Manual	Attached

3. Reference Standards:

The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these specifications.

ASTM D 638	Standard Test Method for Tensile Properties of Plastics.
ASTM D 790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
ASTM D 1238	Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
ASTM D 1505	Standard Test Method for Density of Plastics by the Density-Gradient Technique.
ASTM D 1603	Standard Test Method for Carbon Black in Olefin Plastics.
ASTM D 1693	Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics

ASTM D 2837	Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
ASTM D 3035	Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
ASTM D 3261	Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
ASTM D 3350	Standard Specification for Polyethylene Plastics Pipe and Fitting Materials.
ASTM F 412	Standard Terminology Relating to Plastic Piping Systems.
ASTM F 714	Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
ASTM F 1417	Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.
ASTM F 1473	Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins.
ASTM F 2164	Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.

4. Quality Control:

   The Contractor shall perform pressure testing and camera inspection of HDPE Pipe as described in this section.

5. Quality Assurance:

   Quality Assurance during placement of HDPE Pipe will be provided by the Owner as described in the accompanying Project CQA Manual.

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1. All HDPE Pipe shall be manufactured from new materials meeting the physical requirements shown in Table 1 of this section.

2. All HDPE Pipe shall have smooth interior walls and the DR (dimension ratio) and diameter of the pipe shall be as shown on the Contract Drawings.

3. All HDPE Pipe having an outside diameter 3.5 inches and larger shall meet the requirements of ASTM F 714. All HDPE Pipe having an outside diameter less than 3.5 inches shall meet the requirements of ASTM D 3035. HDPE Pipe shall be iron pipe size (IPS). Ductile iron pipe size (DIPS) may be acceptable if approved by the Engineer.

4. Visible defects, such as cracks, creases, crazing, non-uniformly pigmented areas, or undispersed raw materials shall not be acceptable and will result in rejection of the pipe by the CQA Engineer.

5. Pipe Perforations: The perforations of the perforated HDPE Pipe shall be as shown on the Contract Drawings.

6. All HDPE Pipe fittings shall be in accordance with ASTM D 3261 and shall be pressure rated to match the system piping. The fittings shall be manufactured from the same materials as the pipe itself. The butt fusion outlets of fittings shall be machined to the same DR as the system piping to which they are to be fused.

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The Contractor shall submit the following to the CQA Engineer:

1. Submit a certification and summary of all required test results, prior to installation, that all HDPE Pipe manufactured for the project has been produced in accordance with these Specifications.

2. Submit a copy of the HDPE Pipe Manufacturer's recommendations for shipping, handling, and storage of pipe.

3. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

4. Furnish information on pressure testing, camera inspection, and final cleaning methods and procedures.

5. Survey Results:

   After placement of HDPE Pipe, survey results shall be submitted for review prior to acceptance.

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1. Shipping, Handling, and Storage:

   All HDPE Pipe shall be shipped, handled, and stored in strict accordance with the Manufacturer's recommendations.

2. HDPE Pipe Installation:

   a. The Contractor shall install HDPE Pipe to the lines and grades shown on the Contract Drawings. Line and grade of piping shall be maintained with laser or approved equivalent. The Contractor shall give the CQA Engineer sufficient notice so that the he may observe field location and installation activities.

b. Excavation for buried lines shall be backfilled as directed by the Engineer as shown on the Contract Drawings. Sand backfill or approved soil backfill compacted to at least 95 percent of the Standard Proctor dry density (ASTM D 698) shall be used.

Sharp stones or other potentially damaging material shall be removed from the base of the trench prior to placement of the piping. A leveling course, as required, shall consist of sand or other approved material.

c. Pipe Connections: Joining of HDPE Pipe shall be as follows:

(1) General pipe sections shall be butt-fusion welded according to the Manufacturer's recommendations and shall be performed by an appropriately trained fusion technician.

(2) Pipe ends to be butt-fusion welded shall be clean and dry at the time of welding. No welding shall occur during precipitation or excessive moisture.

(3) The Contractor shall grind burrs or other potentially damaging areas in the welds prior to placement of the pipe.

(4) Specified bolted pipe connections shall be made as specified on the Contract Drawings using stainless steel hardware and neoprene gaskets.

(5) Polyethylene stub ends and flanges must be at the ambient temperature of the surrounding soil at the time they are bolted tight to prevent relaxation of the flange bolts and loosening of the joint due to thermal contraction of the polyethylene.

(6) Properly executed electrofusion fittings may be used in lieu of other methods if approved by the Engineer.

(7) Piping with Cleanout Ports: Where cleanout ports are provided, the associated section of piping is intended to be fully accessible during operations of the facility for inspection (camera) and cleaning using OSHA-approved tools/methods. Thus, appropriate fittings shall be used to facilitate movement of to facilitate movement of inspection and cleaning tools along the entire length of the pipe. Additionally, the grinding of welds on the interior of certain fittings may be necessary. The use of fittings that may inhibit the movement of inspection and cleaning tools shall be avoided.

d. Perforated HDPE Pipe shall be placed during construction as shown on the Contract Drawings.

3. Cleaning:

a. All HDPE Pipe shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind and shall be kept clear of such accumulation until final acceptance of the work.

b. Final Flushing: The Contractor shall flush all leachate collection piping accessible by cleanout ports with potable water at or near the completion of the work. Any sediment, HDPE shavings, etc. remaining at collection points (sumps, manholes, etc.) shall be removed and disposed of as directed by the Engineer.

4. Pressure Testing:

a. All solid piping where factory or field joints have been performed requires pressure testing prior to approval by the CQA Engineer, except as noted below:

(1) Any unjointed section of pipe showing visual signs of damage or that is of questionable quality may be required to be pressure tested as directed by the CQA Engineer.

(2) Cleanout risers within the containment areas do not require pressure testing.

b. Pressure testing shall be conducted by the Contractor in a manner approved by the Engineer. Such testing shall be observed by the CQA Engineer.

c. Leachate Transmission Lines: Pressure testing of leachate transmission lines, including secondary containment piping (where required), shall be as follows:

(1) All gravity piping shall be tested using low-pressure air in accordance with ASTM F 1417.

(2) All force main piping shall be tested using hydrostatic pressure in accordance with ASTM F 2164.

d. The pressures used in testing must not exceed the working pressure of the lowest rated component in the system (i.e. valves, meters, flanges, unions, etc.). The Manufacturer's recommendation for pressure testing may also be acceptable as an alternative if approved in advance by the Engineer.

e. Pressure testing of short sections of piping to be placed in confined or inaccessible areas may be pressure tested by the Contractor prior to installation when approved by the Engineer. Temporary fittings, etc. required to plug section ends shall be provided by the Contractor at no expense to the Owner.

f. Any piping that does not meet the pressure test criteria shall be repaired and retested at the Contractor's expense. No piping shall be approved until successful pressure testing is completed.

6. Surveying:

The Contractor shall survey all HDPE Pipe on 100 foot centers and at bends to ensure the proper location and grade of the piping.

Table 1: Required HDPE Pipe Properties

Property	Test Method	Units	Value[1]
Material Designation (See Note 2)	ASTM D 412	-----	PE 3408
Cell Classification (See Note 2)	ASTM D 3350	-----	345464 C
Density	ASTM D 1505	g/cm^3	0.955
Melt Index	ASTM D 1238	g/10 min	0.1
Flexural Modulus	ASTM D 790	psi	130,000
Tensile Strength @ Yield	ASTM D 638 (Type IV)	psi	3,200
Slow Crack Growth Resistance ESCR SCG (PENT)	 ASTM D 1693 ASTM F 1473	 hours (100% igepal) hours	 > 5,000 > 100
Hydrostatic Design Basis at 73° F	ASTM D 2837	psi	1,600
UV Stabilizer	ASTM D 1603	% Carbon Black	2 - 3%

Notes:
1. Nominal values except where designated.
2. HDPE Pipe having a material designation of PE 4710 and a cell classification of 445574 C is also acceptable.

END OF SECTION

Valves: Butterfly, air and vacuum release, and ball valves are to be installed in the LFG collection and control management system of the landfill.

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1. General:

   The Contractor shall furnish all labor, material, and equipment to complete installation of all valves including all fittings, appurtenances, and transition pieces required for a complete and operable installation in accordance with the Contract Drawings and these Specifications.

2. Related Work:

   Related Contract Work is described in the following sections of the Specifications:

Work	Section
HDPE Pipe	02614
CQA Manual	Attached

3. Reference Standards:

   The latest revision of the following standards of the American National Standard Institute (ANSI) are hereby made a part of these specifications.

   ANSI B 16.1 Pipe Flanges and Flanged Fittings.

4. Quality Assurance:

   Quality Assurance during installation of Valves will be provided by the Owner as described in the accompanying Project CQA Manual.

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1. Valve Materials and Construction:

   a. All valves shall be constructed of new, first quality materials which have strength, wearing, and corrosion resistance characteristics entirely suitable for the types of service for which the individual valves are designated.

   b. All valve body castings shall be clean, sound, and without defects of any kind. No plugging, welding, or repairing of defects will be allowed.

c. Valves shall have flanged ends for exposed service and mechanical joint ends for buried service, unless otherwise shown on the Contract Drawings or specified herein. Flanged ends shall be flat-faced, 125 lb. American Standard unless otherwise shown or specified in accordance with ANSI B16.1. All bolt heads and nuts shall be hexagonal of American Standard size. The Contractor shall be responsible for coordinating connecting piping.

1. Butterfly Valves:

Butterfly valves shall be a wafer type single piece body design rated to 150 psi at 70°F. Body shall be molded of glass fiber reinforced PVC. The valve disc shall be Type 1, Grade 1 PVC or glass reinforced polypropylene. The valve shaft shall be stainless steel and be of blow out proof design. The elastomeric liner shall have an integrally molded flange face seal. Liner and seals shall be EPDM or Teflon. Valves shall be furnished with a electric gear box operator that direct mounts to the valve and is a Valvsys NL 3.5K or equal. The electric gear box shall include a crank handle for manual operation. Butterfly valves shall be as manufactured by TVI (Thermoplastic Valves, Inc.) or equal.

2. Air and Vacuum Release Valves:

Air and vacuum release valves shall operate by sealing a BUNA-N rubber outlet seat with a peripheral float as the liquid enters the valve chamber to raise the float. The valve shall satisfactorily withstand hydrostatic pressures of 300 psi. The valve shall be constructed of cast iron body and top flange with stainless steel or bronze and brass trim. The peripheral guided float shall be stainless steel. Air and vacuum release valves shall be as manufactured by Crispin, or equal.

3. Ball Valves:

Ball valves shall be constructed of PVC. Ball valves shall have two-way blocking capability and shall have flanged (ANSI) ends. Ball valves shall have Teflon seats with Viton backing cushions and Viton o-ring seals, and shall be designed for a maximum water working pressure of 150 psi at 120°F. Ball valves shall be furnished with ABS lever operating handles. Ball valves shall be as manufactured by Asahi/America, Inc., or equal.

4. Valve Operators:

The valve operator shall be designed to unseat, open or close, and seat the valve under the most adverse operating condition to which the valve will be subjected. All gearing shall be totally enclosed, sealed, and permanently lubricated.

5. Valve Boxes:

Valve boxes shall be constructed as shown or indicated on the Contract Drawings or, if not shown, in accordance with local requirements. Valve boxes shall be of the appropriate size depending on the particular valve installed. Valve boxes shall be approved by the Engineer prior to installation. Precast concrete valve boxes shall be in accordance with Section 02608, Precast Concrete Structures, of these Specifications.

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The Contractor shall submit the following to the CQA Engineer:

1. Submit a certification and summary of all required test results, prior to installation, that all valves manufactured for the project have been produced in accordance with these Specifications.

2. Submit Shop Drawings for all valves and accessories prior to installation. Submittals shall include all layout dimensions, size and materials of construction for all components, information on support and anchoring where necessary, pneumatic and hydraulic characteristics, and complete descriptive information to demonstrate full compliance with the Contract Documents.

3. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

4. Operation and maintenance manuals and installation instructions shall be submitted for all valves and accessories. The Manufacturer(s) shall delete all information which does not apply to the equipment being furnished.

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1. Before installation, all valves shall be lubricated, manually opened and closed to check their operation, and the interior of the valves shall be thoroughly cleaned.

2. Install all valves where shown on the Contract Drawings in accordance with the Manufacturer's instructions.

3. Install all valves so that operating handwheels or wrenches may be conveniently turned but without interfering with access, and as approved by the Engineer.

4. Unless otherwise approved, install all valves plumb and level. Valves shall be installed free from distortion and strain caused by misaligned piping, equipment, or other causes. Concrete valve footings shall be provided for each unsupported valve where recommended by the Manufacturer or as directed by the Engineer.

5. Valve boxes shall be set plumb, and centered with the bodies directly over the valves so that traffic loads are not transmitted to the valve. Earth fill shall be carefully tamped around each valve box to a distance of 4 feet on all sides of the box, or to the undisturbed trench face, if less than 4 feet.

END OF SECTION

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Condensate Pump Station and Controls: A Condensate Pump Station and Controls is used to collect & pump condensate from the landfill gas collection and control system (GCCS).

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1. General:

   The Contractor shall furnish all labor, material, and equipment to complete installation of a Condensate Pump Station and Controls, including all necessary and incidental items, in accordance with the Contract Drawings and these Specifications.

2. Related Work

   Related Contract Work is described in the following sections of the Specifications:

Work	Section
HDPE Pipe	02614
Valves	02640
Landfill Gas Wells	13252
Vertical Wellheads	13254

3. Manufacturer Qualifications:

   The Manufacturer shall be a UL listed shop for industrial control systems and shall provide evidence of such on request from the Engineer or Owner.

4. Warranty:

   All equipment shall be warranted by the Manufacturer against defects in material, installation, and workmanship for a period of one (1) year. Warranties shall become effective (initiate) upon field service/start-up by the Manufacturer's representative as required in this section.

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1. General:

   The materials supplied under these Specifications shall consist of new, first-quality products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

2. Wet Well:

Not used.

3. Pumps:

The pump shall include one (1) air-operated, QED AP4+ or equivalent positive displacement, self-priming, lube free pump (or approved equal) capable of the pumping conditions listed in Table 1 of this section. The pump should be air operated have variable capacity and discharge pressures. The pump should have solids capacity up to 3/32 inch in diameter and a bottom inlet.

The pump housing shall consist of polyethylene or stainless steel material. All exposed bolts and nuts shall be stainless steel. Pump seals, diaphragms and internal parts which contact liquid, shall be Viton, Acetal, or stainless steel.

a. General:

The pumps shall be capable of the pumping conditions listed in Table 1 of this section. The pumps shall be suitable for vertical or horizontal installations as shown on the Contract Drawings.

b. Design:

Each pump shall be capable of pumping leachate and condensate. The fluid inlet shall be located at the bottom of the pump intake cylinder and be capable of removing water or product to zero submergence depth. The pump system shall be powered by compressed air.

c. Materials:

Major components shall be made of 300 series stainless steel, seal rings shall be made of Teflon or Viton and bearings are to be Teflon, Viton or stainless steel. In addition, all fasteners shall be 300 series stainless steel.

d. Foot Valve (if Applicable):

The Foot Valve and sucker-rod piston valve shall be a free floating, self cleaning, ball check valve.

4. Access

All access to the pumps and wet well shall be from the surface such that operator is not required to enter a confined space.

Equipment shall be arranged to be easily accessible for operation and maintenance. Service connections including the liquid discharge, pressure balance line, and high pressure inlet shall be mounted through a common flanged cap.

5. Controls:

a. General:

The control system shall be designed to operate the required pump specified on the Contract Drawings.

The control function shall provide for the operation of the pump under normal conditions. As the flow decreases, the pumps shall cut off at the elevations as shown on the Contract Drawings.

The control system shall function as described below. The equipment listed below is a guide and does not relieve the supplier from supplying a system that will function as required.

b. Control System Operation:

The control system shall provide for the automatic and manual control of the pump to maintain a pumped down condition of the wet well. Levels shall be sensed by an internal float adjusted to the levels depicted on the Contract Drawings. The system shall sense the AOn@ and AOff@ levels. As the level in the wet well rises, the pump shall start and pump the station to the AOff@ position.

c. Submersible Pressure Transducer (if specified on Contract Drawings):

Not Used.

6. Gauges:

Gauges shall be furnished and installed under this section. All gauges shall be the Bourdon tube type with a black phenolic case conforming to NEMA 4 requirements and a one (1) inch diameter dial face. Gauge windows shall be constructed of a shatterproof glass. The gauge dial shall have black scale markings on a white background evenly spaced over a 270 degree arc. Gauges shall be provided on the air inlet of the pump in a location as directed by the Engineer.

Air pressure gauges shall be graduated in psi from zero to a minimum of twenty-five (25) psi above the respective pump shutoff head.

Gauges shall be as manufactured by Ashcroft Gauge, Division of Dresser Industries, U.S. Gauge Division of Ametek, or equal.

7. Flexible Hose:

a. External connections shall be PVC reinforced flexible PVC hose or PE pipe. Hose shall be rated for at least 10 inches mercury vacuum at the appropriate buried depth.

b. Internal connections shall be constructed of PVC reinforced PVC hose. The hose shall be rated for a pressure of 100 PSIG at 72 deg F. with a minimum safety factor of 3.

c. The pump suction line shall be connected using a hose capable of sustaining 100 in. w.c., constructed of non-corrosive materials.

8. Piping:

a. Internal piping and fittings shall be stainless steel Schedule for condensate liquids.

b. Compressed air lines in the equipment enclosure shall be 1/2 inch pipe, or neoprene reinforced synthetic rubber hose with a maximum working pressure of 250 PSIG and a safety factor of 2.

9. Filter & Regulator:

The air supply entering the pneumatic pump shall be dry and filtered. A 5-micron filter shall be used for removing particulate, oil and water. The filter/regulator shall have a zinc housing, a nylon bowl, and a plastic bowl guard or of equivalent materials.

The filter/regulator shall be rated for a maximum inlet pressure of 150 PSIG. The regulator diaphragm shall have an internal pressure relief port.

10. Lubricator:

An airline lubricator shall be installed to lubricate the liquid pump if recommended by the Manufacturer. The lubricator shall be capable of automatically proportioning oil flow relative to airflow. The lubricator shall be fabricated using a zinc housing and a nylon bowl with a plastic bowl guard. The lubricator shall fill from the top. The lubricator shall be rated for a maximum inlet pressure of 150 PSIG.

11. Isolation Valve:

An inlet air isolation valve shall be installed to isolate the air components from the air supply. The valve shall have a bleed port to bleed downstream pressure in the off position. The block valve shall be a 1/4 inch NPT brass body ball valve with a brass ball and Buna-N seats.

12. Auto/Manual Selector Valve (If Applicable):

Not Used.

13. Relief Valve:

Not Used.

14. Compressed Air System:

Not used.

15. Flow Counter:

A magnetic piston/spring flow counter shall be installed to count all pump cycles. The counter shall be rated for a maximum of 200 PSI and shall be non-resettable.

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The Contractor shall submit the following to the Engineer:

1. The Contractor shall submit shop drawings for the Condensate Pump Station and Controls for approval at least fifteen (15) days prior to construction.

2. Operation and maintenance manuals shall be provided for all the equipment specified in this section.

3. Manufacturer's Warranty.

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1. Installation:

The Condensate Pump Station and Controls shall be constructed as shown on the Contract Drawings and with the Manufacturer's standard dimensions and tolerances for the pump specified.

The Condensate Pump Station and Controls shall be installed level and plumb and concentrically located within the excavation. The surrounding area shall be compacted and graded that accumulation or ponding of water does not occur around the completed structure.

All hoses, lines, and piping shall be constructed that all liquids are free draining to either the landfill gas pipe or to the sump and shall be free of any obstructions to liquid or airflow. Prior to connection, lines shall be purged of debris and thoroughly cleaned.

2. Field Tests:

The Contractor shall provide the services of the pump and control system Manufacturer's representatives to check the installation, make adjustments, and place the equipment in operation. Provide a minimum of one eight hour day on-site for start-up and checks of the system.

All condensate liquid storage sections and piping shall be tested to verify the unit and connections are liquid and air tight consistent with related sections of these Specifications.

3. Equipment Identification:

The pumps shall be provided with a substantial stainless steel nameplate, securely fastened in a conspicuous place and clearly inscribed with the Manufacturer's name, year of manufacture, serial number, and principal rating data. Nameplate data shall include the rating in gallons per minute, rated head, and efficiency.

Table 1: Pump Requirements

Property	Pump
Model	QED Environmental Systems, or approved equal
Capacity (gpm)	8
Total Head (feet)	50
Air Consumption (SCFM)	4.4
Shutoff Head (feet)	200
Regulated Air Supply (psi)	125
Maximum Particle Size (microns)	5

END OF SECTION

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Prefabricated Flare System: The Prefabricated Flare System is used to collect, process, & flare landfill gas (LFG) from the landfill to destroy organic compounds.

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1. General:

   The Contractor shall furnish all labor, material, and equipment to complete installation of a Prefabricated Flare System, including all necessary and incidental items, in accordance with the Contract Drawings and these Specifications.

2. Related Work:

   Related Contract Work is described in the following sections of the Specifications:

Work	Section
HDPE Pipe	02614
Compressed Air Supply	15880

3. Manufacturer Qualifications:

   The Manufacturer shall be a UL listed shop for industrial control systems and shall provide evidence of such on request from the Engineer or Owner. The Manufacturer shall have previously demonstrated their ability to manufacture flare systems by having successfully manufactured a minimum of 25 flares for landfill gas purposes in the last five (5) years.

4. Warranty:

   All equipment shall be warranted by the Manufacturer against defects in material, installation, and workmanship for a period of one (1) year. Warranties shall become effective (initiate) upon field service/start-up by the Manufacturer's representative as required in this section. Warranties shall cover all labor and material cost for repair and replacement due to defects in material or workmanship. A statement shall also be provided that the flare system is guaranteed to meet the requirements of 40 CFR 60.18, and shall be capable of destroying at least 98% of the total organic compounds in the combusted gas.

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1. General:

   The materials supplied under these Specifications shall consist of new, first-quality products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

2. Blower/Motor Assembly:

   a. General:

      Each blower/motor assembly shall be direct drive, multi-stage, or single-stage exhausters capable of operations under the conditions listed in Table 1 of this section. Blowers shall be as manufactured by Atlas Copco/HIS, Lone Star, Gardner Denver, or approved equal.

      Blowers shall be supplied with a factory applied protective coating to protect all internal parts that will be in contact with the landfill gas and to provide resistance to corrosion. Impellers, if constructed of aluminum or stainless steel, shall not require coating.

   b. Identification:

      The motor and blower housings shall each be provided with a nameplate which states the Manufacturer, model number, serial number, and the pertinent information regarding electrical requirements, size, capacity, etc.

   c. Electrical:

      Each blower motor shall be sized as recommended by the Blower Manufacturer to be compatible with electrical service conditions listed in Table 1 of this section. Blower motors shall be high efficiency, totally enclosed, fan cooled (TEFC) motors.

   d. Controls:

      The control panel shall include a motor starter with ammeter (meter relay), Hand-Off Automatic switch, red run light, time switch, and hour meter. Combination controller shall incorporate I-T-E ETI, or equal, motor circuit protector and full-voltage, non-reversible starter in NEMA 4X enclosure with acrylic window for viewing indicators.

   e. Surge Arrester:

      Provide surge arrester on the 460V, 3 Phase incoming circuit feeder.

   f. Transformer:
      Provide potential transformer to power PLC and 120V convenience receptacle.

g. Future:

The flare skid shall provide space for one (1) additional future blower complete with all future piping and electrical connections.

3. Pressure and Vacuum Gauges:

Pressure and vacuum gauges shall be connected to the inlet and outlet of each blower and the condensate knockout to measure pressure differentials. Each gauge shall have a 4.5" diameter face and a usable range as shown in Table 2 of this section. Pressure and vacuum gauges shall be a Magnehelic type as manufactured by Dwyer Instruments, Inc., or approved equal.

4. Expansion Joints:

Expansion joints shall be furnished by the Blower Manufacturer and installed at each blower inlet and outlet. Expansion joints shall be Hypalon, or approved equal.

5. Valves:

a. Butterfly Valves:

Provide butterfly valves located on the inlet and outlet of each blower. Valves shall be wafer type with cast iron body, 300 series stainless steel disk and shaft, and Viton seat. All valves eight (8) inches or greater shall be gear operated.

Flanged butterfly valves may require spacers between the flange adapters and the valve body in order to allow full travel of the internal disk. If spacers are necessary for any butterfly valve, the Contractor will install valve spacers subject to approval by the Engineer.

All valves shall be resistant to degradation by ultraviolet light, landfill gas, and condensate, and shall be suitable for long-term (i.e. 15-year) performance when exposed to the expected range of temperatures for this application.

b. Isolation Valves:

Provide isolation valves on the unit as needed, including one (1) at each blower inlet and outlet. All valves shall be resistant to degradation by ultraviolet light, landfill gas, and condensate, and shall be suitable for long-term (i.e. 15-year) performance when exposed to the expected range of temperatures for this application.

c. Check Valves:

Provide a check valve located on the outlet of each blower.

6. Condensate Knockout:

a. General:

The above-grade condensate knockout shall have a flow capacity equal to the blower capacity with a maximum pressure loss of 2-in w.c. The knockout shall consist of HDPE or have an internal phenolic or epoxy coating for corrosion protection and a transparent liquid level gage.

b. Gauges:

A differential pressure gauge shall be connected around the demister element to measure pressure drop. The gauge shall conform to Paragraph B.3, Pressure and Vacuum Gauges, of this Section.

c. Demister Pad:

The condensate knockout shall include a removable 300 series stainless steel demister pad suitable for droplet removal to 6 micron diameter.

d. Drains:

The condensate knockout shall gravity drain to a common condensate return line that gravity drains to the blower end of the unit. Drains shall conform to Paragraph B.12, Condensate Drains, of this Section.

e. Controls:

The condensate knockout shall be equipped with two level alarm switches, fully functional and connected to the control panel. The lower switch shall activate a "High Level" alarm. The upper switch shall activate a "High Level Shutdown" condition and shall shutdown the flare system to prevent condensate from damaging the blowers.

7. Identification:

a. Gas Component Markings:

"Landfill Gas" and gas direction arrows shall be marked on all landfill gas piping on the unit. Letters and numerals shall be at least 3 inches high. The condensate knockout shall be marked "Condensate Knockout". Other piping shall be labeled with lettering appropriate to the size of the pipe.

b. Safety Markings:

"Danger - No Smoking" signs shall be prominently displayed on all four sides of the unit.

8. Flare:

a. General:

The flare shall be capable of burning low Btu gas and shall include a burner; automatic pilot ignition; electric igniter; pilot gas automatic valves and pilot gas pressure regulator; stack; automatic gas safety shut-off valve; control panel; flame arrester; piping and all other necessary appurtenances to have a complete operational system. The flare shall be capable of combusting LFG under the conditions listed in Table 3 of this section.

b. Flare Stack:

The flare stack shall be carbon steel with rust protective coating, fitted with necessary connections. The wind shield and portion of the stack exposed to flame and high temperatures shall be stainless steel.

9. Flame Arrester:

Supply a flame arrester compatible with the required LFG flow rates. Flame arrester shall be sized to match the blower discharge pipe or flare inlet pipe, whichever is larger. The housing construction shall be cast aluminum. The unit shall have inlet and outlet pressure taps and pressure indicators with isolation valves, removable aluminum internals, and condensate drain. Head loss through the flare arrester shall not exceed 2 inches w.c. to under the specified operating conditions of the blower.

10. Piping:

All piping shall be fully supported. Landfill gas piping shall be fiberglass, stainless steel, or HDPE with heat shielding as needed. Manufacturer shall warrant that selected materials are compatible in this application.

11. Sampling Ports:

Landfill gas sampling ports shall be provided at the condensate knockout inlet and after the blower outlet. Sampling ports shall be chrome-plated 1/8" flow, 1/4" NPT, female, self-sealing, quick-connect fittings as manufactured by Colder Products Company, St. Paul, Minnesota.

12. Condensate Drains:

a. General:

The flame arrester, flare stack, and blowers shall be equipped with condensate drain piping constructed of a material that is corrosion resistant and capable of withstanding the expected range of temperatures without loss of stiffness or strength. Condensate drains shall drain into the common condensate return line that gravity drains to the blower end of the unit.

b. Protection:

The condensate drain piping exposed to the elements shall be insulated and heat traced, with all wiring complete upon delivery of the unit. The insulation shall be capable of withstanding the heat of the flare without degrading.

c. Drip Traps:

Condensate drains on the pressure side of the blower shall include an automatic drip trap as supplied by VAREC, or approved equal.

d. Knockout Pot:

The knockout pot shall be sufficiently drained by a 3" HDPE gravity discharge line back to the location shown on the Contract Drawings.

13. Automatic Gas Shutoff Valve:

a. General:

Provide automatic pneumatically activated wafer-type butterfly valve with “fail safe” closing in case of power failure or an approved equal. Valve shall have carbon steel or ductile iron body, 300 series stainless steel shaft and disc, and PTFE seal.

b. Compressed Air Supply:

Provide electric air compressor in location approved by the Engineer to supply compressed air to automatic gas shutoff valve. Compressed air supply shall conform to Section 15880, Compressed Air Supply, of these Specifications. The compressor shall be sized to match the demand of the automatic gas shutoff valve.

14. Flow Meter & Chart Recorder:

a. General:

Provide two (2) Kurz 454FTB-WGF Wet Gas Flowmeters, Vedris Verabar, or approved equal, insertion thermal mass flow meter assemblies with 300 series stainless steel probe for 1" NPT mounting and transmitter, with 8-digit total flow and flow rate display, installed in accordance with the Manufacturer’s directions and suitable for output to programmable logic controller (PLC) and to a recording device. The flow meter element shall be mounted such that sufficient straight lengths of pipe are present upstream and downstream of the flow meter in accordance with the Manufacturer’s specifications and such that any accumulated condensate will not contact the active flow sensing element. One (1) flow meter will be located in the pipe to the flare, and one (1) flow meter will be located at a section of line to the future connection for a LFTGE Project.

b. Secondary Flowmeter:

Provide two (2) Lambda Square Inc., or approved equivalent orifice plate flow meter devices in-line with the flow meters (described above) in accordance with the Manufacturer's directions. No output is required for these devices.

c. Chart Recorder:

Provide one (1) Yokogawa DX-1012 paperless chart recorder, or approved equivalent, capable of recording up to twelve (12) inputs, with data storage on removable compact flash cards, an interface for USB flash drive, and an interface with standard Ethernet cable. At a minimum, continuous flow rate, total flow, continuous methane (CH_4) concentration, and flare temperature will be recorded.

15. Structure:

The flare system structure shall be designed to resist winds up to 100 mph without incurring damage when placed as shown on the Contract Drawings.

16. Controls:

a. General:

The controls shall provide for automatic and manual operation and ignition of the flare unit, and shall include a NEMA 4 control panel with programmable logic controller (PLC) and all other necessary components for a complete operational, automatic system. All temperature and time settings will be user-programmable.

b. Flame Monitor:

Provide one (1) main flame monitoring thermocouple and one (1) pilot flame monitoring thermocouple, and all necessary thermocouple wire and mounting hardware. The flame monitor shall record elapsed flame burn time with output to the programmable logic controller (PLC).

c. Rack:

Provide a self-supporting steel rack with control panels attached to front side and pilot gas control components attached to the rear side.

d. Alarms and Indicating Lights:

The control system shall monitor for and indicate the following:

- Panel Power On
- Blower 1 On/Blower 2 On
- Blower 1 Failure/Blower 2 Failure
- Pilot Ignition System Failure
- Flare Ignition System Failure
- Flame Failure
- Flare Low Temperature Shutdown (200° F)
- Failure to Restart (3 consecutive shutdowns)
- Knockout High Level Warning
- Knockout High Level Shutdown
- Automatic Shutoff Valve Open Failure
- Blower Bearing High Temperature
- Condensate Pump Station High Level Warning
- Air Compressor Failure.

e. Telecommunications:

Provide one (1) panel mounted automatic dialer with eight universal inputs and cellular phone communications for alarm notification (Sensaphone 2000 or equal). This unit will be supplied completely functional and ready for cellular phone service activation and with vendor software and a 10 hour battery backup. The Contractor shall coordinate cellular service activation with the Owner.

f. Web Based Communications:

Provide connection to the internet including graphical user interface (GUI) communications for remote operations and monitoring of inputs from the PLC. The unit shall provide both local interface monitoring and remote access with administrator, user, or guest level access with password protection. The unit will be supplied completely functional and ready for service activation and with vendor software. The Contractor shall coordinate internet service activation with the Owner and include extension of necessary cabling to the PLC control panel location.

g. Transformer/Electrical Outlet:

Provide a step-down transformer and 120V, 15A duplex outlet in a NEMA 5-20R receptacle box with cover.

h. Surge Suppressors:

Provide a suppressor on the 480V main line and the secondary side of the potential transformer.

i. Hidden Automatic Shutoffs:

The control system shall not be equipped with any hidden sequences or codes which may discontinue operation once the flare system has been accepted by the Owner and the Engineer. Any program codes or passwords must be supplied to the Owner prior to final acceptance of the flare system package.

17. Ignition Procedure and Control Sequence:

Provide the following ignition procedure and control sequence:

a. Create pilot flame using remote spark ignition of propane gas/air mixture to ignite LFG main flame.

b. Once pilot is proven, activate the blower and open automatic shutoff valve.

c. When main flame is successfully ignited (as detected by thermocouple), shut off pilot gas automatically.

d. If pilot is not ignited within the preselected time interval (as programmed in the PLC), shut off pilot gas and signal "Pilot Ignition Failure" to auto-dialer and trouble light or alphanumeric display.

e. If main flame is not ignited within the preselected time interval (as programmed in the PLC), shut off pilot gas and signal "Flare Ignition Failure" to trouble light or alphanumeric display.

f. If main flame is extinguished after successful ignition, activate the "Loss of Flare Flame" alarm, activate the pilot flame automatically and attempt re-ignition for a designated time interval. Re-ignition procedures must begin within 5 seconds of main flame failure. If 3 consecutive ignition failures or shutdowns occur, close the automatic shutoff valve, shut down the blower and signal "Failure to Restart" to auto-dialer (provided by Owner) and trouble light or alphanumeric display.

g. After shutdown, begin automatic re-ignition procedures after a designated time.

h. If re-ignition is successful, disable alarm conditions.

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The Contractor shall submit the following to the Engineer:

1. The Contractor shall submit shop drawings for the Prefabricated Flare System for approval at least fifteen (15) days prior to construction. Shop drawings shall include the following:

a. All layout dimensions, size, and materials of construction for all components.

b. Certified performance curves for the blower(s) indicating capacity for flow versus pressure head and efficiency.

c. Certified factory performance results of the completed Prefabricated Flare System demonstrating functionality of all components.

d. A detailed scope of work (to be performed by Contractor) for installation of the flare system including a list of connections to be made specifying size and type of all fittings for which field connections are required.

e. Documentation that the flare system is designed to prevent the exposure of personnel to excessive heat.

2. Operation and maintenance manuals (paper and electronic copies) shall be provided for all the equipment specified in this section.

3. The Contractor shall provide the following spare parts and software:

- One (1) matching thermal mass flowmeter with all certified calibration data.
- Two (2) additional thermocouples.
- 450 feet of additional thermocouple wire.
- Two (2) flame arrester elements.
- One (1) each of vacuum and pressure gauges.
- Parts recommended by Blower Manufacturer.
- One (1) gallon of touch up paint.
- PLC Program Software and PLC Control Program with all necessary passwords, codes, and/or control information for full and complete operation and maintenance of the flare system.

4. Final startup report by Flare Manufacturer's representative identifying all system checks and startup procedures and all records of monitoring for the initial startup period. Five percent (5%) of the final cost of the flare shall be held until start up report has been accepted by the Engineer.

5. Manufacturer's Warranty.

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1. Installation:

a. Electrical panel(s) shall be located in a non-hazardous classification electrical area.

b. The blower assemblies shall be mounted on neoprene isolation pads in accordance with the Blower Manufacturer's instructions.

c. Equipment shall be factory tested prior to shipment.

d. Upon delivery to the site, any damage to painted surfaces shall be repaired.

2. Field Tests:

The Contractor shall provide the services of the Prefabricated Flare System Manufacturer's representative for flare system during installation to coordinate and instruct the Contractor, who shall install the flare system as directed by the Manufacturer's representative. The Manufacturer's representative shall certify in writing that the Contractor has correctly installed the flare system. The Manufacturer's representative shall be responsible for conducting a field performance test of the flare system in the presence of the Owner and Engineer. The Manufacturer's representative shall instruct personnel designated by the Owner as to the operation of the system. The flare system shall be operated (by others) for a minimum of seven (7) days before the flare system installation shall be considered complete.

Table 1: Blower/Motor Assembly Requirements

Property	Blower/Motor Assembly
No. of Blowers	2
Capacity (SCFM) (each)	1500
Turn Down Ratio (Minimum)	10:1
Operating Temperature (°F)	100
Relative Humidity of Gas (%)	99
Approx. Elevation (MSL, feet)	5,500
Inlet Pressure (inches of w.c.)	-50
Outlet Pressure (psi)	10
Horsepower (HP)	TBD[1]
Maximum Sound (dBA)	80 (at 8 feet)
Voltage	480V/3 Phase/60 Hz

Notes:
1. Blower horsepower to be determined at the time of construction.

Table 2: Pressure and Vacuum Gauge Requirements

Property	Gauge
Pressure Gauge (Blower) (psi)	0 to 20
Vacuum Gauge (Blower) (inches of w.c.)	0 to -75

Table 3: Flare Requirements

Property	Flare
Make/Model	LFG Specialties, LLC, Perennial Energy, Inc., John Zink Company, or other approved manufacturer
Btu Content (Btu/scf)	300 to 550
LFG Flow Rate (scfm)	Same as Blower Flow Rates
Moisture Content	Saturated
LFG Supply Pressure (inches of w.c.)	Same as Blower Outlet Pressure

END OF SECTION

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Landfill Gas Wells: Landfill Gas Wells are installed within the landfill in order to vent or actively collect landfill gases, particularly methane, which builds up due to the decomposition of waste.

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1. General:

   The Contractor shall furnish all labor, material, and equipment to complete installation of Landfill Gas Wells in accordance with the Contract Drawings and these Specifications.

2. Related Work:

   Related Contract Work is described in the following sections of the Specifications:

Work	Section
Valves	02640
Condensate Pump Station & Controls	11321
Vertical Wellheads	13254

3. Reference Standards:

   The latest revision of the following standards of the American Society of Testing and Materials (ASTM) are hereby made a part of these specifications.

   ASTM D 1785 — Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

4. Quality Assurance:

   Quality Assurance during installation of LFG Wells will be provided by the Owner.

5. Site Conditions:

   Obstructions and saturated conditions are sometimes encountered when drilling in a landfill, many of which can be drilled through. The Contractor is expected to make reasonable efforts to drill through obstructions and saturated conditions and will be paid for offset redrilling and boring abandonment only if prior written approval is obtained from the Owner. The Contractor will be paid for abandonment of abandoned hole and for well installation at the new location.

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1. Solid Wall Pipe:

   All solid pipe and fittings shall be Schedule 80 PVC.

2. Perforated Pipe:

   All perforated pipe and fittings shall be Schedule 80 PVC. Perforations in well piping shall be as shown on the Contract Drawings.

3. Bentonite:

   Coarse-ground, pelletized bentonite from an approved source is to be mixed thoroughly with potable water at a ratio of 5 gallons of water to every 50 lbs. of bentonite.

4. Stone Backfill:

   Stone backfill for Landfill Gas Wells shall be No. 3 stone, or approved equal.

5. Soil Backfill:

   Soil backfill shall be on-site soils as approved by the Engineer.

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The Contractor shall furnish copies of the delivery tickets or other approved receipts to the Engineer as evidence for materials received that will be incorporated into construction.

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1. All Landfill Gas Wells shall be constructed at the locations and according to the details shown on the Contract Drawings. Care shall be taken to ensure that these locations are not in areas which are prone to pond water. The Engineer shall be notified prior to drilling Landfill Gas Wells, such that he may observe the installation.

2. Drilling:

   a. Landfill Gas Wells are to be 36 inch diameter, drilled to the depth shown on the Contract Drawings. The Contractor must use dry drilling equipment; wet rotary drilling equipment may not be used. All borings shall be made with bucket type augers.

   b. The boring depths shown on the Contract Drawings are estimated and may be adjusted in the field by the Engineer. Reason(s) for limiting depth might be as follows:

      (1) If water is encountered in a boring, the Contractor may be directed to drill beyond the point at which it was encountered. If wet conditions

remain, the boring may be terminated and the length of perforated pipe adjusted by the Engineer, or the well may be relocated. If wet conditions cease (e.g. due to trapped water layer), then drilling will continue to the design depth.

(2) If the Engineer believes the well borehole may penetrate the protective cover or bottom liner system (if any).

c. As soon as drilling is completed, a safety screen shall be placed over the top of the bore. This screen shall stay in place until backfilling is within 4 feet of the surface. Safety screen size should be large enough to accommodate all backfill materials and any tools used during backfill yet not large enough for any human to accidently fall through.

d. The bore for the well shall be straight and the well pipe shall be installed in the center of the bore hole. The Contractor will take all tension off of the pipe by mechanical means and center the pipe in the middle of the borehole before starting to backfill.

e. PVC well pipe shall be solvent cemented and lag bolted using stainless steel hardware.

3. Backfilling:

a. Backfilling of the well shall commence immediately after well drilling is completed and the well piping has been installed in the borehole. Backfill materials shall be installed as indicated on the Contract Drawings and as approved by the Engineer.

b. Stone backfill shall be poured or scooped through the screen at a rate that will not endanger the integrity of the well casing.

c. The well seal(s) shall be as shown on the Contract Drawings.

d. Soil backfill shall be used as shown on the Contract Drawings.

4. Abandonment of Boreholes:

Borings which have been advanced into the waste and which have been required to be abandoned by the Engineer shall be backfilled up to the top of existing intermediate cover elevations with on-site soils.

5. Conversion of Existing Gas Vents:

If any liquid is present in existing gas vents that are to be converted to active gas extraction, the liquid shall be pumped out and disposed of as directed by the Engineer. The Engineer shall be notified of any gas vent that rapidly refills with liquid.

6. Disposal of Waste:

Waste from well drilling operations shall be disposed of within the active landfill area as directed by the Owner and Engineer.

END OF SECTION

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Vertical Wellheads: Vertical Wellheads are installed on landfill gas wells for flow control and monitoring purposes.

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1. General:

   The Contractor shall furnish all labor, material, supervision, transportation and installation equipment necessary for the manufacture, delivery, storage, installation, and testing of Vertical Wellheads (wellheads), including installation as specified herein and as shown on the Drawings.

2. Related Work:

   Related Contract Work is described in the following sections of the Specifications:

Work	Section
HDPE Pipe	02614
Valves	02640
Condensate Pump Station & Controls	11321
Landfill Gas Wells	13252

3. Manufacturers Qualifications:

   a. The Contractor shall provide the services of a Wellhead Manufacturer (Manufacturer) who shall meet the qualifications specified in this section. The Contractor shall, however, accept and retain full responsibility for all materials and installation and shall be responsible for any defects in completed wellheads.

   b. The Manufacturer shall be responsible for the production and delivery of wellheads and shall be a well-established firm with more than two years experience in the manufacture of wellheads.

4. Warranty:

   The Contractor shall furnish the Owner with one-year written warranties obtained from the Manufacturer against defects in materials and workmanship. Warranty conditions proposed by the Manufacturer concerning limits of liability will be evaluated and must be acceptable to the Owner.

5. Storage and Protection

Handling, storage, and care of wellheads prior to and following installation at the site is the responsibility of the Contractor. During storage, wellheads shall be protected from excessive heat or cold, puncture, cutting, or other damaging or deleterious conditions. Wellheads shall be stored in accordance with the requirements of the Manufacturer. The Contractor shall be responsible for all damages to the materials incurred prior to final acceptance of the work by the Owner.

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1. General:

The materials supplied under these Specifications shall consist of new, first-quality products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

2. Vertical Wellhead:

Each Wellhead shall consist of piping, flow control gate valve, gas temperature gauge, gas sampling port with quick-connect fitting, static and impact pressure ports with quick-connect fittings, flexible connector, union disconnect, and dust cap. Wellhead piping and fittings shall be HDPE, PVC, or polypropylene. Wellheads shall be QED Precision Landfill Gas Wellheads, or approved equal. It is the intent of this Specification that each wellhead shall be supplied as a complete manufactured unit.

a. Equipment Capabilities:

The equipment shall be capable of withstanding the rigors of landfill gas recovery application including internal high vacuum, weathering, gas constituents, and ultraviolet light exposure.

b. Wellhead Adjustability:

Wellheads shall be leak-free and shall be height adjustable in the field using adapter bushings.

c. Wellhead Compatibility:

Wellheads shall be capable of being used with the LANDTEC QED GEM-5000 (GEM-5000) incorporating all GEM-5000 monitoring functions.

d. Gas Flow Rate Measurement Assembly:

The gas flow rate measurement assembly shall be pre-calibrated and lab certified. The measurement assembly shall have an accuracy and repeatability of ± 5% through the recommended flow range when used and maintained in accordance with the Manufacturer's instructions and recommendations.

3. Flexible Connector:

A flexible connector shall be used to connect wellheads to header piping. The flexible connector shall be Kanaflex 101-PS PVC hose with Kanaflex Powerlock PS clamps or approved equal.

4. Nuts, Bolts, and Gaskets:

a. For above-ground installation, nuts and bolts shall be cadmium plated or galvanized steel.

b. For below-ground installation, nuts and bolts shall be 300 series stainless steel.

c. Gasket for flange installation shall be neoprene rubber.

5. Spare Parts:

a. The Contractor shall provide one (1) complete spare wellhead to the Owner.

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The Contractor shall submit the following to the Engineer:

1. The Contractor shall submit shop drawings for the wellheads for approval at least 2 weeks prior to construction.

2. Operation and maintenance manuals shall be provided for all the equipment specified in this section.

3. Manufacturer's Warranty.

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1. Installation:

Work shall be performed in accordance with the Manufacturer's written instructions and installation drawings.

a. Wellheads shall be lifted and handled according to written instructions supplied by the Manufacturer.

b. Wellheads shall be installed within 0.25% of vertical.

c. Wellheads shall be installed such that the flow measurement assembly is concentric with the well casing.

d. Where a wellhead connects directly to the header, a branch saddle shall be installed on the header in accordance with accepted methods and standards. The wellhead shall be connected to the header branch fitting in accordance with the Manufacturer's written instructions. Adapters shall be used as recommended by the Manufacturer.

e. Wellheads shall be installed on the well casing in accordance with the Manufacturer's written instructions. Where the well casing is made of PE or other material, matching 125 lb or 150 lb flat face flanges conforming to ANSI B16.1 or ANSI B16.5 shall be installed between the casing and wellhead.

2. Field Tests:

At the time of system start-up, the Contractor shall demonstrate to the satisfaction of the CQA Engineer that all wellheads are fully operational. Using a LANDTEC GEM-2000 and other gas monitoring instruments as required, the Contractor shall demonstrate that components and connections are leak-free, the temperature gauge is accurate, the flow measurement assembly is accurate, and the control valve is fully operable.

3. Equipment Identification:

Each wellhead will be permanently labeled with the well number using an engraved stainless steel tag banded to the well casing (or other approved method).

END OF SECTION

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Landfill Gas Collection Trenches: Landfill Gas Collection Trenches include a network of collection trenches installed under the final cover system and landfill gas flares in order to collect and vent/burn landfill gas, which builds up due to the decomposition of waste.

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1. General:

   The Contractor shall furnish all labor, material, and equipment to complete installation of the Landfill Gas Collection Trenches in accordance with the Contract Drawings and these Specifications.

2. Related Work:

   Related Contract Work is described in the following sections of the Specifications:

Work	Section
Excavation	02222
HDPE Pipe	02614

3. Reference Standards:

   The latest revision of the following standards of the American Society of Testing and Materials (ASTM) and the North Carolina Department of Transportation (NCDOT) are hereby made a part of these specifications.

   ASTM D 1785 — Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

   NCDOT — Standard Specifications for Roads and Structures.

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1. All pipe used for construction of Landfill Gas Collection Trenches shall be either solid (header pipe) or perforated (collection pipe) HDPE Pipe in accordance with Section 02614, HDPE Pipe, of these Specifications. The pipe dimension ratio (DR) and diameter shall be as shown on the Contract Drawings.

2. Backfill for collection trenches shall be NCDOT #57 stone (non-calcareous).

3. Alternative Collection Trench Material (Panel Pipe): As an alternative to the perforated piping, stone, and geotextile described above, the Contractor may use a panel pipe (a.k.a. highway edge drain) installed vertically or horizontally and in direct contact with waste (as approved by the Engineer). The low end of each panel pipe shall drain to a pit filled with No. 57 stone (nominal size of 3 feet by 3 feet by 3 feet) excavated into the waste mass. Panel pipe shall be installed using suitable connections/couplings following the Manufacturer's recommendations and as approved by the Engineer. Panel pipe shall be ADS AdvanEDGE having a nominal width of 18 inches as manufactured by Advanced Drainage Systems, Inc. or approved equal.

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1. Submit information on materials and products to be used.

2. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.

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1. Landfill Gas Collection Trenches shall be constructed at the locations and according to the details shown on the Contract Drawings. Care shall be taken to ensure that these locations are not in areas which are prone to pond water.

2. The depth of collection trenches shall be adjusted such that the perforated HDPE piping and stone backfill breaches the existing final/intermediate cover or to a maximum depth of four feet if no waste is encountered.

3. The Contractor shall exercise caution as excavations will extend into existing municipal solid waste. The Contractor shall construct collection trenches such that Contractor personnel are not required to enter the excavation.

4. All waste materials removed during construction of Landfill Gas Collection Trenches shall be disposed of on site in the active lined landfill as directed by the Owner and Engineer. The Contractor shall weigh waste materials at the facility scales prior to disposal. No tipping fee will be charged to the Contractor for disposal of these wastes.

END OF SECTION

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Compressed Air System: includes installation and testing of a Compressed Air System for the landfill gas collection and control system.

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1. General:

   The Contractor shall furnish all labor, material, and equipment to complete installation of the Compressed Air System, including all necessary and incidental items, in accordance with the Contract Drawings and these Specifications.

2. Related Work:

   Related Contract Work is described in the following sections of the Specifications:

Work	Section
HDPE Pipe	02614
Valves	02640

3. Manufacturer Qualifications:

   The Contractor shall provide the services of a Compressed Air System Manufacturer who shall meet the qualifications specified in this Section. The Contractor shall, however, accept and retain full responsibility for all materials and installation and shall be held responsible for any defects in the completed Compressed Air System.

   The Manufacturer shall be responsible for the production and delivery of the Compressed Air System and shall be a well-established firm with more than two (2) years experience in the manufacture of compressed air systems.

4. Warranty:

   The Contractor shall furnish the Owner with one-year written warranties obtained from the Manufacturer against defects in materials and workmanship. Warranty conditions proposed by the Manufacturer concerning limits of liability will be evaluated and must be acceptable to the Owner. Warranty shall begin upon acceptance by the Engineer and Owner.

5. Storage and Protection

Handling, storage, and care of the Compressed Air System prior to and following installation at the site is the responsibility of the Contractor. During storage, the compressed air system shall be protected from excessive heat or cold, puncture, cutting, or other damaging or deleterious conditions. The Compressed Air System shall be stored in accordance with additional requirements of the Manufacturer. The Contractor shall be liable for all damages to the materials incurred prior to final acceptance of the work by the Owner.

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1. General:

The materials supplied under these Specifications shall consist of new, first-quality products designed and manufactured specifically for the purpose of this work, which shall have been satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes.

2. Air Compressor:

The air compressor shall be of rotary screw type compressors with design life of not less than 20,000 hours elapsed running time before major overhaul is required. The air compressor shall be capable of operation under conditions shown in Table 1 of this section.

3. Integrated Air Dryer:

The Compressed Air System may be furnished with integrated refrigerated dryer system as recommended by manufacturer.

4. Filter:

The Compressed Air System shall also include a package pre-filter as recommended by manufacturer to filter solid particles prior to 1 micron.

5. Base:

The compressor and its motor shall be provided with a cast iron or steel base which shall be mounted on air tank or on separate concrete foundation with vibration isolation padding. Tank shall be ASME approved. Size for no more than 12 compressor starts per hour, 33% run time.

6. Receiver Tank:

The receiver tank shall be horizontal mounted with a capacity of 80 gallons constructed steel of welded construction. The tank shall be ASME coded suitable in this application with protective exterior coatings as recommended by manufacturer. The storage tank shall also include automatic electrical drain valve for low maintenance and trouble free operation.

7. Motor and Controls:

The compressor shall be driven by a high efficiency electric motor wound for the current available. Each motor shall be controlled by pressure operated, enclosed pilot switch connected to motor starter. Pressure switches for start/stop control shall be set to operate between 100 and 125 psi. This system shall be equipped with electrical simplex controller, starters, and disconnect switches; thus permitting automatic operation of system.

8. Valves and Gauges:

The compressor shall include intake air cleaner, discharge stop valve, and pressure relief valve and pressure gauges. The relief valve shall be placed between the compressor and the discharge stop valve and shall be set for pressure of 10 psi above control switch cutout pressure. Intake air cleaners shall be of cleanable impingement type.

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The Contractor shall submit the following to the Engineer:

1. The Contractor shall submit shop drawings for the Compressed Air System for approval at least fifteen (15) days prior to construction.

2. Operation and maintenance manuals shall be provided for all the equipment specified in this section.

3. Manufacturer's Warranty.

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1. Installation:

Work shall be performed in accordance with the Manufacturer's written instructions and installation detail drawings.

a. The Compressed Air System shall be lifted and handled according to written instructions supplied by the Manufacturer.

b. The Compressed Air System shall not be used for any other supplemental application without prior approval of the Engineer.

3. Field Tests:

The Contractor shall provide the services of the Compressed Air System Manufacturer's representative to check the installation, make adjustments, and place the equipment in operation. Provide a minimum of one eight hour day on-site for start-up and checks of the system. At the time of system start-up, the Contractor shall demonstrate to the satisfaction of the Engineer that the Compressed Air System is fully operational.

4. Equipment Identification:

The Compressed Air System shall be provided with a substantial stainless steel nameplate, securely fastened in a conspicuous place and clearly inscribed with the Manufacturer's name, year of manufacture, serial number, and principal rating data. Nameplate data shall include the rating in gallons per minute, rated capacity, and efficiency.

Table 1: Air Compressor Requirements

Property	Air Compressor
No. of Compressors	1[1]
Make/Model	Quincy QSI-120, or approved equal.
Capacity (SCFM)	115
Pressure (psig)	125
Maximum Pressure (psig)	175
Maximum Sound (dBA)	65 (at 3 feet)
Tank (gallons)	120
Horsepower (HP)	25
Voltage	460V/3 Phase/60 Hz

Notes:
1. Additional air compressors to be supplied as needed at the time of construction.

END OF SECTION

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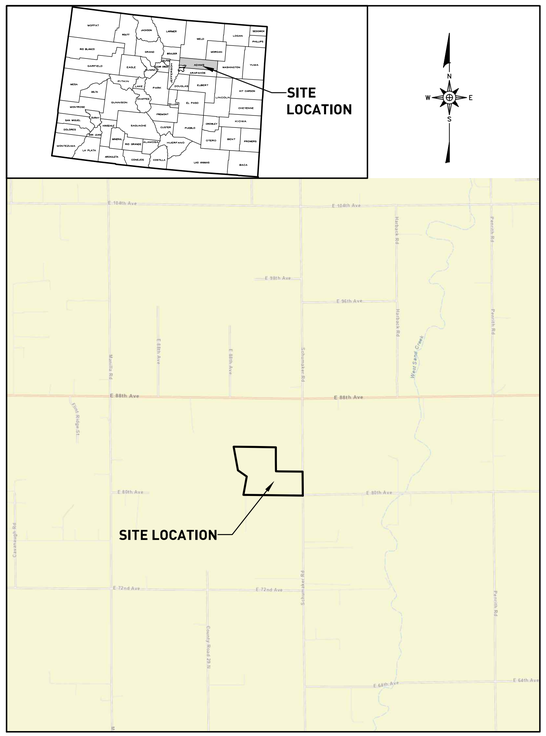
EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

LANDFILL GAS COLLECTION AND CONTROL SYSTEM DESIGN

PERMIT DRAWINGS

AUGUST 2021



SITE LOCATION MAP
NOT TO SCALE

SHEET NO.	DRAWING NO.	DRAWING TITLE
1	-	TITLE - COVER SHEET
2	S1	EXISTING CONDITIONS
3	S2	PLAN
4	D1	DETAILS (SHEET 1 OF 4)
5	D2	DETAILS (SHEET 2 OF 4)
6	D3	DETAILS (SHEET 3 OF 4)
7	D4	DETAILS (SHEET 4 OF 4)

PERMIT ISSUE
NOT FOR CONSTRUCTION

SAFETY NOTE:
Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

SEAL
COLORADO LICENSED
JOHN M. GARDNER
PE0055462
PROFESSIONAL ENGINEER
8/12/21

SEAL

REV.	DATE	DESCRIPTION

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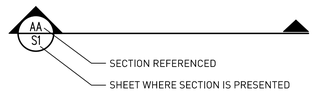
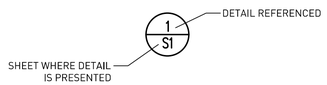
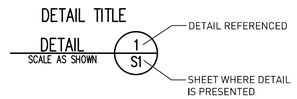
STANDARD SECTION LOCATION CALLOUT (SHEET AND DETAIL)



STANDARD DETAIL CALLOUT



STANDARD DETAIL LABEL AND CALLOUT



STANDARD REVISION CALLOUT (SHEET AND DETAIL)

SMITH+GARDNER
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577
1526 Richland St., Columbia SC 29201

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SAFETY NOTE:
Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

PERMIT ISSUE
NOT FOR CONSTRUCTION

LEGEND

- 150 — EXISTING 10' CONTOUR (SEE REFERENCE 1)
- EXISTING 2' CONTOUR
- APPROXIMATE PROPERTY LINE (SEE REFERENCE 2)
- EASEMENT OR RIGHT-OF-WAY
- LIMIT OF LINER (CONSTRUCTED LANDFILL UNITS)
- LIMIT OF LINER (FUTURE LANDFILL UNITS)
- CELL LIMITS
- MW-3 EXISTING GROUNDWATER MONITORING WELL LOCATION
- GP-3 EXISTING GAS PROBE LOCATION

NOTES
1. EAST REGIONAL LANDFILL HOLDS TITLE V PERMIT NO. 100PAD353 DATED AUGUST 1, 2016.

REFERENCES
1. TOPOGRAPHY FROM AERIAL SURVEY DATED JANUARY 6, 2021 PROVIDED BY COOPER AERIAL SURVEY CO., PHOENIX, AZ.
2. PROPERTY LINE BY R.W. BAYER & ASSOCIATES, 2007.
3. HORIZONTAL GRID COORDINATE SYSTEM REFERENCES COLORADO STATE PLANE NORTH, NAD 83. VERTICAL DATUM IS ASSUMED TO BE NAVD 88.

N 1189000
N 1188000
N 1187000
N 1186000
E 3280000
E 3281000
E 3282000
E 3283000
E 3284000

GAS PIPELINE RIGHT-OF-WAY
CELL 1
CELL 2
CELL 3
CELL 4
CELL 10
MODULE 1 (ACTIVE)
MODULE 2 (FUTURE)
MODULE 3 (FUTURE)
COMPOST AREA
PROPERTY LINE (TYP.) (SEE REFERENCE 2)
OFFICE/SCALEHOUSE
MAINTENANCE BUILDING
SCHUMAKER RD
E 80TH AVE
GP-1
GP-2
GP-3
GP-4
MW-1
MW-2
MW-3
MW-4
CMW-1
W.L. 5315.8

0 150' 300' 450'

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PREPARED FOR:
GFL environmental
EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

PREPARED BY:
SMITH+ GARDNER
ENGINEERS
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577
1526 Richland St., Columbia SC 29201

SEAL
COLORADO LICENSED
JOHN M. GARDNER
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PROFESSIONAL ENGINEER
8/12/21

SEAL

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PROJECT TITLE:
LANDFILL GAS COLLECTION AND CONTROL SYSTEM DESIGN

DRAWING TITLE:
EXISTING CONDITIONS

DESIGNED: M.M.J.	PROJECT NO: ERLGCCS 21-1
DRAWN: C.T.J.	SCALE: AS SHOWN
APPROVED: J.M.G.	DATE: JULY 2021
FILENAME: ERL-D0002	
SHEET NUMBER: 2	DRAWING NUMBER: S1

SAFETY NOTE:
Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

PERMIT ISSUE
NOT FOR CONSTRUCTION

LEGEND

- 150 — EXISTING 10' CONTOUR (SEE REFERENCE 1)
- EXISTING 2' CONTOUR
- 5350 — PROPOSED 10' CONTOUR (SEE NOTE 3)
- PROPOSED 2' CONTOUR (SEE NOTE 3)
- APPROXIMATE PROPERTY LINE (SEE REFERENCE 2)
- EASEMENT OR RIGHT-OF-WAY
- LIMITS OF FINAL COVER
- MW-3 — EXISTING GROUNDWATER MONITORING WELL LOCATION
- GP-3 — EXISTING GAS PROBE LOCATION
- 18"ø — LANDFILL GAS TRANSMISSION HEADER PIPE (ARROW INDICATES DIRECTION OF CONDENSATE FLOW) (PIPE DIA. INDICATED)
- 6"ø — LANDFILL GAS LATERAL PIPE (ARROW INDICATES DIRECTION OF FLOW (PIPE DIA. INDICATED)
- EW-19 — LANDFILL GAS EXTRACTION WELL
- CT-1 — LANDFILL GAS CONDENSATE TRAP

NOTES

1. EAST REGIONAL LANDFILL HOLDS TITLE V PERMIT NO. 100PAD353 DATED AUGUST 1, 2016.
2. LANDFILL GAS WELL, TRANSMISSION AND LATERAL PIPING, AND CONDENSATE TRAY LOCATIONS ARE SUBJECT TO CHANGE DEPENDENT UPON LANDFILL WASTE PLACEMENT.
3. PROPOSED CONTOURS REPRESENT TOP OF FINAL COVER GRADES.

REFERENCES

1. TOPOGRAPHY FROM AERIAL SURVEY DATED JANUARY 6, 2021 PROVIDED BY COOPER AERIAL SURVEY CO., PHOENIX, AZ.
2. PROPERTY LIMIT BY R.W. BAYER & ASSOCIATES, 2007.
3. HORIZONTAL GRID COORDINATE SYSTEM REFERENCES COLORADO STATE PLANE NORTH, NAD 83. VERTICAL DATUM IS ASSUMED TO BE NAVD 88.

PROPERTY LINE (TYP.) (SEE REFERENCE 2)

OFFICE/SCALEHOUSE

BLOWER/FLARE STATION

MAINTENANCE BUILDING

SCHUMAKER RD

E 80TH AVE

GAS PIPELINE RIGHT-OF-WAY

N 1189000
N 1188000
N 1187000
N 1186000
E 3286000
E 3285000
E 3284000

0 150' 300' 450'

PREPARED FOR:

GFL environmental

EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

PREPARED BY:

SMITH+ GARDNER
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14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577
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PROFESSIONAL ENGINEER
8/12/21

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PROJECT TITLE:

LANDFILL GAS COLLECTION AND CONTROL SYSTEM DESIGN

DRAWING TITLE:

PLAN

DESIGNED: M.M.J.	PROJECT NO: ERLGCCS 21-1
DRAWN: C.T.J.	SCALE: AS SHOWN
APPROVED: J.M.G.	DATE: JULY 2021
FILENAME: ERL-D0003	
SHEET NUMBER: 3	DRAWING NUMBER: S2

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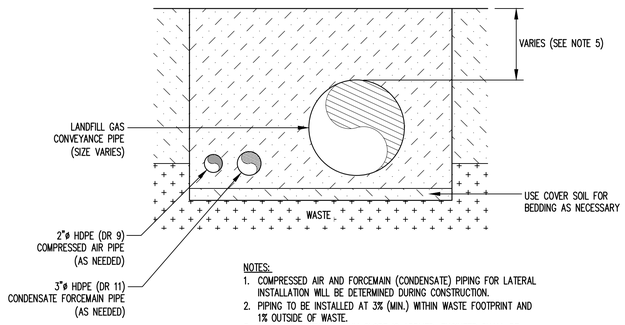
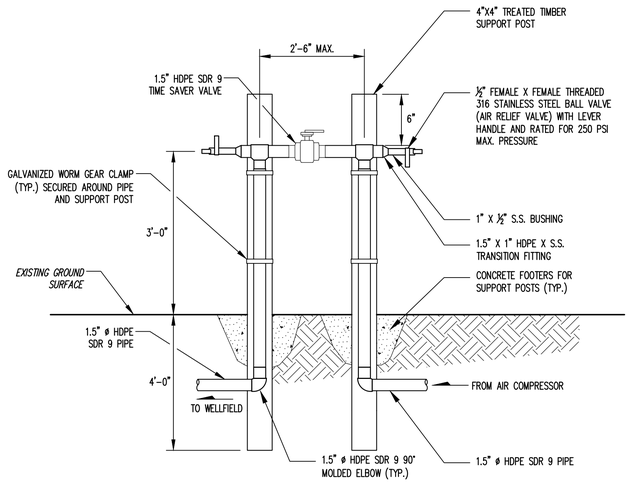


NOTES:
1. COMPRESSED AIR AND FORCEMAIN (CONDENSATE) PIPING FOR LATERAL INSTALLATION WILL BE DETERMINED DURING CONSTRUCTION.
2. PIPING TO BE INSTALLED AT 3% (MIN.) WITHIN WASTE FOOTPRINT AND 1% OUTSIDE OF WASTE.
3. IN CASES WHERE MINIMUM SLOPE IS APPLIED, ENGINEER SHALL BE NOTIFIED FOR REVIEW AND APPROVAL.
4. ALL TIE-INS TO EXISTING PIPING SHALL BE CONSTRUCTED WITH FULL SIZE TEES AND REDUCERS AS NEEDED. USE OF BRANCH SADDLES REQUIRE ENGINEERS APPROVAL.
5. 6" (MIN.) COVER WITHIN THE WASTE FOOTPRINT. 3' (MIN.) COVER OUTSIDE OF WASTE.

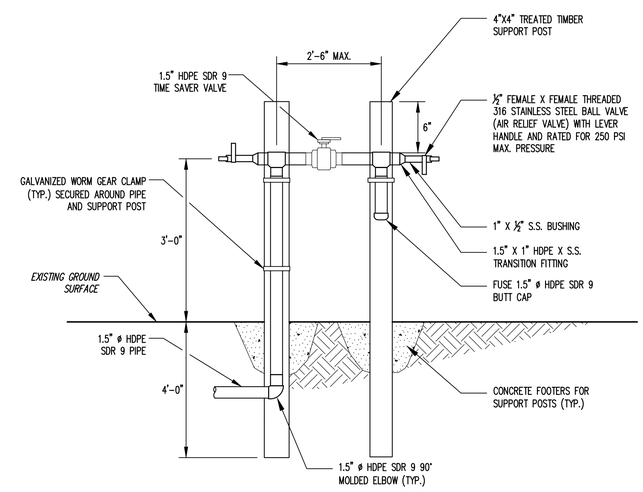
PIPE TRENCH WITH COMPRESSED AIR SUPPLY AND CONDENSATE FORCE MAIN

DETAIL 1/D1 — NOT TO SCALE



AIR LINE ISOLATION AND BLOWOFF VALVES

DETAIL 2/D1 — NOT TO SCALE



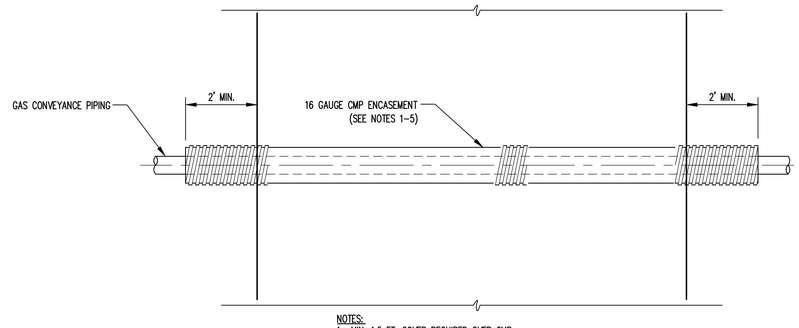
AIR LINE ISOLATION VALVE AND TERMINATION

DETAIL 3/D1 — NOT TO SCALE

NOTES:
1. FLANGE CONNECTIONS SHALL BE WRAPPED IN PLASTIC PRIOR TO BACKFILLING.

CONDENSATE PUMP STATION

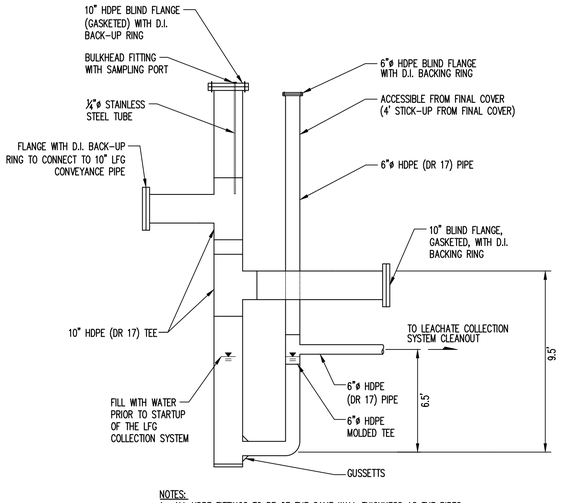
DETAIL 4/D1 — NOT TO SCALE



NOTES:
1. MIN. 1.5 FT. COVER REQUIRED OVER CMP.
2. CONTRACTOR SHALL RESTORE ROAD TO ORIGINAL CONDITION, INCLUDING AGGREGATE SURFACING.
3. LOCATION TO BE DETERMINED BASED UPON SITE CONDITIONS AT TIME OF CONSTRUCTION.
4. ALL HDPE FITTINGS TO BE OF THE SAME WALL THICKNESS AS THE PIPES.
5. CMP SHALL BE 1.5 TIMES THE GAS CONVEYANCE PIPING DIAMETER.
6. FLANGE CONNECTIONS SHALL BE WRAPPED IN PLASTIC PRIOR TO BACKFILLING.

PIPE ENCASEMENT AT ROAD CROSSING

DETAIL 5/D1 — NOT TO SCALE



NOTES:
1. ALL HDPE FITTINGS TO BE OF THE SAME WALL THICKNESS AS THE PIPES.
2. FLANGE CONNECTIONS SHALL BE WRAPPED IN PLASTIC PRIOR TO BACKFILLING.

CONDENSATE TRAP

DETAIL 6/D1 — NOT TO SCALE

PERMIT ISSUE
NOT FOR CONSTRUCTION

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PREPARED FOR:

GFL environmental

EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

PREPARED BY:

SMITH+ GARDNER
ENGINEERS
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1526 Richland St., Columbia SC 29201

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JOHN M. GARDNER
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PROFESSIONAL ENGINEER

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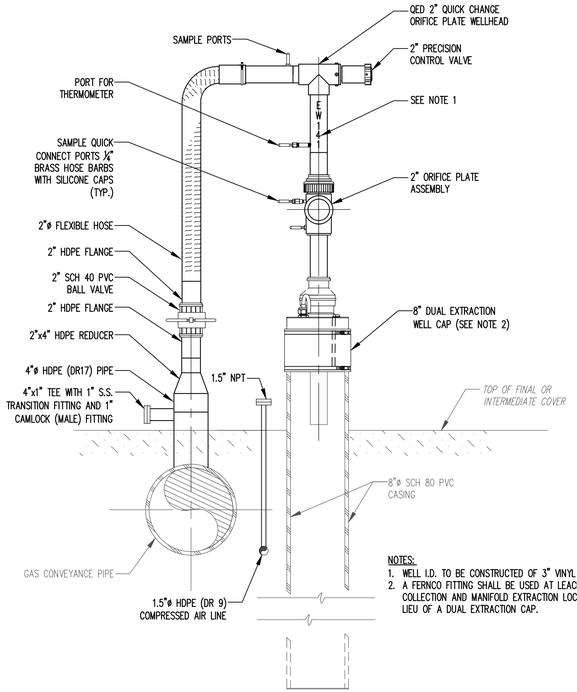
PROJECT TITLE:

LANDFILL GAS COLLECTION AND CONTROL SYSTEM DESIGN

DRAWING TITLE:

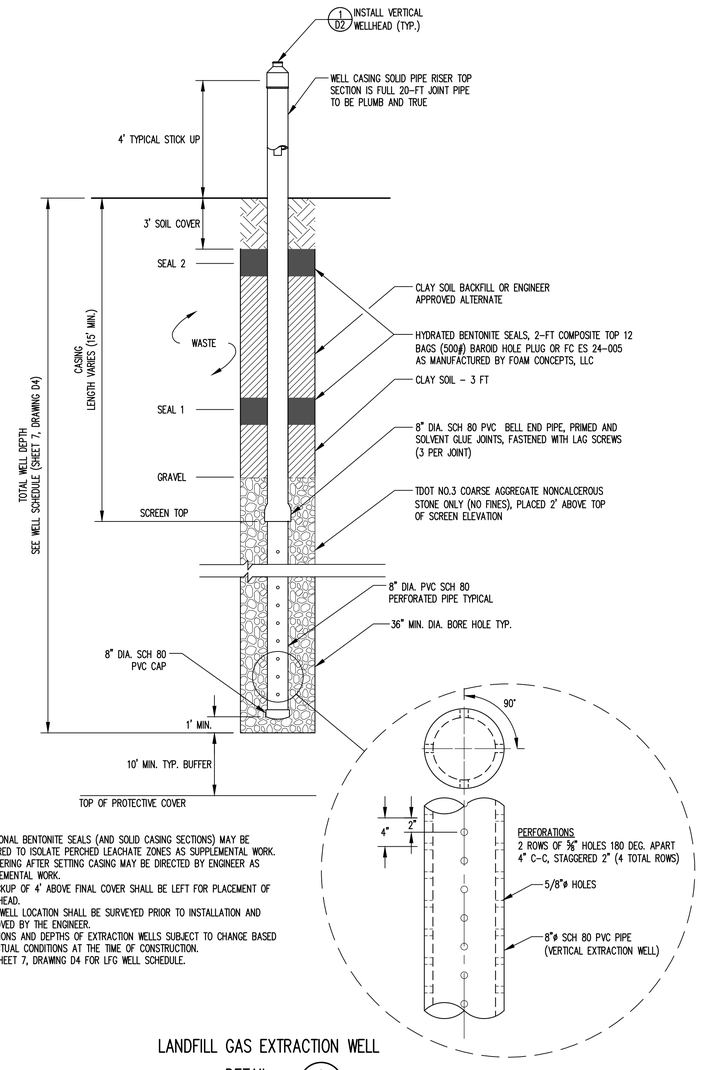
DETAILS
(SHEET 1 OF 4)

DESIGNED: M.M.J	PROJECT NO: ERLGCCS 21-1
DRAWN: C.T.J.	SCALE: AS SHOWN
APPROVED: J.M.G.	DATE: JULY 2021
FILENAME: ERL-D0004	
SHEET NUMBER: 4	DRAWING NUMBER: D1



VERTICAL WELLHEAD

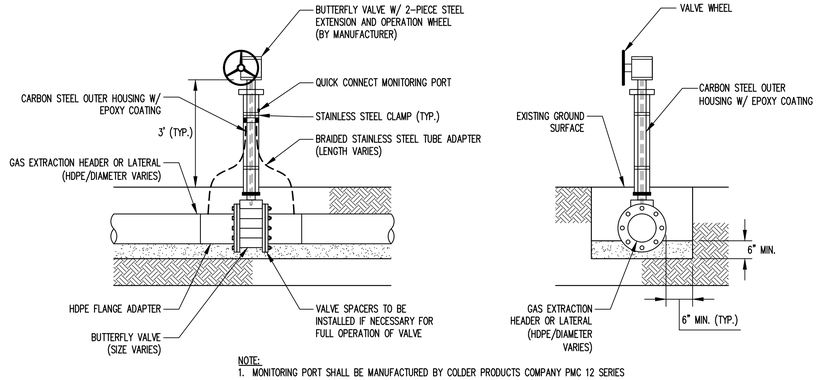
DETAIL 1/D2 — NOT TO SCALE



NOTES
1. ADDITIONAL BENTONITE SEALS (AND SOLID CASING SECTIONS) MAY BE REQUIRED TO ISOLATE PERCHED LEACHATE ZONES AS SUPPLEMENTAL WORK.
2. DEWATERING AFTER SETTING CASING MAY BE DIRECTED BY ENGINEER AS SUPPLEMENTAL WORK.
3. A STICKUP OF 4' ABOVE FINAL COVER SHALL BE LEFT FOR PLACEMENT OF WELL HEAD.
4. EACH WELL LOCATION SHALL BE SURVEYED PRIOR TO INSTALLATION AND APPROVED BY THE ENGINEER.
5. LOCATIONS AND DEPTHS OF EXTRACTION WELLS SUBJECT TO CHANGE BASED ON ACTUAL CONDITIONS AT THE TIME OF CONSTRUCTION.
6. SEE SHEET 7, DRAWING D4 FOR LFG WELL SCHEDULE.

LANDFILL GAS EXTRACTION WELL

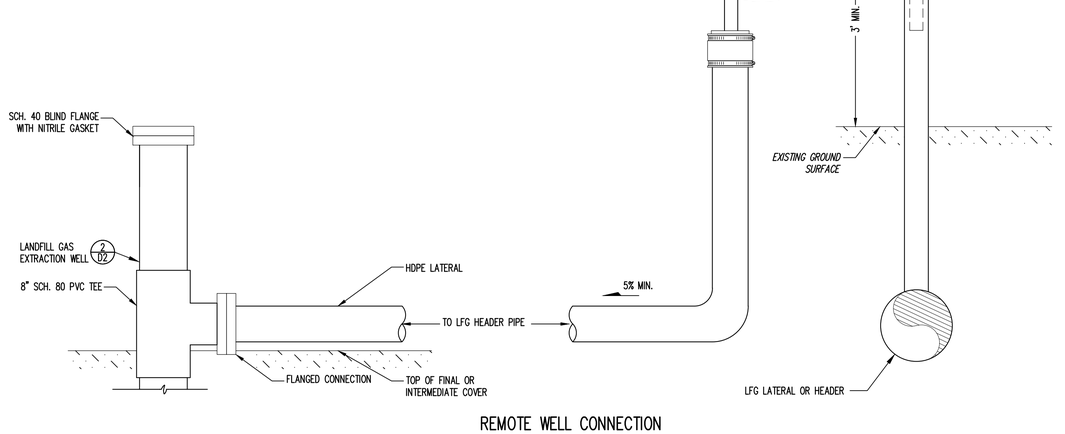
DETAIL 2/D2 — NOT TO SCALE



NOTE:
1. MONITORING PORT SHALL BE MANUFACTURED BY COLDER PRODUCTS COMPANY PMC 12 SERIES QUICK CONNECT COUPLINGS OR EQUIVALENT.
2. ALL FLANGED CONNECTIONS SHALL BE WRAPPED IN PLASTIC PRIOR TO BACKFILLING.

ISOLATION VALVE ASSEMBLY

DETAIL 3/D2 — NOT TO SCALE



REMOTE WELL CONNECTION

DETAIL 4/D2 — NOT TO SCALE

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PERMIT ISSUE
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PREPARED FOR:
GFL environmental
EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

PREPARED BY:
SMITH+ GARDNER
ENGINEERS
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577
1526 Richland St., Columbia SC 29201

SEAL
COLORADO LICENSED JOHN M. GARDNER PE0055462 PROFESSIONAL ENGINEER 8/12/21

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PROJECT TITLE:
LANDFILL GAS COLLECTION AND CONTROL SYSTEM DESIGN

DRAWING TITLE:
DETAILS (SHEET 2 OF 4)

DESIGNED: M.M.J	PROJECT NO: ERLGCCS 21-1
DRAWN: C.T.J.	SCALE: AS SHOWN
APPROVED: J.M.G.	DATE: JULY 2021
FILENAME: ERL-D0004	
SHEET NUMBER: 5	DRAWING NUMBER: D2

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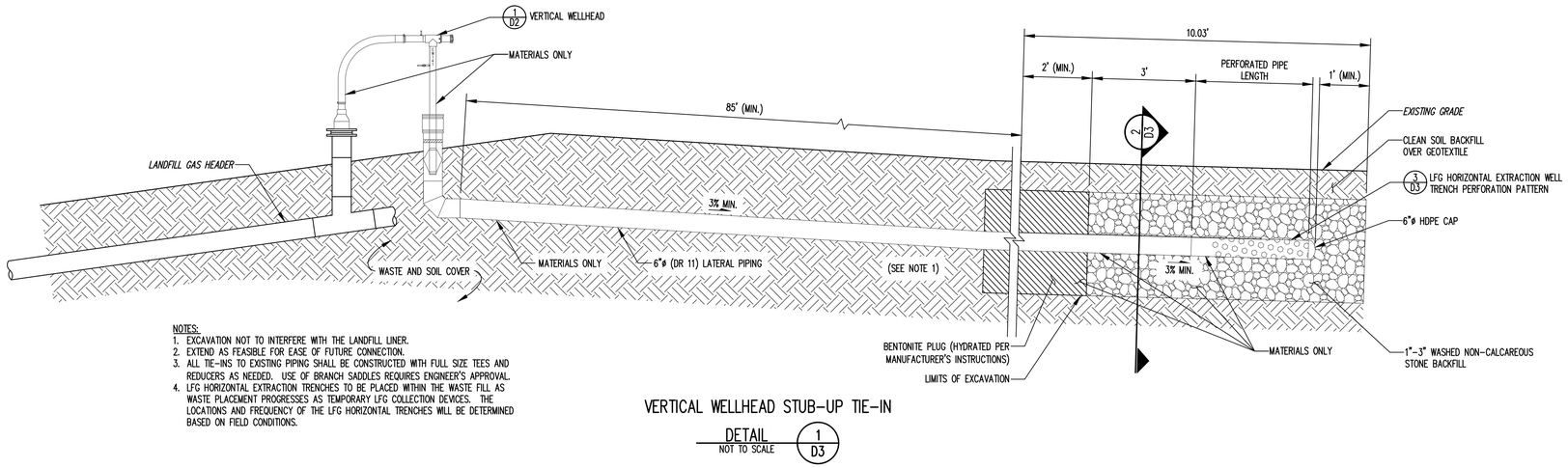
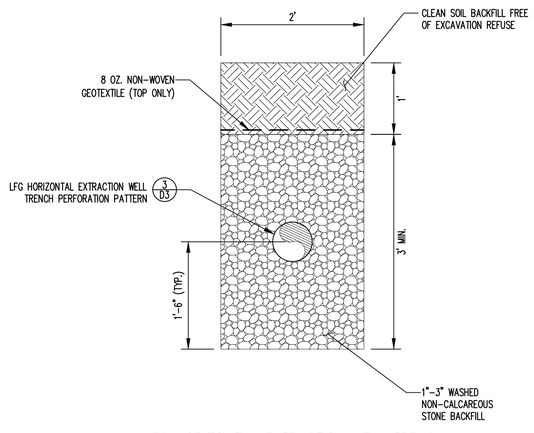


NOTES:
1. EXCAVATION NOT TO INTERFERE WITH THE LANDFILL LINER.
2. EXTEND AS FEASIBLE FOR EASE OF FUTURE CONNECTION.
3. ALL TIE-INS TO EXISTING PIPING SHALL BE CONSTRUCTED WITH FULL SIZE TEES AND REDUCERS AS NEEDED. USE OF BRANCH SADDLES REQUIRES ENGINEER'S APPROVAL.
4. LFG HORIZONTAL EXTRACTION TRENCHES TO BE PLACED WITHIN THE WASTE FILL AS WASTE PLACEMENT PROGRESSES AS TEMPORARY LFG COLLECTION DEVICES. THE LOCATIONS AND FREQUENCY OF THE LFG HORIZONTAL TRENCHES WILL BE DETERMINED BASED ON FIELD CONDITIONS.

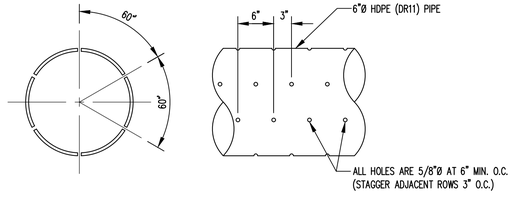
VERTICAL WELLHEAD STUB-UP TIE-IN

DETAIL 1 / D3 — NOT TO SCALE



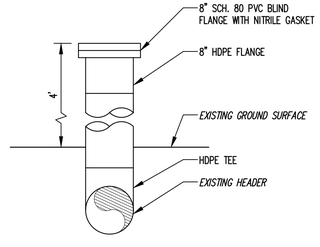
LFG HORIZONTAL EXTRACTION WELL TRENCH

DETAIL 2 / D3 — NOT TO SCALE



LFG HORIZONTAL EXTRACTION WELL TRENCH PERFORATION PATTERN

DETAIL 3 / D3 — NOT TO SCALE



NOTES:
1. ALL TIE-INS TO EXISTING PIPING SHALL BE CONSTRUCTED WITH FULL SIZE TEES AND REDUCERS AS NEEDED. USE OF BRANCH SADDLES REQUIRES ENGINEERS APPROVAL.
2. CONTRACTOR TO VERIFY EXISTING HEADER DIAMETER.

LFG HORIZONTAL EXTRACTION TRENCH MANIFOLD STUB-UP

DETAIL 4 / D3 — NOT TO SCALE

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PREPARED FOR:

GFL environmental

EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

PREPARED BY:

SMITH+ GARDNER
ENGINEERS
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577
1526 Richland St., Columbia SC 29201

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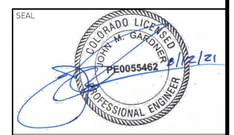

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PROJECT TITLE:

LANDFILL GAS COLLECTION AND CONTROL SYSTEM DESIGN

DRAWING TITLE:

DETAILS (SHEET 3 OF 4)

DESIGNED: M.M.J	PROJECT NO: ERLGCCS 21-1
DRAWN: C.T.J.	SCALE: AS SHOWN
APPROVED: J.M.G.	DATE: JULY 2021
FILENAME: ERL-D0004	
SHEET NUMBER: 6	DRAWING NUMBER: D3

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LFG WELL SCHEDULE

WELL ID	NORTHING	EASTING	DESIGN TOP OF CLAY (ELEV.)	DESIGN TOP OF FINAL COVER (ELEV.)	DESIGN WELL DEPTH (FT)
EW-1	1188483.79	3281155.62	5295.26	5341.90	36
EW-2	1188489.96	3281648.05	5286.19	5331.49	34
EW-3	1188453.37	3282150.03	5278.58	5337.28	48
EW-4	1188359.15	3281915.80	5283.38	5357.28	63
EW-5	1188346.42	3281407.20	5291.76	5359.24	56
EW-6	1188341.92	3280905.27	5300.98	5356.38	44
EW-7	1188194.38	3280652.91	5308.58	5355.32	36
EW-8	1188202.25	3281160.46	5298.26	5367.22	58
EW-9	1188209.00	3281671.40	5288.02	5365.11	66
EW-10	1188220.22	3282164.88	5282.47	5338.27	45
EW-11	1188060.46	3281926.29	5286.05	5364.30	67
EW-12	1188061.58	3281417.61	5295.41	5373.37	67
EW-13	1188056.96	3280908.30	5304.58	5368.47	53
EW-14	1187985.07	3280514.31	5313.83	5361.04	36
EW-15	1187862.53	3280758.33	5310.43	5372.70	51
EW-16	1187917.45	3281171.65	5301.81	5381.32	69
EW-17	1187917.45	3281674.71	5291.49	5376.42	74
EW-18	1187936.51	3282167.14	5289.95	5335.15	34
EW-19	1187772.25	3281920.67	5291.22	5364.04	62
EW-20	1187770.99	3281422.99	5299.92	5387.81	77
EW-21	1187780.77	3281047.81	5306.05	5383.90	67
EW-22	1187763.09	3280404.08	5318.37	5359.50	30
EW-23	1187682.63	3280735.27	5313.10	5375.39	51
EW-24	1187630.33	3281171.60	5305.91	5385.86	69
EW-25	1187623.58	3281656.65	5298.31	5377.24	68
EW-26	1187626.73	3282053.27	5293.47	5357.41	53
EW-27	1187487.36	3281913.81	5296.32	5364.38	57
EW-28	1187471.61	3281409.63	5304.08	5389.00	74
EW-29	1187496.31	3280912.74	5311.95	5372.92	50
EW-30	1187546.72	3280510.64	5318.52	5363.33	34
EW-31	1187335.42	3280657.28	5318.30	5358.98	30
EW-32	1187334.30	3281152.45	5309.74	5374.69	54
EW-33	1187338.66	3281663.85	5301.93	5376.86	64
EW-34	1187335.39	3282041.25	5298.71	5357.99	48
EW-35	1186996.79	3282403.77	5289.31	5358.08	58
EW-36	1187194.45	3281897.20	5301.66	5365.49	53
EW-37	1187195.58	3281406.18	5307.37	5380.80	62
EW-38	1187164.07	3280907.27	5315.80	5359.77	33
EW-39	1187054.94	3281149.23	5324.08	5369.25	34
EW-40	1187051.57	3281642.16	5307.77	5379.47	61

LFG WELL SCHEDULE

WELL ID	NORTHING	EASTING	DESIGN TOP OF CLAY (ELEV.)	DESIGN TOP OF FINAL COVER (ELEV.)	DESIGN WELL DEPTH (FT)
EW-41	1187052.58	3282138.96	5295.42	5358.24	52
EW-42	1187033.39	3282667.27	5281.02	5356.22	64
EW-43	1187009.75	3282915.01	5275.84	5357.38	71
EW-44	1187035.63	3283205.37	5273.29	5356.06	72
EW-45	1187037.88	3283529.48	5271.40	5355.50	73
EW-46	1186821.87	3283445.08	5271.57	5359.58	77
EW-47	1186733.46	3282934.14	5280.52	5371.19	80
EW-48	1186777.82	3282391.94	5295.75	5369.03	62
EW-49	1186908.39	3281885.90	5302.20	5372.48	59
EW-50	1186910.61	3281391.41	5318.28	5381.92	53
EW-51	1186867.15	3281045.40	5325.31	5365.58	29
EW-52	1186745.23	3281099.93	5324.89	5369.49	34
EW-53	1186763.23	3281641.25	5311.36	5386.00	64
EW-54	1186766.60	3282131.92	5301.59	5370.87	58
EW-55	1186750.74	3282658.16	5287.92	5370.35	71
EW-56	1186734.99	3283183.73	5275.33	5371.10	85
EW-57	1186505.38	3283429.64	5274.98	5359.61	74
EW-58	1186526.76	3282901.82	5286.26	5372.21	75
EW-59	1186501.55	3282394.53	5303.32	5370.63	56
EW-60	1186597.61	3281892.53	5310.14	5375.70	55
EW-61	1186759.78	3281407.23	5318.26	5384.32	55
EW-62	1186502.91	3280996.35	5326.18	5366.69	30
EW-63	1186495.16	3281150.39	5325.27	5373.01	37
EW-64	1186579.46	3281643.60	5316.99	5377.24	49
EW-65	1186579.71	3282139.49	5307.35	5374.44	56
EW-66	1186470.33	3282650.00	5295.94	5369.23	62
EW-67	1186446.63	3283191.93	5280.27	5368.39	77
EW-68	1186255.37	3283448.52	5279.35	5358.46	68
EW-69	1186241.87	3282898.20	5294.26	5357.96	53
EW-70	1186275.62	3282380.51	5308.71	5359.33	40
EW-71	1186294.70	3281885.80	5319.70	5360.76	30
EW-72	1186488.49	3281402.33	5323.57	5372.76	38
EW-73	1186288.21	3280941.52	5328.19	5362.56	23
EW-74	1186306.82	3281152.48	5326.71	5363.59	26
EW-75	1186297.00	3281373.28	5325.46	5363.19	27
EW-76	1186269.95	3281634.21	5324.37	5361.77	26
EW-77	1186293.32	3282130.20	5318.70	5360.11	30
EW-78	1186261.08	3282639.82	5302.07	5358.76	46
EW-79	1186197.72	3283187.50	5286.25	5355.69	58

NOTES
1. WELL DEPTHS AND LOCATIONS MAY VARY FROM THIS TABLE BASED ON ACTUAL FIELD CONDITIONS AT THE TIME OF THE WORK.
2. THE EXTRACTION WELLS SHALL BE STAKED AND SURVEYED (HORIZONTAL AND VERTICAL) PRIOR TO WELL DRILLINGS. THE ENGINEER SHALL REVIEW THE AS-STAKED LOCATION AND APPROVE THE WELL DEPTH PRIOR TO DRILLING.

PREPARED FOR:
GFL environmental
EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

PREPARED BY:
SMITH+GARDNER
ENGINEERS
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577
1526 Richland St., Columbia SC 29201

SEAL
COLORADO LICENSED
JOHN M. GARDNER
PE0055462
PROFESSIONAL ENGINEER
8/12/21

SEAL

REV.	DATE	DESCRIPTION

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PROJECT TITLE:
LANDFILL GAS COLLECTION AND CONTROL SYSTEM DESIGN

DRAWING TITLE:
DETAILS (SHEET 4 OF 4)

DESIGNED: M.M.J	PROJECT NO: ERLGCCS 21-1
DRAWN: C.T.J.	SCALE: AS SHOWN
APPROVED: J.M.G.	DATE: JULY 2021
FILENAME: ERL-D0004	
SHEET NUMBER: 7	DRAWING NUMBER: D4

G:\CAD\East Regional Landfill\ERLGCCS 21-1\sheets\ERL-D0004.dwg - 8/13/2021 10:09 AM

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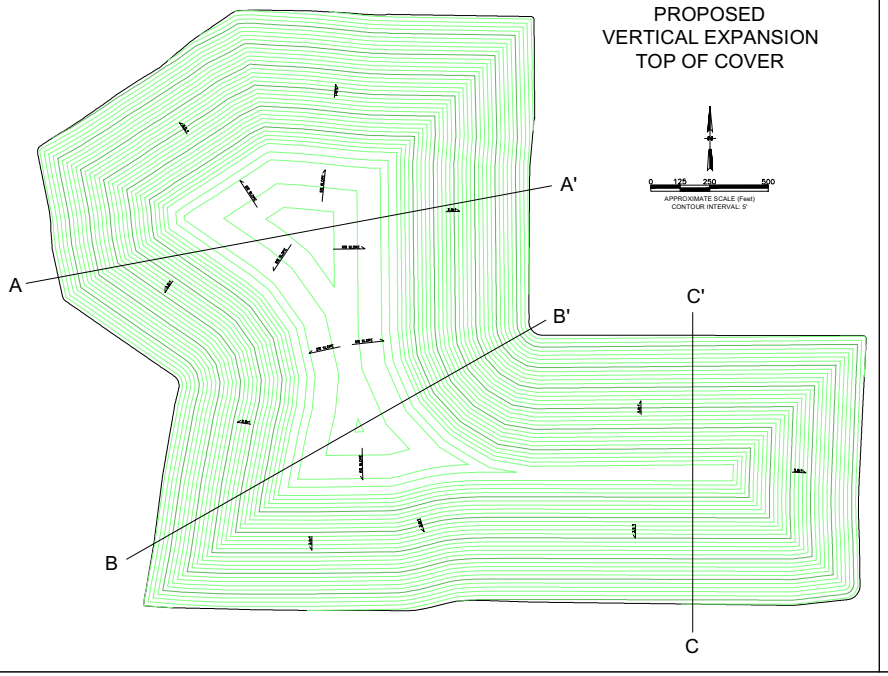
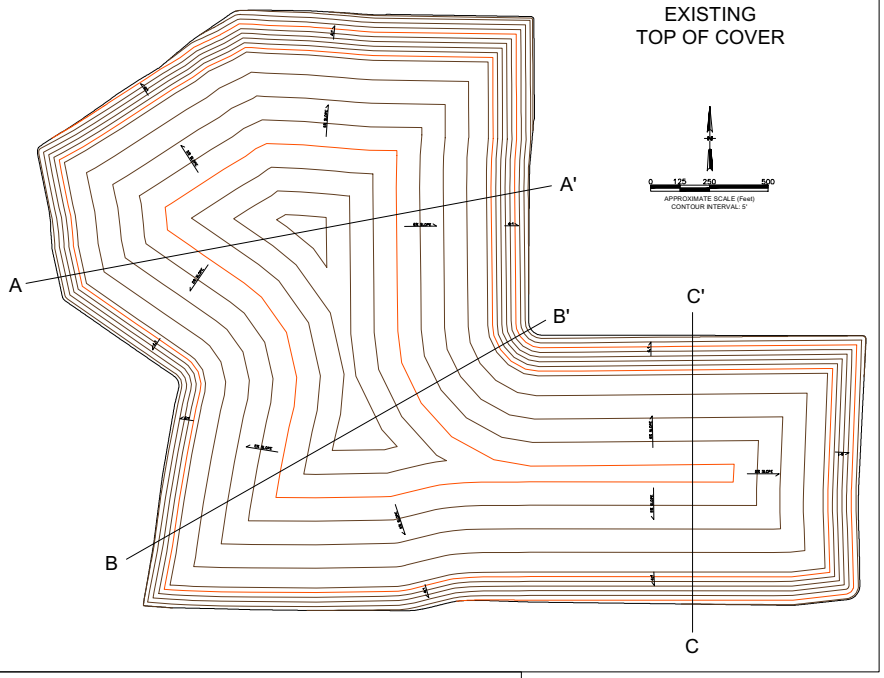
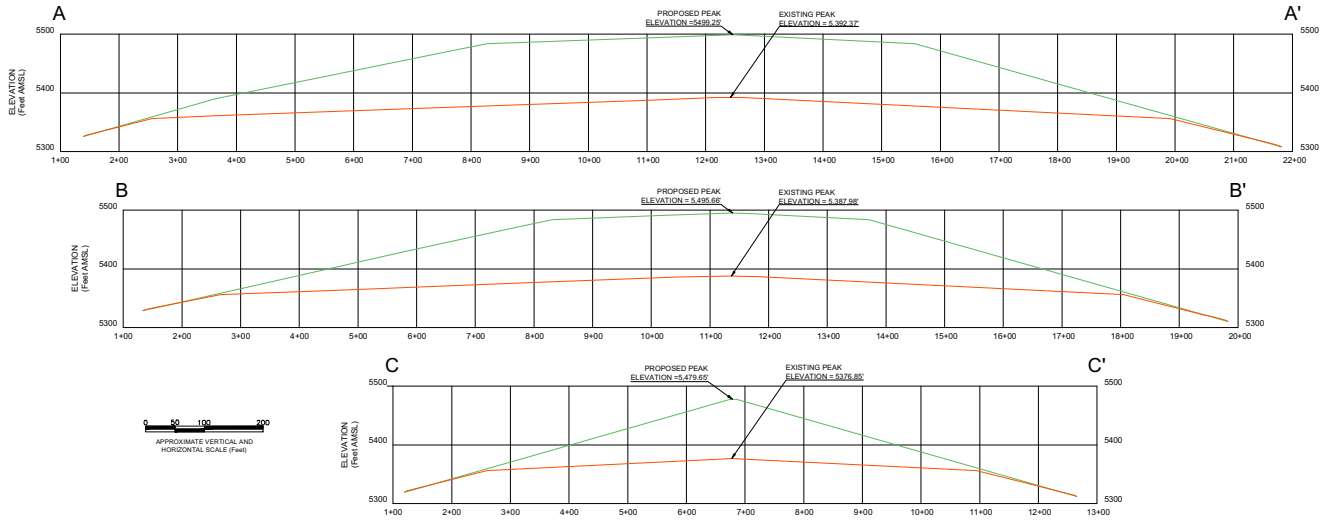
ATTACHMENT D

Site Development Plan/Site Plan







LEGEND

- 5315 — PROPOSED 3.5 TO 1 SLOPE TOP OF COVER CONTOURS (2 FT. INTERVAL)
- 5315 — EXISTING 4.0 TO 1 SLOPE TOP OF COVER CONTOURS (5 FT. INTERVAL)
- PROFILE THROUGH PROPOSED TOP OF COVER
- PROFILE THROUGH EXISTING TOP OF COVER

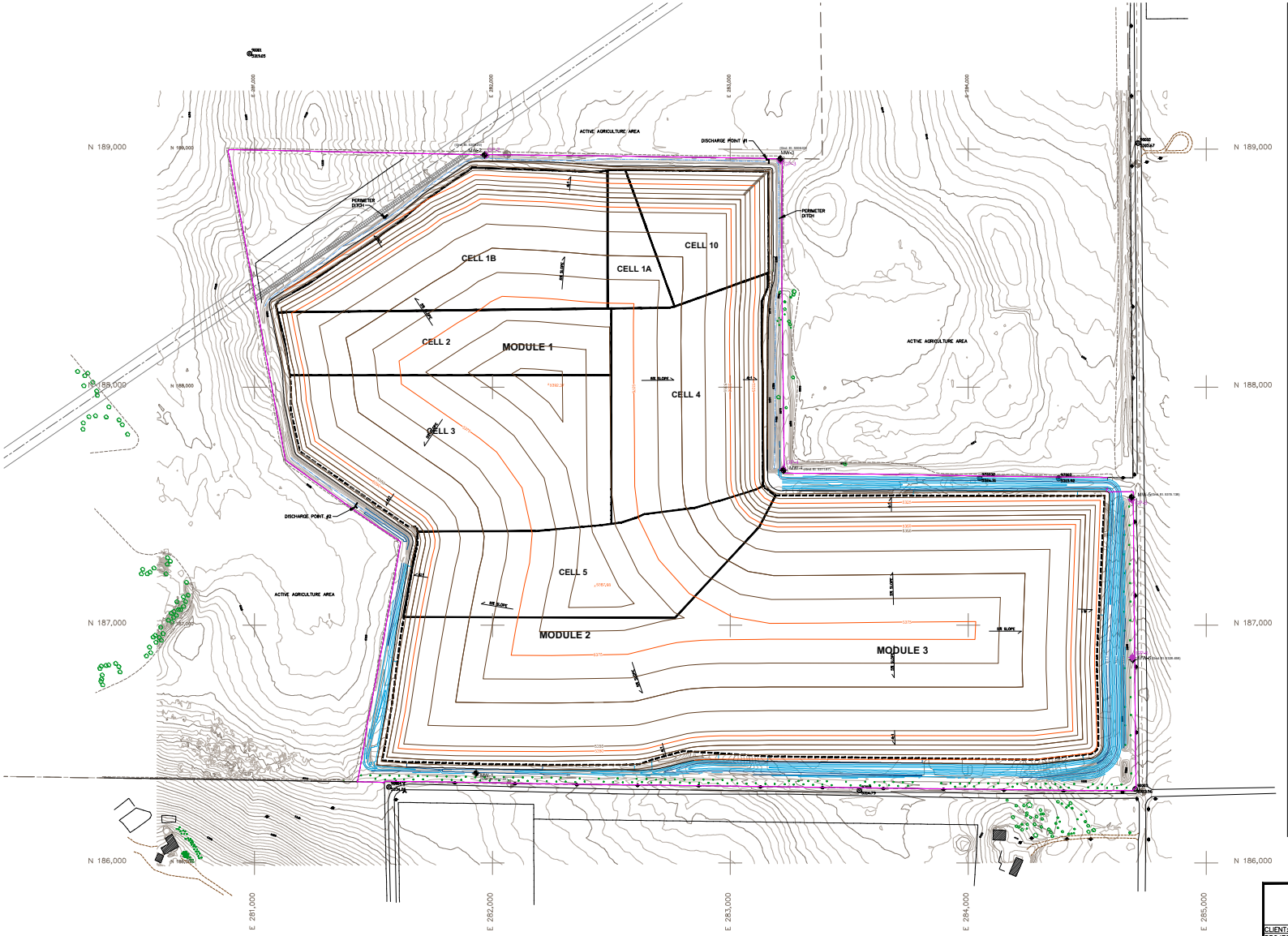
TOTAL AIRSPACE VOLUME SUMMARY:

	Fill (cu. Yds.)
Permitted Top of Cover	11,640,618
ADDITIONAL AIRSPACE FROM TOP OF PERMITTED FINAL COVER	
3.5:1 top of Cover	10,925,498

SHEET 1
VERTICAL EXPANSION FINAL COVER COMPARISON TO PERMITTED FINAL COVER
EAST REGIONAL LANDFILL , FIVE PART DEVELOPMENT
ADAMS COUNTY

CLIENT: FIVE PART DEVELOPMENT, LLC	
PROJECT: VERTICAL EXPANSION	
PROJECT NO:	DATE COMPLETED: 8/2025
DESIGNED BY: CJA	APPROVED BY: CJA
DRAWN BY: MBT	DWG NAME:
REVISION:	REVISED BY: RDS DATE: 05/2026
0 ISSUED FOR REVIEW	
1 REVISED FOR ADCO COMMENTS	

AEC AMERICAN ENVIRONMENTAL CONSULTING, LLC.



LEGEND

- LIMIT OF WASTE
- EXISTING 4 TO 1 SLOPE TOP OF COVER CONTOURS (5 FT. INTERVAL)
- PROPERTY LIMIT (BY R.W. BAYER & ASSOCIATES, 2007)
- CONTROL POINTS
- ADJOINING PROPERTY BOUNDARY
- GAS PIPELINE RIGHT OF WAY
- AS BUILT STORM WATER DRAINAGE FLOW LINES
- GAS PIPELINE ACCESS ROAD
- SECTION MARKER
- MW-3 EXISTING GROUND WATER MONITORING LOCATION (APPROXIMATE HIGH GROUNDWATER ELEVATION)
- GP-2 EXISTING GAS MONITORING WELL LOCATION
- LANDSCAPED SCREENING BERM
- SCREENING TREE LOCATION
- SCREENING BUSH LOCATION

TOTAL AIRSPACE VOLUME SUMMARY:

	Fill (cu. Yds.)
Permitted Top of Cover	11,640,618

NOTE: PANEL CONTROL POINT LOCATIONS ARE SHOWN IN MODIFIED STATE PLANE THAT IS USED ON SITE FOR MONITORING, DESIGN AND CONSTRUCTION PURPOSES.

0 100 200 400
APPROXIMATE SCALE (FEET)

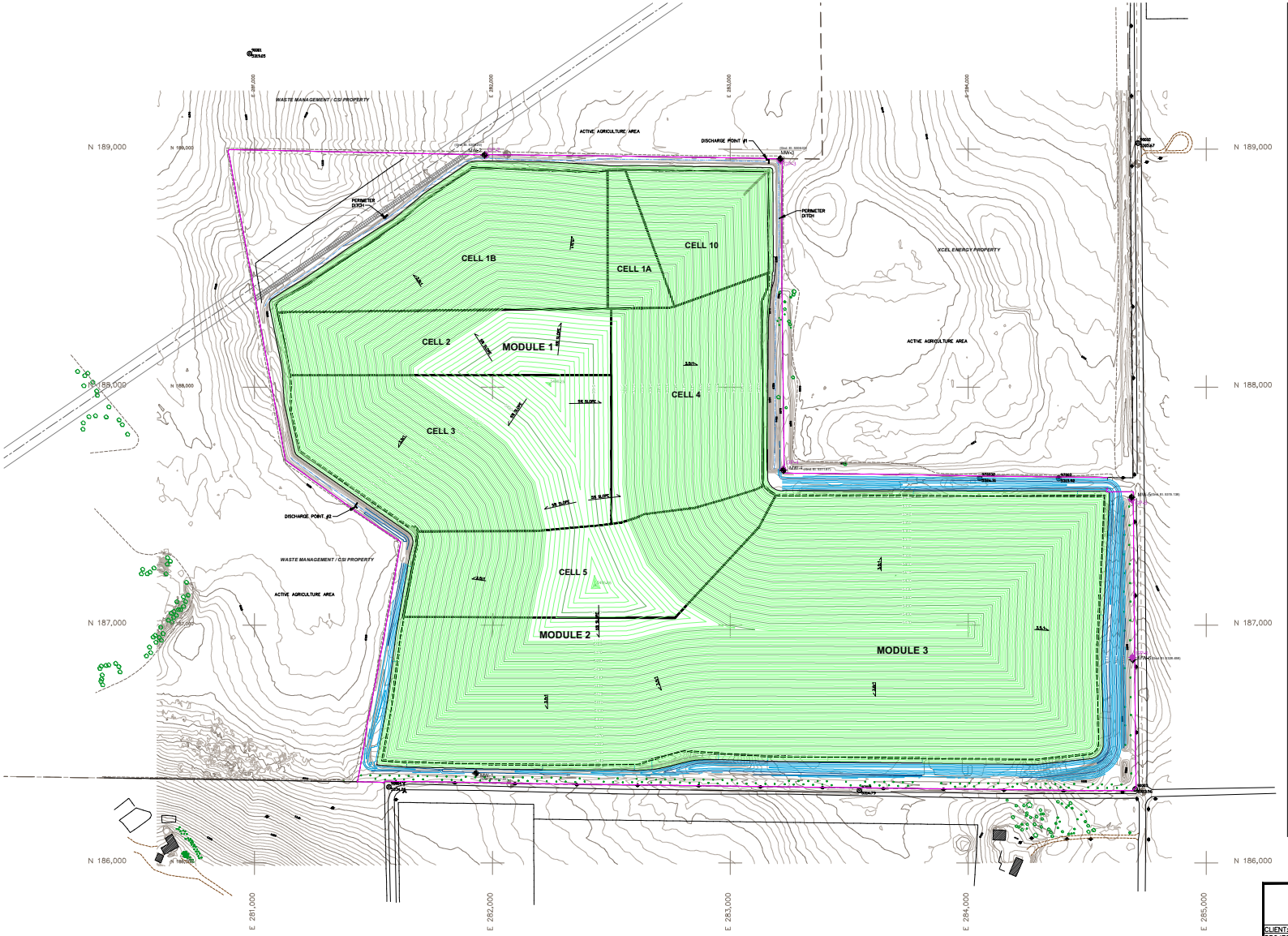
CONTOUR INTERVAL: 1'
DATE OF TOPOGRAPHY FLIGHT: 1/13/20
SURVEY BY COPPER AERIAL SURVEY CO.
Phoenix, Arizona

SHEET 2
EAST REGIONAL LANDFILL EXISTING FINAL COVER PLAN
ALLIED WASTE SYSTEMS OF COLORADO
ADAMS COUNTY

CLIENT: FIVE PART DEVELOPMENT, LLC	
PROJECT: VERTICAL EXPANSION	
PROJECT NO:	DATE COMPLETED: 8/2024
DESIGNED BY: CJA	APPROVED BY: BC
DRAWN BY: TML	DWG NAME:
REVISION:	REVISED BY: RDS DATE: 05/26

0	ISSUED FOR REVIEW
1	REV FOR ADCO COMMENTS

AEC AMERICAN ENVIRONMENTAL CONSULTING, LLC.



LEGEND

- LIMIT OF WASTE
- PROPOSED 3.5 TO 1 SLOPE TOP OF COVER CONTOURS (2 FT. INTERVAL)
- PROPERTY LIMIT (BY R.W. BAYER & ASSOCIATES, 2007)
- CONTROL POINTS
- ADJOINING PROPERTY BOUNDARY
- GAS PIPELINE RIGHT OF WAY
- AS BUILT STORM WATER DRAINAGE FLOW LINES
- GAS PIPELINE ACCESS ROAD
- SECTION MARKER
- MW-3 EXISTING GROUND WATER MONITORING LOCATION (APPROXIMATE HIGH GROUNDWATER ELEVATION)
- GP-2 EXISTING GAS MONITORING WELL LOCATION
- LANDSCAPED SCREENING BERM
- SCREENING TREE LOCATION
- SCREENING BUSH LOCATION

TOTAL AIRSPACE VOLUME SUMMARY:

	Fill (cu. Yds.)
Permitted Top of Cover	11,640,618
ADDITIONAL AIRSPACE FROM TOP OF PERMITTED FINAL COVER	
3.5:1 top of Cover	10,925,498

NOTE: PANEL CONTROL POINT LOCATIONS ARE SHOWN IN MODIFIED STATE PLANE THAT IS USED ON SITE FOR MONITORING, DESIGN AND CONSTRUCTION PURPOSES.

0 100 200 400
APPROXIMATE SCALE (FEET)

CONTOUR INTERVAL: 1'
DATE OF TOPOGRAPHY FLIGHT: 1/13/20
SURVEY BY COPPER AERIAL SURVEY CO.
Phoenix, Arizona

PLATE 4
EAST REGIONAL LANDFILL PROPOSED FINAL COVER PLAN
ALLIED WASTE SYSTEMS OF COLORADO
ADAMS COUNTY

CLIENT: FIVE PART DEVELOPMENT, LLC	
PROJECT: VERTICAL EXPANSION	
PROJECT NO:	DATE COMPLETED: 8/2024
DESIGNED BY: CJA	APPROVED BY: BC
DRAWN BY: TML	DWG NAME:
REVISION:	REVISED BY: RDS DATE: 05/26

0	ISSUED FOR REVIEW
1	REV FOR ADCO COMMENTS

AEC AMERICAN ENVIRONMENTAL CONSULTING, LLC.

ATTACHMENT E

Update Tables – Landfill Capacities

Table 1-A

ERL Permitted v. Proposed Capacity and Remaining Soil Requirements [1]		
Existing Gross Airspace (top of liner to top of final cover)[2]	**11,640,618**	CY
Expanded Gross Airspace (top of liner to top of final cover)[2]	**22,566,116**	CY
Existing Total Waste Airspace (top of protective soil to bottom of synthetic final cover)[3]	**11,420,937**	CY
Expanded Total Waste Airspace (top of protective soil to bottom of synthetic final cover)[3]	**22,022,035**	CY
Remaining Waste Airspace without expansion (2024 topo basis)[4]	**5,657,467**	CY
Remaining Waste Airspace after Expansion (2024 topo basis)[4]	**16,258,565**	CY
Current Waste in Place (total waste airspace minus remaining waste airspace)	**5,763,470**	CY
Total Area	132.4	Acre
Module 1	61.2	Acre
Module 2	36.1	Acre
Module 3	35.1	Acre
SOIL REQUIREMENTS		
General Fill Soil Required to Bring Subgrade Up in Future Cells[5]	35,535	CY
General Fill Soil Required to Outside of Cells[6]	21,852	CY
Protective Cover Soil over Liner Needed for future cells[7]	94,577	CY
Final Cover Soil Volume Required[8]		
Water Balance Alternative Final Cover (AFC) (3.5-foot-thick soil)	772,449	CY
Synthetic Geomembrane Final Cover (1.5-foot-thick soil)	353,048	CY
Soil for Tack On Berms[9]	58,317	CY
Remaining Daily/Int Cover Required (10% of Remaining Airspace)	1,625,856	CY
Remaining Soil Volume Required		
Total Soil Required Using AFC	**2,608,586**	CY
Using Synthetic Final Cover	**2,189,185**	CY
Available Soil from future Excavation[10]	1,292,819	CY
Soil Deficit		
Soil Deficit using AFC	**-1,315,767**	CY
Soil Deficit using Synthetic FC	**-896,366**	CY

Notes:

1 All existing conditions calculations are based on the topography from April 22, 2024. All volume units "CY" are bank cubic yards.

2 Gross Airspace includes volume from top of liner to top of final cover (including previously filled areas). Includes the 1-ft protective (operations layer) soils. All future cells will be lined with synthetics, and so they do not require any site soils.

3 Total Waste Airspace is the volume available for solid waste and daily/intermediate cover in the entire landfill (including previously filled areas) without the 1-foot protective (operations layer) soil and without the 1.5-foot final cover soil required for the synthetic final cover option. If the AFC final cover option is used, the total waste airspace volume will be reduced to accommodate the additional two feet of soil used in the final cover construction.

4 Remaining Waste Airspace is the remaining volume available for solid waste and daily/intermediate cover in the landfill. It is the volume from the 2024 existing top of waste in Cells 1-5 (already constructed at this time) and from the top of protective (operations layer) in future cells, to the base of the 1.5-foot-thick synthetic final cover system. If the AFC final cover option is used, the remaining waste airspace volume will be reduced to accommodate the additional two feet of soil used in the final cover construction.

5 Volume of soil required to fill the 2024 existing ground surface to the design excavation grades in the future cells, within the limit of waste.

6 Volume of soil required to fill the 2024 existing ground surface to the design excavation grades in the future cells, outside of the limit of waste. This is primarily the volume of soil required to build perimeter surface water control features and to build the portions of side slopes outside the limits of waste.

7 Volume of soil required to construct the 1-foot protective/operations layer atop the liner in future cells.

8 Volume of soil required to build the final cover system. There are two final cover options in the EDOP: a synthetic geomembrane final cover which requires an additional 1.5 feet of soil, and a water-balanced (alternative) final cover system requiring 3.5 feet of soil. These volumes do not include intermediate cover, which is budgeted separately.

9 Additional soil required to construct the surface water control berms atop the final cover.

10 Soil gained by excavating from the 2024 existing ground surface to the design excavation grades in future cells.

Table 1-B

ERL Permitted v. Proposed Site Life Estimate				
Existing Remaining Airspace (Waste and Daily/Intermediate Cover)	5,657,467	cy		
Expanded Remaining Airspace (Waste and Daily/Intermediate Cover)	16,258,565	cy		
Volume of daily/intermediate Soil Cover Used	15%	of airspace volume =	848,620	cy existing
			2,438,785	cy expanded
Volume of Waste Remaining without Expansion =	4,808,847	cy		
Volume of Waste Remaining after Expansion =	13,819,780	cy		
Volume of Waste Airspace Landfill Used Daily =	2,000	cy		
Existing Remaining Days of Site Life =	2,404	days		
Expanded Remaining Days of Site Life =	6,910	days		
Days Open Per Year =	260	days		
Existing Years of Remaining Site Life =	9.2	years		
Expanded Years of Remaining Site Life =	26.6	years		

ATTACHMENT F

Compost Operations Plan

Weaver Consultants Group

May 21, 2026

Ms. Rachel DeRosa
Colorado Department of Public Health and Environment
Solid Waste and Materials Management Division
4300 Cherry Creek South Drive
Denver, CO 80246

Re: CDPHE Comments and Adams County Comments
Engineering Design and Operations Plan Composting Operation
East Regional Landfill
Project No. 0120-754-10-01

Dear Ms. DeRosa:

On behalf of our client, Five Part Development, LLC, Weaver Consultants Group (WCG) submits this response to comments received from the Colorado Department of Public Health and Environment (CDPHE) and Adams County. Technical comments from CDPHE were provided in a letter to the East Regional Landfill dated April 9, 2026. Additional technical comments from Adams County were provided in an email dated May 7, 2026. Both sets of comments are in reference to the Engineering Design and Operations Plan for the Composting Operation dated March 12, 2026.

Additionally, please find the attached Engineering Design and Operations Plan Composting Operation Revision 1 dated May 20, 2026, that has been updated to incorporate CDPHE's comments and Adams County comments, as explained in the responses below.

Each technical comment is listed in italics below, followed by the response.

Response to Comments to CDPHE

Comment 1. Section 2.3 Feedstocks: Please provide a list of specific feedstocks that will be accepted at the Facility, including allowable bulking agents. Treated wood is mentioned, and it is unclear if it is allowed or prohibited. Additionally, not all Class III compost operations are allowed to accept Type 3 materials. Please specifically list the materials that will be accepted.

RESPONSE: Thank you for the comment. The text in Section 2.3 has been revised to clarify the list of feedstocks accepted at ERL.

Comment 2. Section 2.4 Potential Impacts to Existing Surface Water and Groundwater: Pursuant to Section 14.4.3(C)(5)(i) of the Regulations, provide the regional thickness of consolidated bedrock material.

RESPONSE: Thank you for the comment. The text in Section 2.4 has been revised to include the regional thickness of consolidated bedrock material.

Comment 3. Section 2.4 Potential Impacts to Existing Surface Water and Groundwater: Pursuant to Section 14.4.3(C)(5)(g) of the Regulations, describe the existing quality of groundwater beneath the facility.

RESPONSE: Thank you for the comment. The text in Section 2.4 has been revised to describe the existing quality of groundwater beneath the facility.

Comment 4. Section 2.4.1 Surface Water: The first paragraph of this section states "A portion of the surface water discharge from the site will discharge to the west, but currently only runoff from a portion of the farm operations discharges to the west". Please confirm this statement is still relevant to the Facility. If it is no longer relevant, please remove it.

RESPONSE: Thank you for the comment. The text in Section 2.4.1 has been revised to provide clarification on surface water drainage.

Comment 5. Section 3.3 Feedstock Processing Areas: A maximum throughput capacity of 10,000 cubic yards on-site at any given time is listed. This will be the approved maximum volume for the site.

RESPONSE: Thank you for the comment. The text in Section 3.3 has been revised to acknowledge that the approved maximum volume of compost is 10,000 cubic yards on-site at any given time.

Comment 6. Section 4.1 General: Pursuant to Section 14.4.5(A), describe how the facility will comply with the operational requirements in each of these sections of the Regulations by clearly specifying the section of the EDOP where each requirement is discussed.

RESPONSE: Thank you for the comment. Section 4.1 of the report has been revised to identify where each operational requirement of Section 14.4.5(A) is addressed within the EDOP.

Comment 7. Section 4.2 Financial Assurance: Pursuant to Sections 4.2.1, 4.3.1, and 4.5.2 of the Regulations, revise this section to state "the Facility will submit the revised cost estimates prior to operating the facility. Within 60 days after the increase, the owner/operator will either increase the value of the mechanism and submit evidence of such increase to the Department and local governing authority or obtain other financial assurance to cover the increase".

a. *Pursuant to Section 4.5.1 of the Regulations, during the active life of the solid waste disposal site and facility, the owner or operator must annually revise the financial assurance instrument to account for inflation and must submit the revised estimate to the Financial Assurance Manager annually by April 30th for approval.*

b. *Pursuant to Section 4.5.3 of the Regulations, after department approval of the initial cost estimate, and during the active life of the facility, the owner or operator must replace original cost estimates with new cost estimates every five years, unless otherwise requested by the Department.*

RESPONSE: Thank you for the comment. The text in Section 4.2 has been revised provide clarification on financial assurance and cost estimate requirements.

Comment 8. Section 4.3 Material Acceptance: Manure and other feedstocks should be stored on the work pad. Clean wood bulking materials may be stored off the work pad in designated areas.

RESPONSE: Thank you for the comment. The text in Section 4.3 has been revised to clarify that manure and other feedstocks will be stored on the working pad while clean wood bulking materials may be stored off the compost pad.

Comment 9. Section 4.3.2 Feedstock Management: Liquid feedstock storage and mixing standard operating procedures (SOPs) should be developed, included in the EDOP for review and approval, and followed at the Facility. These SOPs must detail how liquids will be stored and applied to compost piles in a manner that prevents ponding, discharge, runoff, and the generation of excessive contact water or leachate. If an engineered basin is to be used, please provide details on its operation, as well as a statement indicating that until the engineered mixing basin is approved by CDPHE, feedstock not passing the paint filter test will not be accepted by the Facility.

RESPONSE: Thank you for the comment. The text in Section 4.3.2 has been revised to indicate that liquids will not be stored at the compost facility.

Comment 10. Section 4.4 Surface Water Control: Any liquid waste storage tanks must have secondary containment, and their use must be consistent with the liquids management protocols described in Section 4.3.2.

RESPONSE: Thank you for the comment. The text in Section 4.4 has been revised to indicate that liquids will not be stored at the compost facility.

Comment 11. Section 4.7 Nuisance Conditions & Odor Plan and Section 4.8 Contingency Plan: These sections list potential nuisance conditions, but do not include plans of action to be taken upon the discovery of nuisance conditions. Specifically, plans should be provided for correcting odor issues and abating vectors including flies.

RESPONSE: Thank you for the comment. The text in Section 4.7.2 (Odors) has been revised to include response procedures in the event a nuisance condition is identified. The text in Section 4.7.4 (Vectors) has also been updated to include fly abatement measures.

Comment 12. Section 4.7.2 Odors: Pursuant to Section 14.4.5(J)(3) of the Regulations, include strategies for mitigating off-site odors (e.g., communication with neighbors, responding to complaints within 24 hours).

RESPONSE: Thank you for the comment. The text in Section 4.7.2 Odors has been revised revised to include strategies for mitigating off-site odors.

Comment 13. Section 4.10 Personnel Training: Pursuant to Sections 14.1.5(A) and 14.4.5(K) of the Regulations, a facility shall go no longer than 12 months without having an operator on staff that has completed the Certified Compost Operator Training. Include the requirement for the aforementioned training in this section.

RESPONSE: Thank you for the comment. The text in Section 4.10 has been updated to include language regarding the Certified Compost Operator Training.

Comment 14. Section 4.11.1 Compost Processing: Unless actively aerated, static pile composting must still meet the minimum requirements for windrow composting, including a minimum of five turns during the period when temperatures are above 131 degrees Fahrenheit.

RESPONSE: Thank you for the comment. The text in Section 4.11.1 has been revised to clarify static pile requirements.

Comment 15. Section 4.11.2 Temperature and Moisture Monitoring Procedures: Temperature readings should be taken at least once per day while operators are on-site. A minimum of 15 non-consecutive days above 131 degrees Fahrenheit are required for static pile/windrow composting. Additionally, the language regarding temperature monitoring locations is difficult to follow. Please revise this to state that each active compost pile or windrow will be monitored.

RESPONSE: Thank you for the comment. The Text in Section 4.11.2 has been revised to clarify language regarding temperature monitoring for static piles.

Comment 16. Section 4.12 Groundwater Monitoring Plan: The Groundwater Monitoring Plan provided in the 2011 EDOP Compost Operations states groundwater samples will be analyzed for major anions and cations, plus fecal coliform and salmonella, whereas this section states groundwater samples will be analyzed only for the inorganics listed in Table 1 in Section 14.6 of 6 CCR 1007-2, Part 1 (arsenic, cadmium, copper, lead, mercury, nickel, selenium, and zinc). Provide justification for this reduced analyte list or revise this section to state that groundwater samples will be analyzed for Appendix IA and IB inorganic constituents.

RESPONSE: Thank you for the comment. The groundwater monitoring program for compost facility monitoring CMW-1 has been refined to focus on constituents that are most representative of potential impacts associated with composting operations at the ERL facility.

The analyte list has been reduced to the inorganic parameters identified in Table 1 of Section 14.6 of 6 CCR 1007-2, Part 1 (arsenic, cadmium, copper, lead, mercury, nickel, selenium, and zinc), as these constituents are the most relevant indicators of potential leachate-related impacts from the composting feedstocks managed at the site. Given that the constituents in Table 1 reflect the contaminants of concern for saleable compost, WCG believes they also reflect appropriate contaminants of concern for potential groundwater contamination from the compost operation. Salmonella and fecal coliform are excluded because they naturally will rapidly attenuate.

Comment 17. Section 4.13 Finished Compost Sample Testing/Analysis: The Division recommends using the Test Method for the Examination of Composting and Compost (TMECC) for sampling of finished compost.

RESPONSE: Thank you for the comment. The text in Section 4.13 has been revised to indicate that sampling of finished compost may be conducted in accordance with general practices outlined in the TMECC method.

Comment 18. Section 4.13 Finished Compost Sample Testing/Analysis: Pursuant to Section 14.6(I) of the Regulations, discuss how the facility will handle finished compost that exceeds the maximum levels presented in Table 1.

RESPONSE: Thank you for the comment. The text in Section 4.13 has been revised to describe the procedures for managing finished compost that exceeds the maximum levels identified in Table 1.

Comment 19. Section 4.13 Finished Compost Sample Testing/Analysis: Pursuant to Section 14.6(F) of the Regulations, add a statement indicating that finished compost which has been sampled and tested, but to which raw or partially composted feedstock, bulking material, or liquid waste is added prior to, or during distribution, must be reintroduced into the composting process, re-sampled, and retested prior to commencing or continuing distribution.

RESPONSE: Thank you for the comment. The text in Section 4.13 has been revised to clarify the procedures to be followed if materials are introduced into finished compost.

Comment 20. Section 6.1 Composting Operation Closure: Please revise bullet 5 to read "if testing indicates that pathogens or other contaminants associated with compost operations remain in the soil or that they are otherwise not suitable for a successful revegetation program, they will be removed and disposed of at an appropriate solid waste disposal facility".

RESPONSE: Thank you for the comment. The text in Section 6.1 of the report has been updated.

Comment 21. Section 6.1 Composting Operation Closure: Revise the last paragraph of this section to clearly indicate that the requirement to place a notation on the deed notifying any

potential purchaser that the property has been used as a composting facility would no longer be required if subsequent landfill operations are conducted in the compost area because a different deed notification will be required to indicate it was used as a landfill.

RESPONSE: Thank you for the comment. The text in Section 6.1 has been revised to clarify the deed notification requirements for a composting or landfill facility.

Comment 22. Section 6.2 Post-Closure Care and Maintenance: Add to this section the requirement for monitoring well CMW-1 to continue being sampled through the post-closure care period.

RESPONSE: Thank you for the comment. The text in Section 6.2 has been revised to require continued monitoring for monitoring well CMW-1 through the post-closure care period.

Comment 23. Miscellaneous: There appear to be several references to the Tri-County Health Department throughout the document. Please remove these and where appropriate, provide reference to the Adams County Health Department instead.

RESPONSE: Thank you for the comment. References to the Tri-County Health Department have been replaced with the Adams County Health Department.

Comment 24. Drawing 1 Compost Pad Layout: Feedstocks appear to be stored upgradient of in-process compost on the work pad, which would allow contact water and leachate from these feedstocks to contaminate those in-process compost piles. It is recommended that feedstocks be stored down- or cross-gradient from active and finished compost.

RESPONSE: Thank you for the comment. It has been acknowledged that food waste storage and processing area is located upgradient of the active compost piles. Given the constraints of the already constructed pad, relocation of the active composting piles is not practicable. However, Drawing 1 has been revised to remove stockpiles situated in the anticipated stormwater flow path to improve separation between feedstock storage and active compost piles. The revisions are intended to minimize potential for contact water and leachate contamination. Additional operational controls may be implemented on an as-needed basis to further reduce contamination potential.

Comment 25. Drawing 1 Compost Pad Layout: Clearly indicate on this figure where finished compost will be stored.

RESPONSE: Thank you for the comment. The drawing has been revised to show where finished compost will be stored.

Comment 26. Appendix B Surface Water Calculations: Provide stormwater calculations for the most recent construction, including the new area of the pad, the new berm, and the culverts from 2012.

RESPONSE: Thank you for the comment. The stormwater calculations have been performed as a check but uses assumptions from the 2012 Compost Design and the 2025 Compost Expansion Design. The calculations are included as Appendix B.1.

Response to Comments to Adams County

Comment 1. The County would like more specificity regarding nuisance control strategies for various sources and causes of nuisance conditions to be including within Section 4.7.

a. *In Section 4.7.1, the fact that grinding and screening operations can be a source of dust is noted but there is no discussion as to specific best practices and control strategies that will be employed to control fugitive dust during these operations. For instance, are wind conditions considered/monitored and if so, how will that inform those operations?*
b. *In Section 4.7.2 certain causes of odors are discussed, but specificity is lacking on control strategies such as, procedures for identifying and documenting the source, determining appropriate control strategy, implementation procedures, verifying abatement, tracking source conditions for continued abatement, and recordkeeping.*
c. *Section 4.7.3: the County is concerned with the statement that small quantities of plastic present in the feedstock will be incorporated into the compost. Please define "small quantity" in relation to acceptable feedstock contamination and at what threshold mitigation is required to remove non-compostable materials during processing.*
d. *Section 4.7.5: is signage employed to direct trucks to appropriate area for offloading? Under what specific conditions (volume of mud or pooled water on the pad, visible tracking) will grading be required? What level of tracking is indicative of nuisance condition requiring corrective measures?*

RESPONSE: Thank you for the comment. The text in Sections 4.7.1, 4.7.2, 4.7.3 and 4.7.5 has been revised to provide clarification on various nuisance conditions.

Comment 2. Can more detail be provided in Section 4.11.1, Static Pile, including specific operational procedures for determining and maintaining adequate "pile structure?"

RESPONSE: Thank you for the comment. The text in Section 4.11.1 has been updated to include clarification on operational procedures and maintaining adequate pile structure.

<u>Comment 3.</u> The County recommends that procedures for probe calibration, frequency and recordkeeping be included in the EDOP, Section 4.11.2.

RESPONSE: Thank you for the comment. The language in Section 4.11.2 has been updated to indicate that no calibration is required for the Reotemp thermometers, as verified with the manufacturer.

<u>Comment 4.</u> There are several references to Tri-County Health that need to be updated to reference Adams County Health Department.

RESPONSE: Thank you for the comment. Previous references to the Tri-County Health Department have been updated to the Adams County Health Department.

If you have questions or concerns regarding the attached, please do not hesitate to contact us.

Sincerely,
Weaver Consultants Group

Jacob Midkiff, P.E.
Project Director

Grace Hart, E.I.T.
Project Engineer

Attachment

Weaver Consultants Group

May 21, 2026

Via electronic transmission

Ms. Rachel DeRosa
Colorado Department of Public Health and Environment
Hazardous Materials and Waste Management Division
4300 Cherry Creek Drive
Denver, CO 80246

Re: EDOP Composting Operation
East Regional Landfill
Project No.: 0120-754-10-01

Dear Ms. DeRosa:

On behalf of our client, Five Part Development, LLC, Weaver Consultants Group is submitting the attached Engineering Design and Operations Plan for the Composting Operation at the East Regional Landfill.

Sincerely,
Weaver Consultants Group

Jake Midkiff, P.E.
Project Director

Attachment

cc:

900 Bannock St • Denver, Colorado 80204 • 720.529.0132 • wcgrp.com • Offices Nationwide

EAST REGIONAL LANDFILL

ENGINEERING DESIGN AND OPERATIONS PLAN
COMPOSTING OPERATION

PREPARED FOR

FIVE PART DEVELOPMENT, LLC

May 21, 2026

PREPARED BY

Weaver Consultants Group

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1 INTRODUCTION

The East Regional Landfill (ERL), owned by Five Part Development, LLC (FPD) and operated by Republic Services, received a Certificate of Designation (CD) to construct and operate a facility to accept municipal solid waste (MSW) for disposal by burial on June 29, 2009. In 2011, the CD was amended to include compost operations. This Compost Engineering Design and Operations Plan (Compost EDOP) incorporates updates from construction of the Compost Pad Expansion and refines the accepted materials for the Class III facility.

ERL intends to resume composting operations at the landfill in accordance with a Class III composting operation as defined in the Colorado Regulations Pertaining to Solid Waste Sites and Facilities, 6 CCR 1007-2, Part 1 (the Regulations). Section 14 of the Regulations governs composting operations and were used to guide the development of this EDOP. This Compost EDOP provides details on the expansion of the Compost Pad and updates the plan to align with Regulation amendments to Section 14 that became effective in March 2024. The Compost EDOP must be submitted to Adams County and the CDPHE for consideration for approval. Adams County, as the permitting agency, also has regulations that are applicable to portions of the compost operations, many of which are already addressed in the existing CD issued by Adams County such as landscaping, access, noise, etc. The ERL shall comply with the health laws, standards, rules, and regulations of the Department, the Water Quality Control Commission, the Air Quality Control Commission, and all applicable local laws and ordinances.

This Compost EDOP has been adapted from the previous plan titled “Engineering Design and Operations Plan Compost Operations - East Regional Landfill” dated March 10, 2011, prepared by American Environmental Consulting, LLC (AEC) and approved by CDPHE on March 24, 2011.

2 GENERAL

Section 14.1 and 14.4 of the Regulations present minimum standards, design, and operation criteria. FPD intends to resume operations of the Class III composting facility on the ERL property. The compost facility layout is shown on Drawing 1 and in Appendix A.

2.1 Composting Facility

The compost facility is located on the ERL property at:

8201 Schumaker Road
Bennett, CO 80102

The East Regional Landfill is located in portions of the southeast and southwest quarters of Section 25, Township 2 South, Range 64 West of the 6th Principal Meridian in Adams County, Colorado.

The ERL is approximately seven miles northwest of the Town of Bennett, Colorado. The property covered under the CD for the East Regional Landfill is approximately 164 acres, approximately 142 of which is designated for disposal of solid waste, commonly referred to as the waste footprint. Compost operations will be conducted on an approximate six-acre parcel located near the center of the property, shown on Drawing 1.

2.2 Owner and Operator Contact Information

The owner of the ERL compost facility is Five Part Development, LLC (FPD). The operator is Republic Services.

Facility Contact
Facility Manager: Justin Keever
Mobile: 303-210-6215
JKeever@RepublicServices.com

Facility Owner/Operator
Five Part Development, LLC (owner)

The Facility Manager will have authority to take action in the event of an emergency.

2.3 Feedstocks

FPD will operate a Class III composting operation as defined in Section 14 of 6 CCR 1007-2 Part l as follows:

A Class III composting facility is one that is permitted to receive Type I, Type 2 and/or Type 3 feedstocks. In accordance with the regulations, the facility could accept the following feedstocks for composting:

- Type I: Vegetative waste, and other materials determined by the Department to pose a low risk to human health and the environment.
- Type 2: Animal waste, manure, source-separated organics, food residuals and food processing vegetative waste.
- Type 3: Waste associated with animal materials or source separated food waste.

The facility will not accept any additional Type 3 feedstocks for composting, other than waste associated with animal materials or source separated food waste, without further approved modifications to the CD.

The facility will not accept liquids that fail the paint filter test. The facility will also not accept treated wood waste in accordance with the Regulations. The facility will not accept asbestos or asbestos containing materials, infectious waste, hazardous waste, polychlorinated biphenyl waste or lead-acid batteries for composting.

The facility will accept agricultural crop residues, yard waste, and other green wastes acceptable for composting to be used as bulking agents. Yard waste may consist of leaves, grass clipping and ground woody material (trees and brush).

FPD currently collects and receives approximately 300 tons per month, or 3600 tons per year, of source separated food waste at its waste transfer station. The content of the food waste varies substantially depending on the source (restaurants, grocery stores, etc.) and contains varying quantities of whole and partial vegetables, fruits, breads, and meats. Depending on the proximity of the source of the food waste, some food wastes are delivered directly to the facility without going through the waste transfer station, but will only be accepted if they are separated from other wastes at the source and relatively clean of other materials that are unacceptable for composting in accordance with this plan.

The ERL is located in a rural agricultural area and receives some volume of agricultural crop residues, manure, yard, and other green wastes acceptable for composting. Yard waste such as leaves, grass clippings, and ground woody material (trees and brush) can be either a source of carbon, nitrogen, or both depending on the structure of the material and the season. The facility has a grinder on site that may be used to reduce the size of certain feedstocks to enhance the composting process.

2.4 Potential Impacts to Existing Surface Water and Groundwater

The geology and hydrogeology of the site have been studied extensively for the permitting of the Waste Management CSI facility, the Public Service/Xcel Energy site, and the East Regional Landfill site. Information provided in this section is summarized in the overall site EDOP titled "Engineering Design and Operations Plan, East Regional Landfill" prepared by AEC in February 2025, and approved by the CDPHE on July 25, 2025. Further discussions on original site characterization can be found in Appendix A of the overall site EDOP. The ERL is designed and operated such that waste is not placed below or into surface water or groundwater.

The surficial materials in the vicinity of the site include loess and eolian deposits and consist of loam, silty loam, clay loam, and sandy loams, or very fine sands. Variable percentages of gravel are typical of these deposits. The geology at the site was characterized by the completion of over 40 soil borings conducted within and surrounding the landfill site. The existing soil association at the site is the Weld-Adena-Colby, specifically consisting of Ascalon and Weld series soils at the site. Ascalon soils are well drained and typically contain varying amounts of sand and gravel. Field infiltration rates range from $4x10^{-4}$ to $1x\ 10^{-3}$ cm/sec. The Weld series soils surfaces are a non-calcareous loamy material but becomes calcareous sandy loam with depth. Field infiltration rates range from approximately $4x10^{-5}$ to $1x10^{-4}$ cm/sec. In general, the thickness of the unconsolidated surficial materials at the site increase from west to east across the site, ranging from approximately 10 feet in the western portions of the site to 50 feet in the eastern portions along Schumaker Road.

The East Regional Landfill is located approximately 35 miles east of the structural axis of the Denver Basin. The uppermost bedrock formation beneath the site is the Tertiary Upper-Cretaceous Denver Formation and is the uppermost bedrock formation beneath the surficial materials at the site. The Denver Formation is a continental-type deposit characterized by interbedded shale, claystone, siltstone, and sandstone. Across the Denver Basin, the Denver Formation ranges in thickness from 200 to 1000 feet (600-1500 feet in some sources) and commonly contains lenses of lignite.

The Denver Aquifer is the uppermost aquifer beneath the landfill and compost site and is of the most interest to site operations. Investigations show a saturated thickness of less than 50 feet for this aquifer with the base of the aquifer in the vicinity of the site at approximately 160 feet below the ground surface, implying that the top of the aquifer is approximately 110 feet below the surface. The water bearing strata are described as irregular lenses of interbedded sandstone and siltstone that are hydraulically separated by thick sequences of claystone. The water is classified as either a sodium sulfate or sodium bicarbonate of acceptable quality.

According to the 2025 Second Semi-Annual Groundwater Monitoring Report, prepared by Weaver Consultants Group on January 7, 2026, the groundwater elevations in the area

of the compost operations range from approximately 20 to 30 feet below the working elevation of the compost pad. Groundwater generally flows to the northeast across the site. A potentiometric surface map is included as Figure 1 of the groundwater monitoring report.

Permeability testing was conducted on the various unsaturated and saturated materials during characterization for the ERL site. The permeability of the unsaturated materials was evaluated by packer tests which resulted in an average permeability of 2.8×10^{-4} cm/sec. The permeability of saturated materials was conducted by the slug test method in and around the ERL site. The slug out test resulted in an average permeability of 2.8×10^{-4} cm/sec, while the slug in test resulted in an average permeability of 2.2×10^{-4} cm/sec. Further discussion of the results are in Appendix A of the 2025 EDOP prepared by AEC.

Flow rate calculations in for the saturated materials in the Perched Groundwater Zone are problematic due to the isolated and discontinuous nature of many of the saturated materials encountered in this zone. A groundwater time of travel calculation was included in Appendix A of the 2025 EDOP prepared by AEC. Results indicate a groundwater flow velocity of 2.5 feet per year, with the assumption that Darcy's law is valid for the system.

2.4.1 Surface water

The landfill is situated in an area of very flat topography with little topographical relief and generally poorly defined drainage features. Surface water flow across the site is predominantly overland sheet flow to the northeast but can concentrate in natural drainage swales and constructed control features during heavy precipitation events. Surface water exits the site at multiple locations. Within disturbed areas, flow paths are variable based on localized grading conditions; however, overall site drainage is generally directed toward the northeast.

Incorporating information from the original Compost Pad Design and the Compost Pad Expansion shows that the pad is sloped in the northeast direction at an approximate 1% slope. The pad is sloped towards (2) CMP culverts. Precipitation and liquids generated through the compost process will follow the grading of the pad, through the culverts, emptying into the collection basin. However, liquids in the very northeastern portion of the pad are diverted to the culverts by a 1.5-foot-tall berm. Further discussion of the pad and collection basin construction is described in Section 3.0.

Surface water runoff that leaves the site in the northeast corner travels northward along a very gentle natural swale, passing under 88th Avenue through three culverts approximately ½ mile north of the site and eventually enters an unnamed tributary to Lost Sand Creek (also referred to as West Sand Creek on some maps) approximately 2 miles northeast of the property.

Surface water exiting the site on the western site boundary enters an unnamed tributary, which is normally dry, that runs northward and then east to enter Lost Sand Creek approximately 8 miles northeast of the site.

All of the known surface water features within one-half mile of the site are ephemeral and only exhibit flow following heavy precipitation with the possible exception of what has been identified as a riparian habitat located approximately 2000 feet west of the compost area on Waste Management property.

The landfill footprint is not located within any 100-year flood plain designated by the Federal Emergency Management Agency (FEMA). The compost area is within the permitted landfill footprint and is outside of any flood plain. A flood plain study was conducted during the permitting of the Waste Management CSI facility north of the site by QCI Consultants (November 1989) and is referenced in Appendix A of the 2025 EDOP prepared by AEC.

There are no known public water supply wells, springs, or surface water intakes within a one-mile radius of the facility.

2.4.2 Groundwater Quality

Groundwater monitoring well CMW-1 is present on site and used to monitor compost operations. The well is located downgradient from the collection basin to monitor the uppermost groundwater beneath the basin to assess potential impacts from compost operations. Potential environmental impacts to the groundwater from the compost operations are much less than those from the landfill. Monitoring well CMW-1 is sampled in accordance with Section 4.12. Sampling results for 2025 indicate that all analyzed constituents across all wells are generally within historical ranges. Recent sampling of well CMW-1 indicates that anion and cation concentrations are also generally within historical ranges, and no fecal coliform or Salmonella species were detected in the samples.

2.4.3 Geologic Hazards

The ERL and compost operations are located in a geologically stable area with relatively flat lying stratigraphic features. Based on the geology and surface morphology of the area in which the compost operations will be located, slope stability, faulting, folding, rockfalls, landslides, subsidence, or erosion is not a concern. The facility is designed with very gentle slopes and small features that do not present a slope stability concern and any erosion will be minor and very local in nature.

3 DESIGN

The original compost pad design was completed by AEC in March 2011. Accompanying compost design drawings to the 2011 Compost EDOP are located in Appendix A. The Compost Pad was expanded in 2025 using the document titled "Modification to the Engineering Design and Operations Plan Compost Operations" dated January 30, 2025, prepared by HDR with conditional approval by CDPHE on July 25, 2025. The construction of the pad was documented in a CQA report by AEC dated October 18, 2011, and approved with modifications by the CDPHE in a letter dated November 8, 2011. Information presented in this section are summarized excerpts from AEC or HDR.

Incorporating information from the original Compost Pad Design and the Compost Pad Expansion indicates that the compost pad area is approximately 247,000 square feet. The collection basin depth and storage characteristics incorporated into the calculations were based on the stage-storage table provided in the 2011 Stormwater Calculations. The 2011 Stormwater Calculations are provided in Appendix B. The compost pad is situated to take advantage of the surface topography and is designed with an approximate 1% slope to the northeast. The pad is sloped northeast towards (2) 12" CMP culverts. Precipitation and liquids generated through the compost process will follow the grading of the pad, through the culverts, emptying into the collection basin. However, liquids in the very northeastern portion of the pad are diverted to the culverts by a 1.5-foot-tall berm. Further discussion of the pad and collection basin construction is described below.

All feedstocks and bulking materials with the potential to adversely affect surface soils or groundwater are processed on the compost pad. Innocuous feedstocks such as grass, untreated lumber and wood waste, and leaves/brush may be ground outside of the compost pad.

3.1 General Fill

According to the 2011 Compost CQA Plan, general fill soil was used in the backfilling of over-excavated materials to design the subgrade prior to construction the clay liner system and also used to construct the perimeter berms around the pad and collection basin. Compaction of general fill was conducted with heavy equipment and placed in accordance with the approved design plans and tolerances.

3.2 Low Permeability Liner

The compost pad was constructed with a minimum one-foot of clay recompacted to a permeability of $\leq 1x10^{-6}$ cm/sec as is potentially required by Section 14.4.4 of 6 CCR 1007-2. Permeability tests conducted during construction indicated the soils had a hydraulic conductivity of $1x10^{-7}$ cm/sec or less. The clay liner on the compost pad is protected from desiccation and damage with a minimum of one foot of protective site soils.

3.3 Feedstock Processing Areas

The maximum throughput capacity compost operation is 10,000 cubic yards on site at any one time.

The compost pad has a one-foot minimum low permeability clay soil liner. A minimum 12-inch protective cover layer was placed on top of the low permeability liner. The soils were placed in a uniform fashion, compacted and graded using standard construction equipment (dozer). Minimum slope grade and thickness were achieved with survey verification. However, the working surface was constructed at a minimum thickness of 12 inches to allow for heavy equipment operation or other vehicular access, and to minimize damage or failure that creates ponding or infiltration of surface water greater than the designed permeability rate as stated in 14.4.4 (B)(4) of the Regulations.

The working surface is sloped at an approximate 1% grade to prevent the ponding of water on the compost pad. The current compost pad footprint, including the expansion, covers an approximate area of 247,000 square feet for Class III feedstock processing. This area accommodates composting operations as well as storage of food waste, limbs, chipped wood, and compost.

3.4 Surface Water Containment

The collection basin is located north of the compost pad and is constructed with a minimum of three-feet of site clay compacted to a permeability of $1x10^{-6}$ cm/sec in compliance with Section 14.4.4 of 6 CCR 1007-2. The clay liner in the basin is also protected with a minimum one foot of protective site soils. The collection basin is designed to retain the water volume runoff from the compost pad resulting from the 24-hour 25-year storm event plus an additional two-foot of freeboard. Stormwater calculations, performed by AEC, are located in Appendix B.

The compost pad and collection basin are built above the surrounding grade and are partially surrounded by a berm designed to prevent surface water run-on to the pad from the peak discharge from the 24-hour 25-year storm event. The berm is a minimum of 1.5-feet above the top of the compost pad and three to four feet above the surrounding grade on the south, east, and north sides of the area. Based on the existing topography, surface water runoff toward the compost area will naturally be directed around the compost pad to enter the site drainage north of the compost area. There is no need to construct additional surface water drainage around the perimeter of the compost area with the exception of the west side, where a small (approximately 1-foot deep by 2-feet wide bottom) drainage is designed on the west side of the access road to route surface water runoff toward the pad northward to the site drainage system. Based on site observations following construction, the south, east, and north perimeters of the compost area can be graded as necessary to direct surface water around and away from the pad and basin.

The collection basin will be pumped periodically and the water collected will generally be used for moisture control of the compost materials. ln accordance with regulations, the collection basin will be dewatered within 30 calendar days of a storm event so that full runoff storage capacity is maintained and that a minimum of two feet of freeboard is maintained at any given time. Should the capacity of the tank prove insufficient, the ERL may also re-circulate water pumped from the collection basin into the active portions of the landfill under the same criteria that the landfill leachate is recirculated (i.e., areas that do not have final cover and stormwater is controlled within the lined landfill).

3.5 Construction Quality Assurance Plan

A Construction Quality Assurance Plan (CQA) titled "Compost Pad and Collection Basin, East Regional Landfill" was developed by AEC dated March 2011 to provide assurance that the compost pad and collection basin were constructed in accordance with the approved design. The compost pad expansion CQA was developed using the approved CQA Plan. The CQA Plan is included in Appendix D.

Following construction, AEC prepared the document titled "Construction Quality Assurance Report" on October 18, 2011, for the compost facility, with approval from CDPHE on November 8, 2011. This report provides certification for on-site construction of the compost facility.

Following construction of the compost pad expansion, Geo-Logic Associates prepared the document titled "Final Construction Quality Assurance Report, Compost Pad Expansion". The CQA documentation report was submitted on March 6, 2026, pending approval from CDPHE. The report can be found in Appendix E.

4 OPERATIONS

A Class III compost operation will be conducted by the Static Pile (SP) method on the compost pad spanning approximately 247,000 square feet, located in the approximate center of the East Regional Landfill permit boundary. The compost piles will be actively managed by adding moisture and turning as necessary to maintain acceptable moisture content, distribute moisture evenly throughout the pile, and ensure aerobic conditions to provide oxygen to the process and minimize odors.

The compost pad is graded to the northeast at an approximate 1% grade toward a collection basin at the northeast corner of the pad. This basin is designed to contain the runoff volume from the 25-year 24-hour storm event from the compost pad plus two feet of freeboard. The pad and collection basin are elevated above the surrounding ground surface, preventing stormwater from the 25-year 24-hour storm event from entering the compost pad and basin. Surface water runoff to the compost area will be diverted around the pad and basin to the site surface water control system. More detailed information on the design of the compost area and associated surface water controls is discussed in Section 4.0.

4.1 General

The composting facility is subject to compliance with the operational requirements set forth in Sections 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.1.5, 2.1.7, 2.1.8, 2.1.9, 2.1.11, 2.1.15, 2.1.17, 2.1.18, and Section 14 of the Regulations.

Regulatory Section	Requirement Description Summary	EDOP Section Reference
Section 2.1.1	Regulatory Compliance	Section 1 (Introduction)
Section 2.1.2(A)	Hazardous Waste	Section 2.3: Feedstocks
Section 2.1.2 (B)	Hazardous Waste Prevention	Section 2.3: Feedstocks, Section 4.3 Materials Acceptance
Section 2.1.2 (C), (D), (E)	Waste Characterization Plan	Section 2.3 Feedstocks, See overall Site EDOP (AEC, 2025) Appendix Q: Waste Characterization Plan
Section 2.1.3	Nuisance Conditions	Section 4.7: Nuisance Conditions and Odor Plan

		Section 4.8: Contingency Plan
Section 2.1.4	Water Pollution	Section 3.4: Surface water containment, Section 4.8: Contingency Plan, Section 4.12: Groundwater Monitoring Plan
Section 2.1.5	Aquifer Protection	Section 2.4: Potential Impacts to Existing Surface Water and Groundwater Section 3: Design
Section 2.1.7	Debris Containment	Section 4.5: Access Control Section 4.7.3: Windblown Debris
Section 2.1.8	Control Public Access	Section 4.5: Access Control
Section 2.1.9	Open Burning	Section 4.9: Fire Protection Plan
Section 2.1.11	Mitigating Windblow Debris	Overall Site EDOP (AEC, 2025) Section 7.5.3: Dust
Section 2.1.15	Groundwater Standards Compliance	Section 4.12: Groundwater Monitoring Plan
Section 2.1.17	No groundwater/surface water disposal	Section 2.4: Potential Impacts to Existing Surface Water and Groundwater
Section 2.1.18(A),(B),(C)	Release Notification Required	Site wide monitoring plan (CMW-1 is included)

4.2 Financial Assurance

The ERL will amend their financial assurance engineering cost estimates and financial assurance mechanism to reflect the cost associated with implementation of this Closure and Post-Closure Care and Maintenance Plan and the Facility will submit the revised cost estimates prior to operating the facility. Within 60 days after the increase, the owner/operator will either increase the value of the mechanism and submit evidence of

such increase to the Department and local governing authority or obtain other financial assurance to cover the increase.

During the active life of the ERL, the financial assurance instrument will be annually revised to account for inflation and will be submitted to the Financial Assurance Manager annually by April 30th for approval.

After department approval of the initial cost estimate, the ERL will replace original cost estimates with new cost estimates every five years, unless requested by the Department.

4.3 Material Acceptance

The facility will receive bulk feedstocks and bulking materials at the site in a variety of vehicles including, but not limited to, transfer trailers, roll-offs, farm trucks, pick-up trucks and possibly passenger vehicles. Some wastes, particularly yard waste, received from the general public, may arrive in plastic yard or garbage bags and the customer will be required to empty the bags and dispose of them.

Signage at the facility entrance denotes the name of the facility and lists wastes that are allowed and prohibited from disposal at the facility. All of the wastes intended for use in this compost operation are also allowed for disposal at the facility, and the list of wastes prohibited for disposal are also prohibited for use in the compost operation with the exception of discarded liquid food waste such as beer, soda, etc.

All vehicles carrying waste or material to be incorporated into the compost operation will pass through the scales and check in with the scalehouse attendant. The attendant will question the vehicle driver about the material being transported and examine the waste load if necessary based on the description of the waste given by the driver. The attendant will direct the driver to either the disposal area or the compost area, as appropriate. Additional signage on the facility access road will direct vehicles to either the disposal area or the compost area. A facility employee will be present during offloading of all compost feedstocks to ensure only appropriate and acceptable materials are offloaded in the compost area. If materials inappropriate for composting are discovered to have been offloaded in the compost area, such as garbage or materials contaminated with excessive amounts of inappropriate material, the material will be removed and transported to the landfill for disposal. If material is identified that is neither appropriate for composting or disposal, the driver of generator will be contacted to remove the material from the site.

Some innocuous dry wastes such as untreated lumber, yard and tree trimmings, and grass clippings, will be offloaded either on or off of the compost pad depending on their volume and anticipated time until needed. Manure and other feedstocks will be stored on the compost pad. Clean wood bulking materials may be stored off the compost pad, in designated areas, without creating environmental concerns.

4.3.1 Bulking Materials

The primary purpose of incorporating bulking materials into the compost process is to provide porosity to the compost piles to promote air circulation, which is necessary to enhance the aerobic compost process and minimize odors due to anaerobic conditions. The typical compost operation uses ground wood chips as a bulking material, and wood chips and untreated construction or demolition lumber ground on site or transported to the site are anticipated to provide the majority of bulking material used at the facility.

The facility has a grinder on site that produces chips of approximately two-inches in size and will serve as an adequate bulking material. While most woods have a relatively high C:N ratio, only a small percentage of the total carbon is available in chips of this size and so should not be counted on to provide an appreciable amount of available carbon. Although the various feedstocks and bulking materials will be mixed during turning of the piles, certain feedstocks may be run through the grinder along with lumber and wood to provide some level of mixing prior to being placed in piles.

4.3.2 Feedstock Management

Feedstock materials will be inspected closely by the scalehouse and operators. Incompatible loads will be rejected from the compost site and re-routed to the landfill. Individuals with acceptable loads will be directed to unload their materials within specific locations of the receiving area.

Feedstocks and bulking agents will arrive at the facility by truck or other means of transportation. After an initial inspection of the material, receipt of the feedstocks and bulking agents will be documented. Documentation will include generator and transporter information, classification of the material, and volume information. If required, samples of the materials may be taken at this time.

After documentation is completed, the materials will be delivered to the designated composting/recycling operation and offloaded at designated areas for blending or mixing, placement in piles, storage, and or further processing.

Food waste will be covered with ground bulking agents and accumulated until there is sufficient quantity for grinding and/or mixing, or it will be ground (if needed) and mixed with bulking agent. When sufficient volume is present the mixture will be placed into piles. The operator will monitor the site for material that is left exposed and creating nuisance condition and cover as appropriate.

Production activities will consist of mixing or blending of feedstocks, bulking agents, and wetting agents on the processing site, and formation of, or placement in appropriate processing units (windrows, static piles, etc.). If wetting agents are needed (liquids), mixing will be accomplished in above ground mixing basins, mixing equipment, or applied with tank trucks directly to the piles.

The operator will utilize EPA Method 9095B – Paint Filter Liquids Test, Revision 2, dated November 2004 to determine the location for mixing of Feedstock materials. Feedstock materials passing the paint filter test will be mixed on the production site surface, in the existing concrete feedstock mixing area. Feedstock materials not passing the paint filter test will be considered liquid and will not be accepted. The operator will be responsible to observe the physical characteristics of high moisture materials being mixed or blended at the compost site. Should excessive amounts of free liquids or puddles be observed, that material will be mixed or blended on the existing concrete pad. The best available technology utilizing site operating practices and equipment will be used in determining which composting procedure to use.

4.4 Surface Water Control

Liquids that have had contact with the feedstocks (with the exception of innocuous feedstocks such as grass, leaves, etc) or actively composting materials will be referred to as leachate and must be handled appropriately. All compost leachate will remain on the lined work pad or drain to the collection basin. The operator has a mobile tank on site for storage of fresh water and leachate for use in the compost operation if needed to transport excess liquids.

The collection basin is sized to retain anticipated volume of runoff from the compost pad resulting from the 24-hour 25-year storm event, plus two feet of free-board. In accordance with Section 14.4.4 of 6 CCR 1007-2, Part 1, the collection basin will be dewatered within 30 calendar days of a storm event so that full runoff storage capacity is maintained and that a minimum of two feet of freeboard is maintained at any given time.

Compost leachate removed from the collection basin can be managed in a number of ways, including:

1. Direct application back onto the compost;
2. Sprayed onto the active landfill face for evaporation and recycling through the landfill leachate collection and removal system.

4.5 Access Control

ERL maintains the required access control for a solid waste facility, as outlined in Section 2.1.8 of the Regulations. The landfill and compost facility are surrounded by fencing and is entered from the east side of the site off of Schumaker Road. This entrance is gated and is locked when the facility is closed.

4.6 Signage

Signage at the facility entrance denotes the name of the facility and lists wastes that are allowed and restricted from disposal at the facility. All of the wastes intended for use in this compost operation are also allowed for disposal at the facility, and the list of wastes prohibited for disposal are also prohibited for use in the compost, with the exception of discarded liquid food waste that may be used in the compost operations.

4.7 Nuisance Conditions & Odor Plan

The compost operation has the potential to create nuisance conditions, with odor being of most concern. Most nuisance conditions are a result of improper management of the composting process from receipt of the feedstocks and bulking materials at the facility through removal of the finished compost off of the site. Fortunately, most nuisance conditions can be eliminated, minimized, or mitigated by instituting proper management techniques. The potential nuisance conditions and methods to eliminate or mitigate the conditions are discussed below.

4.7.1 Dust

Dust may be created by vehicles transporting feedstocks and bulking materials to the facility. The addition of the compost operation to the site landfill operations is not expected to increase site vehicle traffic by any appreciable amount since most of the vehicles arriving with compost materials would normally still be arriving at the facility for disposal purposes if the compost operation was not available. The landfill has a current Construction Permit that includes a dust control plan to minimize the generation and migration of particulate emissions. That plan includes such items as incorporating crushed asphalt paving on portions of the site access roads, compaction and revegetation of soil stockpiles, and the use of water or other dust suppressants as needed on site to control dust generation. These same control measures are applicable to the dust suppression measures resulting from the compost traffic and will be implemented to control particulate emissions resulting from traffic associated with the compost operation. The facility has a water well for ready access to water and a water truck for watering roads, stockpiles, and other disturbed areas on an as-needed basis.

Dust may also be generated during processing of feedstocks, particularly bulking materials, if the grinder is used. However, if grinding of food waste is needed, the high moisture content of the materials is not anticipated to create dust. The grinder is equipped with a water spray system that will be used in the event dust suppression is necessary during grinding operations. Dust may also be generated during the screening of finished compost. Grinding and screening operations are not conducted on an ongoing basis. These operations are only needed periodically when processing feedstocks and bulking materials, or if needed on completed compost.

Wind conditions are monitored with guidance from the overall site EDOP. Should the ERL close during high wind events, the compost operations will also close. Compost operations are subject to the same operational closures as the ERL.

4.7.2 Odors

The compost operations are situated in the center of the site approximately 550 feet from the southern property boundary and well within the landfill footprint. Odors from the compost operation are expected to dissipate within a short distance, and the generation of most compost odors can be eliminated or reduced through proper operational techniques and adjustments.

Odors may be generated from the feedstocks themselves or from adverse conditions within the compost itself. The best method to minimize odors from feedstocks with particularly strong odors is to process, mix, and pile the feedstock as soon as it arrives at the facility. The compost process will begin, and odors will decrease as soon as the proper mix of feedstocks, providing an acceptable C:N ratio, is complete and bulking materials are added to provide access to oxygen.

Localized sources of ammonia odor within the piles can usually be mitigated by turning and mixing the compost materials. This is most common with high nitrogen materials such as grass cuttings that can easily "mat" and become anaerobic.

If an odor is discovered that cannot be mitigated by the procedures discussed above, additional corrective actions will be implemented. These actions may include consultation with technical experts to evaluate the cause of the odor and to select an appropriate remedy. These remedies can include commercial chemical masking agents, odor destroying compounds (such as lime), or a change to operational procedures. Odor control activities will be evaluated prior to implementation to verify that the compost quality or end-use characteristics will not be adversely impacted. For example, adding lime to the compost can mitigate odors, but will lower the pH of the compost to a range where it limits its usefulness as a growing media.

At ERL, odor self-inspections are performed daily and follow a consistent route through and around the facility. Inspections are completed by staff and submitted using an approved tracking tool. If an odor is identified during an inspection, ERL staff will identify the odor using the Odor Classification Library. All odors will be addressed, and any odor complaints will be addressed immediately. Odors identified by field staff or complaints are to be entered into tracking tool within 24 hours. Upon identification of an odor or receipt of a complaint, meteorological data will be recorded, the source of the odor will be identified, and mitigation of the odor will occur at this time. Documentation of inspections, complaints, site conditions, source of the odor, and mitigation actions will be maintained in the Site Operating Record.

4.7.3 Windblown Debris

Windblown debris is a very minimal concern with the compost operations. Incidental quantities of paper, plastic, and cardboard commonly associated with food waste may be present in the compost feedstock. Prior to the sale or distribution of compost, visual inspections and screening of compost material will be conducted to remove incidental quantities of paper, plastic, and cardboard. In addition, the landfill has a litter control plan that includes regular patrols of the facility and surrounding public property and extends to the compost operation.

4.7.4 Vectors

The compost operations have the potential to provide a food source for vectors such as birds, rodents, and flies. Rodents are not expected to be a major concern because of the frequency of activity associated with the compost operations. Controlling the rodent population removes one potential food source for birds. If necessary, professional extermination services will be obtained to reduce vectors that attract birds, such as rodents.

The compost operation can potentially attract birds because the feedstocks can provide a food source. The expected frequency of activity on the compost pad should be sufficient to discourage bird landings in the compost area. The ERL has an approved Bird Mitigation Plan that was developed with input from the Federal Aviation Administration (FAA) and the Wildlife Services Division of the United States Department of Agriculture (USDA) and reviewed by the FAA, USDA, Denver International Airport, and the Front Range Airport. The Bird Mitigation Plan includes actions to be taken to mitigate any bird concerns, including the use of hand-fired pyrotechnic shells, and will be implemented for the compost operations if birds become problematic.

Fly abatement will be managed through daily operational controls, including minimizing the exposed waste area, promptly placing and covering fly-attracting materials (e.g., food waste), and maintaining positive drainage to prevent conditions conducive to fly breeding and activity.

4.7.5 Mud

The compost pad is sloped to drain toward the collection basin, but planned pile placement will intercept much of the surface water runoff. This configuration is beneficial in that it reduces the required size of the collection basin but also provides a ready source of water for moisture conditioning of the compost. Since the surface of the compost pad is compacted soil, it may be muddy at times. Good housekeeping practices such as periodic grading to eliminate low spots will reduce the impact of mud on the compost operations.

Compost traffic is directed by the scalehouse attendant and signage at the compost pad identifies where green waste should be placed. Typically, only landfill equipment that does not leave the site will travel on most of the compost pad. Most vehicles traveling to the site with feedstock or bulking material will be restricted to the southern portions of the pad for offloading, but all areas subject to traffic will be paved with recycled asphalt.

If mud becomes problematic, the operator may place a bed of wood chips over the protective soils to mitigate mud issues, and one foot of protective soils will be maintained at all times. Continued visual maintenance will be conducted to evaluate the need for periodic grading at the site.

4.8 Contingency Plan

The procedures and protocol in this EDOP provide management of the delivery of unapproved feedstock, water contamination, and control of nuisance conditions.

- Delivery of unapproved feedstock. As a part of the ERL operation, materials arriving at the facility that are not acceptable for composting can generally be disposed of in the landfill. Signage at the entrance gate of the site lists prohibited wastes that are not acceptable for the compost operation or landfilling. All vehicles entering the facility with compost or waste materials are required to pass over the scales and check in with the scalehouse attendant. During offloading, the compost materials will be examined. If unacceptable materials are identified, the vehicle driver will be requested to haul it over to the landfill for disposal, or remove it from the site, as appropriate. Records are maintained of all vehicles arriving at the facility. In the case that unacceptable compost materials are discovered after the driver has left the site, the driver or generator will be contacted and asked to remove the materials. If the driver or generator cannot be contacted, landfill personnel will remove the waste themselves and transport it to the landfill for disposal or arrange for transport to an alternative appropriate facility.

- Surface Water Contamination. As described in this EDOP, there is little potential for contamination of surface or groundwater because of the compost operations. If compost leachate breaches the pad or collection basin, the affected soil will be excavated and disposed of in the landfill or incorporated into the compost operation. If the leachate enters the site drainage system, the potential of the leachate to discharge from the facility will be evaluated and the appropriate sampling and remedial efforts will be implemented. In the very unlikely event that groundwater contamination occurs from the compost operations, the source and causes behind the contamination will be evaluated and repaired, either through repair of damaged structures, or changes in the facility design or operations. The extent and severity of the contaminated groundwater will be evaluated, and the operator will take all steps required by regulations to correct the problem. If a

release occurs that results in potential environmental harm, the CDPHE and the Adams County Health Department will be notified.

- Occurrence of nuisance conditions. The control of nuisance conditions is discussed in detail above. The most effective step to control nuisance conditions is by implementing proper operational procedures and good housekeeping practices. If nuisance conditions develop, the appropriate actions will be taken to mitigate the nuisance condition, including modifications to the receipt and processing of compost materials. Professional assistance will be obtained, if needed.

4.9 Fire Protection Plan

The composting facility will comply with Section 2808 of the International Fire Code specifically 2808.3 which states, "[P]iles shall not exceed 25 feet in height, 150 feet in width and 250 feet in length". The fire code is authorized to allow the pile size to be increased with additional fire protection provided. Fires associated with feedstock preparation or composting will be managed with onsite machinery by moving and isolating materials.

The fire hazard for a properly operated compost operation with piles of the size planned for this facility is minimal. Temperature monitoring of the piles will allow excess temperature generation to be identified and the piles will be turned to cool down should the pile temperature continue to climb above 160°F.

A 16-foot wide fire lane is provided between each pile to provide access to site equipment to fight small fires and for larger fire-fighting equipment in the event a large fire occurs. The relatively small size of the piles simplifies any fire-fighting efforts. If smoke or small fire from a pile is observed, access to the compost area to anyone other than site personnel will be restricted. Site personnel will create a buffer around the smoking portion of the compost using the site front loader, dozer, or other suitable equipment to remove other potentially combustible materials to a safe distance from the smoke or fire. Soil will be placed on the compost in an effort to extinguish the fire. When safe to do so, the soil and compost will be mixed to provide a non-combustible mixture and the material will be allowed to cool to ambient temperature. Alternatively, a nearby source of water, such as the compost collection basin, storage tank, or water truck may be used in an attempt to extinguish the fire. Once the fire is extinguished and the material has cooled to ambient temperature, the material may be re-introduced to the compost operation or disposed of in the landfill. Although fire extinguishers will not likely be effective if a fire starts in the compost, all site equipment is outfitted with a fire extinguisher.

In the event of a larger fire, the Bennett Fire Department or 911 will be contacted immediately. All non-essential personnel will be prohibited from entering the compost area and required to remain at safe distance away from the compost facility. If the fire is

large enough, the entire landfill facility will be closed and no one other than site or emergency personnel will be allowed into the property.

The Bennett Fire Department will be notified of these operations and given the opportunity to provide comments or recommendations to these plans. The facility will comply with all local fire codes.

Open burning of solid waste deposited at ERL is prohibited except as otherwise authorized by applicable regulations. In extreme emergencies, the Department may authorize the supervised burning of large quantities of combustible materials, such as agricultural wastes, silvicultural wastes, land clearing debris, diseased trees, or debris from emergency cleanup operations.

4.10 Personnel Training

Facility personnel that are responsible for operational aspects of the compost operations will be required to read and understand the information and requirements provided in this EDOP. In particular, the training will place emphasis on compost processing, pile management, recordkeeping, and mitigation of nuisance conditions. At least one employee knowledgeable in compost operations will be on site at all times that compost feedstocks are delivered to the facility or when processing or pile management activities are occurring.

All employees will be trained to identify prohibited materials and potential problems that could occur when the compost is not being attended to, including the presence of smoke or fires, odors, or windblown debris. The ERL will not go longer than 12 months without having an operator on staff that has completed the Certified Compost Training. Emergency contact numbers will be posted in a conspicuous location in the gatehouse, and will include the facility manager's phone number, the corporate office phone number, and the local police and fire department phone numbers. A copy of the employee training form is included as Appendix F of this Compost EDOP.

4.11 Compost Processing Time and Temperatures

The regulatory requirements for each composting process are based on the requirements to produce compost for public distribution. The requirements for the compost process are found in Section 14 of the Regulations.

4.11.1 Compost Processing – Static Pile

Static pile technology is similar to aerated windrow technology in that large piles of predetermined mixtures are constructed. Static piles must meet the minimum requirements for windrow composting which includes a minimum of five turns during the period when temperatures are above 131 degrees Fahrenheit. The difference from

aerated windrows is that the piles are allowed to compost without excessive aeration events (turning). Temperature in the piles will again elevate as they do in the aerated windrow technique. Pile structure is very important in this process. Pile structure will determine the airflow and subsequent availability of oxygen to the bacteria, moisture balance, and overall efficiency of the composting process.

The static piles will be constructed so that they are approximately 25 feet wide at the base, and approximately five feet high. The length of each pile may vary depending on available pad space. However, the maximum on-site capacity of the compost operation will not exceed 10,000 cubic yards at any one time. Windrow size and configuration may be adjusted provided that the equipment can adequately mix and turn the pile. A 16-foot-wide fire lane will be maintained in between compost rows. A schematic of the anticipated pile configuration is shown on Drawing 1.

Bulking materials will be added to the piles if necessary to increase the porosity of the mix to be composted. Depending on the nature and moisture content of the feedstocks, a 2: I ratio by volume of bulking material to feedstock may be a good place to start; however, this is dependent on the chemical and physical nature (moisture content, particle size, etc). In addition, as the decomposition process proceeds during composting, the compost material settles, reducing the original pore space available for oxygen and increasing the bulk density of the composting material. Among other factors, this condition is highly dependent on the extent of grinding of the feedstocks. The various feedstocks, and bulking materials if needed, will be mixed on the compost pad using a loader. Water may be added during the mixing process, if necessary, to create a relatively moist mixture. Water may be obtained from the stormwater retention basin or the on-site well. A qualitative check for the proper moisture content is to provide sufficient water to create a sheen in the mixture but not so much that it runs off after it is mixed in. It should be noted that the actual percentage of moisture required will change during the compost process as the pore space is reduced and the compost settles.

The moisture content and temperature of all actively composting piles will be monitored and logged on a regular basis. To evaluate the progress of new piles as they are constructed, they will initially be monitored on a daily basis each day that the facility is open until a pattern of speed and efficiency of the compost process becomes evident. The moisture content and pore space will be qualitatively evaluated and the temperature measured by the operator and will be adjusted as deemed necessary. Different populations of microorganisms are active under different environmental conditions within the compost.

The operator will qualitatively assess the aerobic condition of the compost by visual and olfactory examination. An initially aerobic pile can become anaerobic if there is either too much moisture in the pile (water fills the pore space rather than oxygen), or there is not sufficient pore space to maintain a minimum level of oxygen necessary to support the microbial population. As stated above, one indicator of excessive moisture content is that

moisture is draining out of the pile, which can sometime be observed as the pile settles and the amount of pore space is reduced. The generation of ammonia is the predominant qualitative indicator of anaerobic conditions (which can also be caused by an excessively low C:N ratio, i.e., too much nitrogen). Because the outer layer of the pile is exposed to the environment, anaerobic conditions may be present deeper in the pile and not evident until the interior of the pile is exposed. Aerobic conditions can also be locally restricted within the pile, usually due to poor mixing of a particular feedstock. Depending on the causes of an anaerobic condition, it can be remedied by one or a combination of the following; l) decreasing the moisture content, 2) increasing the available carbon content, 3) mixing in additional bulking material, and/or, 4) turning the pile to more thoroughly mix the feedstocks and bulking material and introduce oxygen.

4.11.2 Temperature and Moisture Monitoring Procedures

The operator will monitor each pile for temperature and moisture content to determine the effectiveness of the feed-stock blend to elevate temperatures. At a minimum, pile temperatures are taken once per day while operators are on-site, and moisture readings are taken once per week. If piles are below effective composting temperatures of 130°-150°F, the operator will implement techniques to increase temperatures and/or moisture within the pile per the desired compost recipe. Monitoring is also adjusted for the applicable age of each pile because younger piles require more monitoring than older established piles.

As the feedstock materials enter the active composting phase, composting temperatures, duration, and turning rates are monitored and documented by ERL. In order to be distributed for public use, utilizing the static pile, the compost must reach and maintain an internal pile temperature of at least 131˚F for a period of 15 days or longer, the 15 days do not need to be consecutive.

The elevated temperatures reached in composting destroy pathogens, weed seeds, and impart the black color of final compost. Typically, temperature rises at the beginning of the process (assuming the pile is at the right moisture, has enough air, and the right mix of nutrients) as the thermophilic bacteria become most dominant.

At ERL, compost pile temperatures are monitored using Reotemp thermometers. Calibration of Reotemp thermometers is not required as verified by the manufacturer. A thermometer is inserted into the material when the pile is created and passively records readings at 15-minute intervals. Each active compost pile will be monitored and will be equipped with a Reotemp thermometer. Temperature records are maintained at ERL.

The following methodology for temperature monitoring may also be employed in lieu of the Reotemp thermometers if needed or required.

A four-foot probe fitted with thermisters at 10”, 20”, 30” and 40” is attached to a temperature recording device. A four-foot probe with a single sensor can also be used if

tape is placed at the four different depths on the probe. The process is somewhat slowed using the single sensor method as the temperature has to stabilize as the probe is pushed from one depth to the next. Temperatures should be compared with the other tests to get an overall view of how the compost process is progressing.

ERL will perform testing on the composting site's piles no less than 5 per site as follows:

1. Put the pile #, date, time, and ambient temperature on a Compost Temperature Log sheet. Occasionally, the probe should be tested and calibrated.

2. Determine the four sites that will be tested by quartering the row. It is best to randomly test different points within each quarter.

3. At Site One carefully insert the probe all the way into the row at a 25 to 30 degree angle just to the downside of the peak of the row.

4. Let the device stabilize. The reading should stay the same for 10 seconds before recording the values. Record the temperatures in the Site One boxes across from right to left (high temperatures to low).

5. ***Carefully remove the probe by pulling on the steel section of the probe and by pulling as straight as you can from the insertion hole***. Pulling at an angle to the hole will bend the probe and pulling on the yellow probe handle will break the thermister connections.

6. Repeat steps 4 through 6 for sites two, three, four and five.

7. Optional equipment and or other protocol may be used as long as the intent and quality assurance measures described above are maintained and results recorded.

4.12 Groundwater Monitoring Plan

The Groundwater Monitoring Plan is summarized below.

The design of the compost facility and the composting methods and operations discussed in this EDOP should have a negligible impact on the groundwater or surface water quality and requires minimal environmental monitoring outside of that already conducted for the landfill operations.

The ERL will sample the compost facility groundwater monitoring well, CMW-1, semi-annually concurrently with the semi-annual groundwater monitoring events for the landfill. The sampling protocol (including the field parameters) currently conducted for the landfill groundwater monitoring wells will be adhered to, but the sample will be submitted for laboratory analysis of only the inorganics listed in Table 1 in Section 14.6 of

6 CCR 1007-2, Part 1. The constituents to be sampled include Arsenic, Cadmium, Copper, Lead, Mercury, Nickel, Selenium, and Zinc. These constituents will be analyzed by the laboratory using SW846 Method 6020 or SW846 Method 6010, or another equivalent method. The data will be reviewed and included in the semi-annual groundwater monitoring reports that are submitted to the CDPHE and Adams County following each sampling event and will be maintained in the site Operating Record.

The groundwater monitoring program for compost facility monitoring CMW-1 has been refined to focus on constituents that are most representative of potential impacts associated with composting operations at the ERL facility. The analyte list has been reduced to the inorganic parameters identified in Table 1 of Section 14.6 of 6 CCR 1007-2, Part 1 as these constituents are the most relevant indicators of potential leachate-related impacts from the composting feedstocks managed at the site. Given that the constituents in Table 1 reflect the contaminants of concern for saleable compost, WCG believes they also reflect appropriate contaminants of concern for potential groundwater contamination from the compost operation. Salmonella and fecal coliform are excluded because they naturally will rapidly alternate.

4.13 Finished Compost Sample Testing/Analysis

Sampling of the finished compost will be conducted by testing the constituents presented in Table 1 of this Compost EDOP.

In addition to the constituent testing presented in Table 1 of this Compost EDOP, ERL will also have finished product tested to certify its nitrogen, phosphorus, potassium, and carbon content.

Finished compost samples will be collected in general accordance with the methodology outlined below. Compost sampling and analysis may also be conducted in accordance with applicable TMECC methods. According to the regulations, samples will be collected at a frequency of once every 10,000 cubic yards of compost produced, or annually, whichever is more frequent. However, the site may elect to conduct sampling at a greater frequency as operational conditions warrant. A composite sample of the finished compost is collected from the finished pile by scraping back the surface of the pile in multiple locations spaced uniformly around the pile and collecting finished compost from each location. The composite sample is then mixed for uniformity and placed into sample containers. Samples are then placed in the cooler for shipment. In addition, a Chain of Custody form will be shipped in the cooler. Samples will be shipped overnight to remain within the 24-hour holding time for fecal coliform testing.

If testing of finished compost results in exceedance of the maximum levels presented in Table 1, the compost should be managed as follows:

- Finished compost with exceedances in biological parameters (including fecal coliform and Salmonella) shall be reintroduced to the active composting process for re-treatment.
- Finished compost with exceedances inorganics (heavy metals) shall be disposed of in the ERL.

Finished compost that has been sampled, tested, and meets regulatory standards for distribution will be considered a final product. No raw or partially composted feedstock, bulking materials, or liquid waste shall be added to finished compost before or during storage, handling or distribution. If such materials are introduced to finished compost, the compost will be deemed no longer finished and will be reintroduced into the active composting process. Prior to distribution, the compost shall be re-sampled and retested to verify compliance.

5 RECORD KEEPING AND REPORTING

The facility will be required to maintain an operating record for the facility to include the following records as required by Section 14.4.6 of 6 CCR 1007-2:

- Windrow/pile aeration data
- Financial assurance documentation
- Operational monitoring data, including time and temperature readings
- Engineering Design and Operations Plan
- Facility personnel records
- Compost analytical data
- Feedstock analytical data
- Liquid waste analytical data
- The types of materials received for composting
- Amount in tons or cubic yards of each material received for composting
- Amount of unprocessed feedstock and feedstock in process onsite at the beginning of the previous calendar year
- Amount of unprocessed feedstock and feedstock in process onsite at the end of the previous calendar year
- Amount of compost distributed the previous calendar year

Records of temperatures and sample tests will be maintained and kept in the landfill office. Temperature records will be input into the computer database/digital file, as well as maintained in a written log.

Compost sample data received from companies performing sample testing will be kept up-to-date and filed in the landfill office.

ERL will complete the Composting Facility Annual Reporting Form and submit it to the CDPHE by March 1 of each year for the previous calendar year.

6 CLOSURE & POST CLOSURE CARE

Closure and Post-Closure Care and Maintenance of the compost operation is simplified because of its location at the ERL. As stated earlier, the compost facility is within the waste footprint of the landfill and will need to be closed or moved to accommodate future landfilling operations. Presumably, the landfill will still be open when it becomes necessary to close or move the compost operations. In that case, it is assumed the feedstocks, bulking materials, actively composting materials, and finished compost are suitable for disposal in the landfill.

6.1 Composting Operation Closure

In accordance with Section 14.4.7 of 6 CCR 1007-2, if at any time the composting facility ceases operations, including discontinued receipt, processing, and sale or use of materials for more than 180 days, the owner or operator shall notify the CDPHE and Adams County Health Department and begin closure of the facility unless otherwise approved.

Within 14 calendar days of commencing closure of the compost operations, the facility shall provide written notification of the initiation of closure activities to the CDPHE and Adams County.

Closure activities shall not exceed 90 days unless otherwise approved by the CDPHE and Adams County. The following steps will be taken to close the compost facility:

1. A notice will be placed at the landfill entrance notifying customers that the compost operations is no longer accepting materials for composting.

2. All stored raw feedstock and bulking material will be transferred to the ERL for disposal, or to another appropriate solid waste disposal facility. The materials may also be transported to another facility for beneficial use with approval from the CDPHE and Adams County.

3. All other wastes associated with the compost operations will likewise be transferred to the ERL or another permitted solid waste disposal facility for disposal.

4. All tanks, buildings, equipment, and other structures will be removed from the compost facility and reused or disposed of at an appropriate facility.

5. The work pad and collection basin soils will be sampled to ensure that no contaminants, particularly pathogens, remain in the soil. The soils will remain in place if they are free of contaminants associated with the compost operations and are suitable for successful revegetation. If testing indicates that pathogens or other contaminants associated with compost operations remain in the soil or that

they are otherwise not suitable for a successful revegetation program, they will be removed and disposed of at an appropriate solid waste disposal facility.

6. The collection basin will be filled in with site soils and the entire compost area will be regraded and revegetated to restore it to pre-development conditions. Clean site soils will be used as necessary to bring the compost facility to approximate the original grades and the area will be prepared and seeded in accordance with recommendations by the Natural Resource Conservation Service (NRCS) or other qualified vegetation specialist.

7. All storm water control and collection structures will be removed, regraded, and revegetated as described above unless specifically approved to remain on site by the CDPHE and Adams County.

8. All partially composted feedstocks and bulking material will be disposed of at the ERL or other appropriate solid waste disposal facility. These materials may also be transported to another compost facility with approval from the CDPHE and Adams County.

9. Finished compost will be distributed off-site or used on site for closure of the facility or in reclamation activities at the ERL.

Within 30 calendar days of completing closure activities, the facility shall provide written notification to the CDPHE and Adams County to document that all the requirements and conditions of the closure plan have been achieved.

Following closure of the compost operations, a notation must be placed on the deed notifying any potential purchaser that the property has been used as a composting facility. This requirement does not apply if the compost area is later used for landfill operations, as a separate deed notification would then be required to reflect its use as a landfill.

6.2 Post-Closure Care and Maintenance

There is no need to conduct post-closure care and maintenance of the compost facility if landfill operations extend through the compost area. This is because the surface soils directly beneath the compost facility will be excavated to accommodate the landfill design.

If the compost area is not used for landfilling following its closure, the compost area will be inspected and maintained for a minimum post-closure care and maintenance period of five years following closure. If requested, the post-closure period may be reduced by the CDPHE after consulting with Adams County or may be extended by the CDPHE after

consulting with Adams County, if it is determined that the lengthened period is necessary to protect human health and the environment.

Sampling and testing of the reclaimed compost area is not necessary unless agricultural testing of the soils is required to develop a specific fertilizer or amendment program to aid in establishing vegetation. However, monitoring well CMW-1 will continue to be sampled through the post-closure care period.

The compost facility will be inspected twice per year for the post-closure period to verify that the revegetation program is successful and to identify potential problem areas such as erosion. Because of the nearly flat grades after closure of the compost facility, erosion is not expected to be a problem. Each inspection will be documented, and the results will be included in an inspection report submitted annually to the CDPHE and Adams County.

Following the end of the post-closure care and maintenance period, the owner or operator must submit a certification signed by an independent Colorado registered P.E. verifying that the post-closure care has been completed in accordance with the post-closure plan and has been placed in the operating record.

7 REFERENCES

1. East Regional Landfill, Engineering/Design and Operations Plan, American Environmental Consulting, LLC, February 2025.

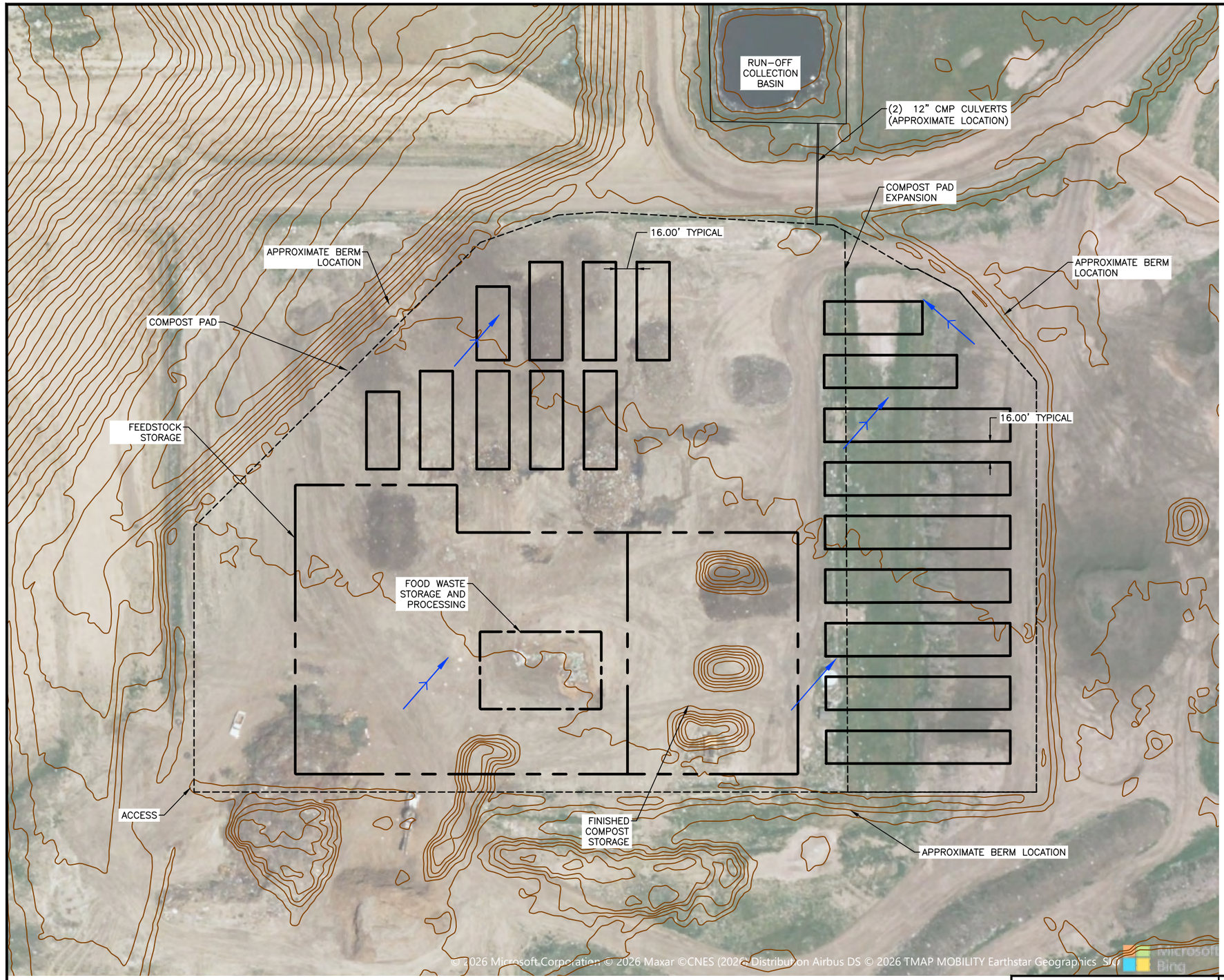
2. East Regional Landfill, Engineering Design and Operations Plan, Composting Operations, American Environmental Consulting, LLC, March 10, 2011.

3. Construction Quality Assurance Plan, Compost Pad and Collection Basin, East Regional Landfill, Adams County, Colorado, American Environmental Consulting, LLC, March 2011.

4. Construction Quality Assurance Report, Compost Facility Construction, East Regional Landfill, American Environmental Consulting, LLC, October 18, 2011.

5. Final Construction Quality Assurance Report, Compost Pad Expansion, East Regional Landfill, Geo-Logic Associates, March 6, 2026.

DRAWINGS



LEGEND:

- APPROXIMATE COMPOST PAD BOUNDARY
- FLOW DIRECTION
- FEEDSTOCK STORAGE (APPROXIMATE LOCATION)
- ACTIVE COMPOST PILES (APPROXIMATE LOCATION)

N

0 40 80

SCALE IN FEET

[X] DRAFT
[ ] FOR INFORMATIONAL PURPOSES ONLY
[ ] ISSUED FOR CONSTRUCTION

DATE: 03/2026
FILE: 0120-754-10-01
CAD: Compost Pad Layout.dwg

DRAWN BY: GEH
DESIGN BY: JBM
REVIEWED BY: JBM

Weaver Consultants Group

PREPARED FOR
FIVE PART DEVELOPMENT, LLC

REVISIONS

NO.	DATE	DESCRIPTION

COMPOST PAD LAYOUT

ADAMS COUNTY, COLORADO

WWW.WCGRP.COM

DRAWING 1

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G:\Projects\Republic\east region\1\compost exhp\compost pad layout.dwg

TABLES

TABLE 1

MAXIMUM CONSTITUENT CONCENTRATION FOR COMPOST SOLD OR DISTRIBUTED FOR OFF-SITE USE (MG/KG DRY WEIGHT BASIS)

Constituents	Maximum Level
Inorganics[1] (mg/kg)	
Arsenic (As)	41
Cadmium (Cd)	39
Copper (Cu)	1500
Lead (Pb)	300
Mercury (Hg)	17
Nickel (Ni)	420
Selenium (Se)	100
Zinc (Zu)	2800
Biological	
Fecal coliform[2]	-
Salmonella[2]	-

[1] Inorganic Methodology: Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846) Third Edition, December 1996: As, Cd, Cu, Pb, Ni, Se, and Zn by Method 6010 or 7000, Hg by 7471. These documents are available for review at the Colorado Department of Public Health and Environment (See §1.1.2 of these Regulations) and the State Publications Depository Libraries.

[2] The owner or operator shall ensure that:

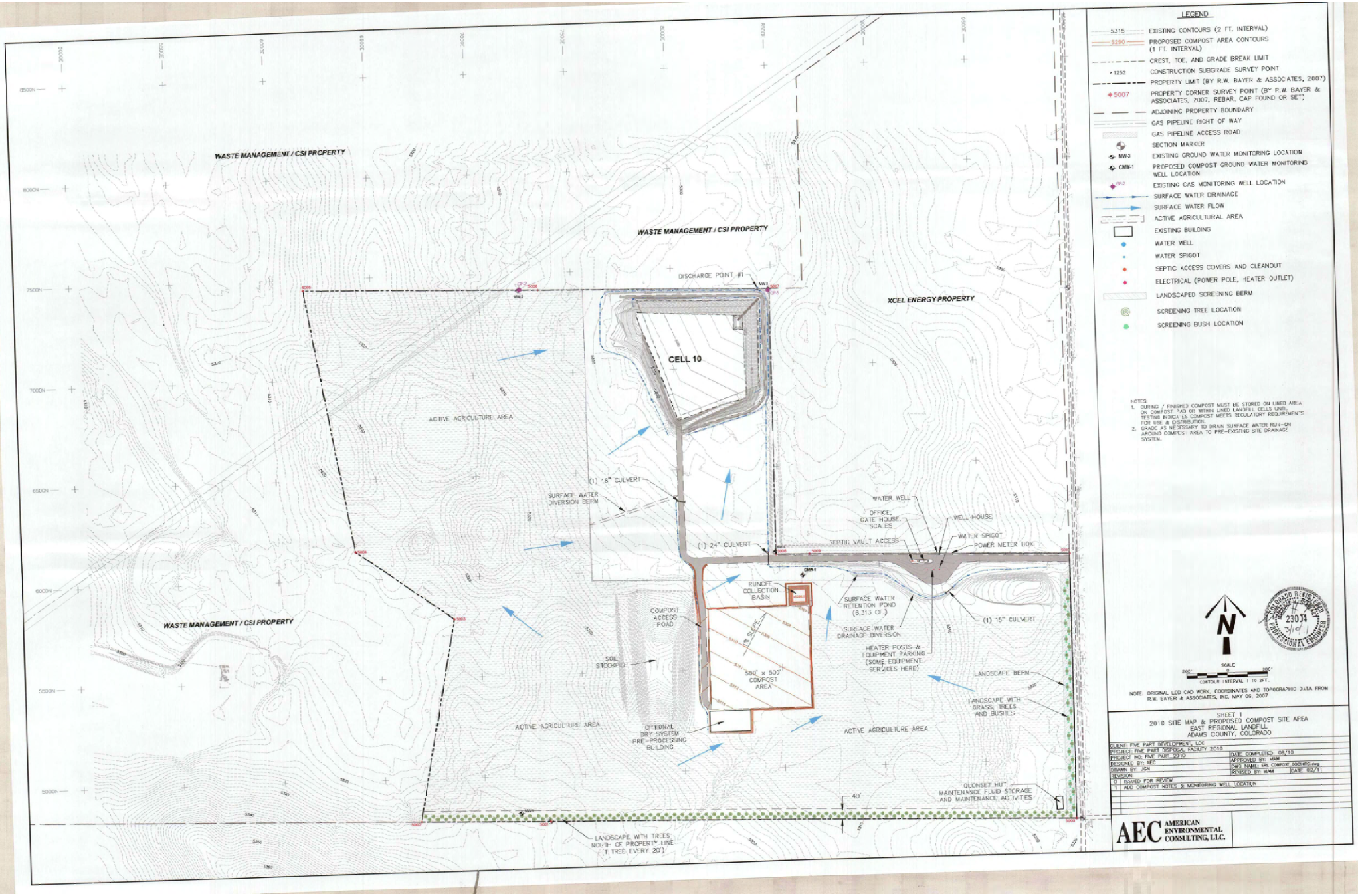
a. The density of the fecal coliform present in the compost is less than 1000 Most Probable Number per gram of total solids (dry weight basis); or

b. The density of Salmonella. Bacteria in the compost is less than three Most Probable Number per four grams of total solids (dry weight basis) at the time the compost is to be sold or otherwise distributed for use.

Reference: Table 1 in Section 14 of Colorado's "Regulations Pertaining to Solid Waste Disposal Sites and Facilities," 6 CCR 1007-2.

APPENDIX A

DESIGN DRAWINGS



LEGEND

- 5315 — EXISTING CONTOURS (2 FT. INTERVAL)
- 5290 — PROPOSED COMPOST AREA CONTOURS (1 FT. INTERVAL)
- CREST, TOE, AND GRADE BREAK LIMIT
- 1252 — CONSTRUCTION SUBGRADE SURVEY POINT
- PROPERTY LIMIT (BY R.W. BAYER & ASSOCIATES, 2007)
- 5007 — PROPERTY CORNER SURVEY POINT (BY R.W. BAYER & ASSOCIATES, 2007, REBAR, CAP FOUND OR SET)
- ADJOINING PROPERTY BOUNDARY
- GAS PIPELINE RIGHT OF WAY
- GAS PIPELINE ACCESS ROAD
- SECTION MARKER
- MW-3 — EXISTING GROUND WATER MONITORING LOCATION
- CMW-1 — PROPOSED COMPOST GROUND WATER MONITORING WELL LOCATION
- CP-2 — EXISTING GAS MONITORING WELL LOCATION
- SURFACE WATER DRAINAGE
- SURFACE WATER FLOW
- ACTIVE AGRICULTURAL AREA
- EXISTING BUILDING
- WATER WELL
- WATER SPIGOT
- SEPTIC ACCESS COVERS AND CLEANOUT
- ELECTRICAL (POWER POLE, HEATER OUTLET)
- LANDSCAPED SCREENING BERM
- SCREENING TREE LOCATION
- SCREENING BUSH LOCATION

NOTES:
1. CURING / FINISHED COMPOST MUST BE STORED ON LINED AREA ON COMPOST PAD OR WITHIN LINED LANDFILL CELLS UNTIL TESTING INDICATES COMPOST MEETS REGULATORY REQUIREMENTS FOR USE & DISTRIBUTION.
2. GRADE AS NECESSARY TO DRAIN SURFACE WATER RUN-ON AROUND COMPOST AREA TO PRE-EXISTING SITE DRAINAGE SYSTEM.

N

SCALE
200' 0 200'
CONTOUR INTERVAL 1 TO 2FT.

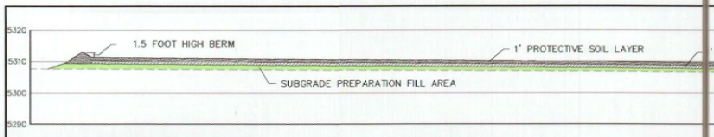
NOTE: ORIGINAL LDD CAD WORK, COORDINATES AND TOPOGRAPHIC DATA FROM R.W. BAYER & ASSOCIATES, INC. MAY 05, 2007

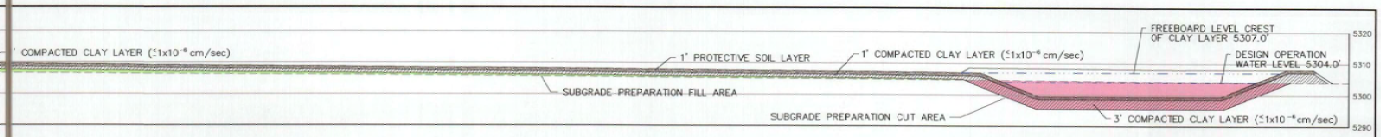
COLORADO REGISTERED PROFESSIONAL ENGINEER 23034 5/9/11

SHEET 1
2010 SITE MAP & PROPOSED COMPOST SITE AREA
EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

CLIENT: FIVE PART DEVELOPMENT, LLC	
PROJECT: FIVE PART DISPOSAL FACILITY 2010	
PROJECT NO: FIVE_PART_2010	DATE COMPLETED: 05/10
DESIGNED BY: AEC	APPROVED BY: MAM
DRAWN BY: JDN	DWG NAME: ERL_COMPOST_001-ORIG.dwg
REVISION:	REVISED BY: MAM DATE: 05/11
0 ISSUED FOR REVIEW	
1 ADD COMPOST NOTES & MONITORING WELL LOCATION	

AEC AMERICAN ENVIRONMENTAL CONSULTING, LLC.





CROSS SECTION B-B'

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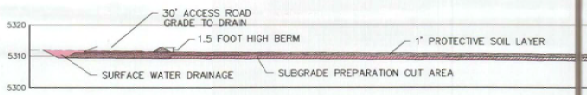
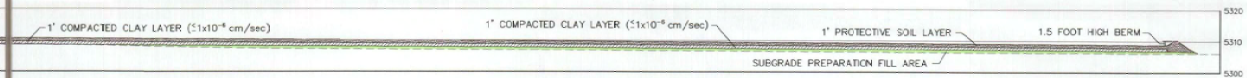
VERTICAL SCALE 1" = 20'





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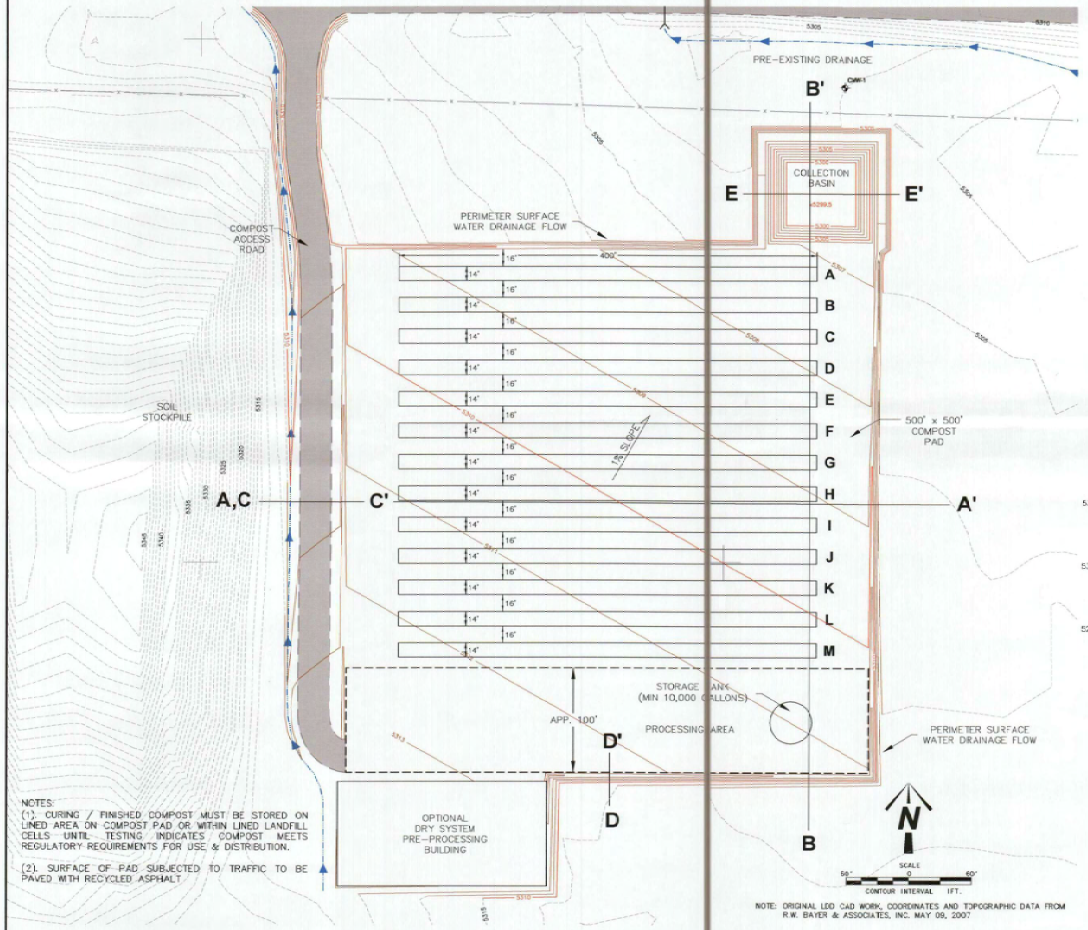
VERTICAL SCALE 1" = 20'

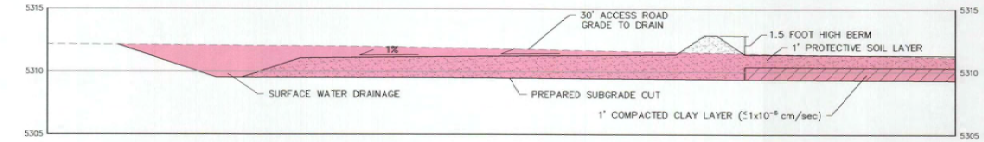


NOTES:
(1). CURING / FINISHED COMPOST MUST BE STORED ON LINED AREA ON COMPOST PAD OR WITHIN LINED LANDFILL CELLS UNTIL TESTING INDICATES COMPOST MEETS REGULATORY REQUIREMENTS FOR USE & DISTRIBUTION.

(2). SURFACE OF PAD SUBJECTED TO TRAFFIC TO BE PAVED WITH RECYCLED ASPHALT.

TYPICAL WINDROW CONFIGURATION

NOTE: ORIGINAL LDD CAD WORK, COORDINATES AND TOPOGRAPHIC DATA FROM R.W. BAYER & ASSOCIATES, INC. MAY 09, 2007



CROSS SECTION C-C'

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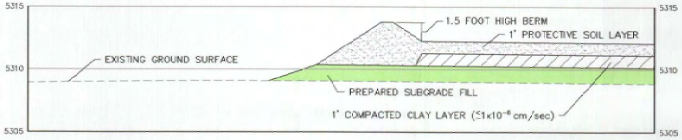
VERTICAL SCALE 1" = 5'



CROSS SECTION D-D'

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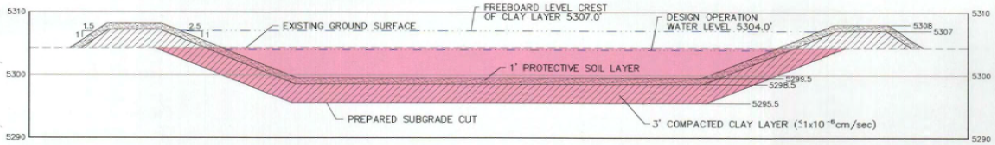
VERTICAL SCALE 1" = 5'



CROSS SECTION E-E'

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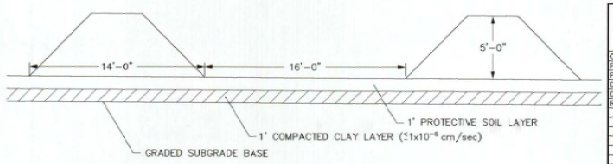
VERTICAL SCALE 1" = 10'



TYPICAL WINDROW DIMENSIONS

N.T.S

LEGEND

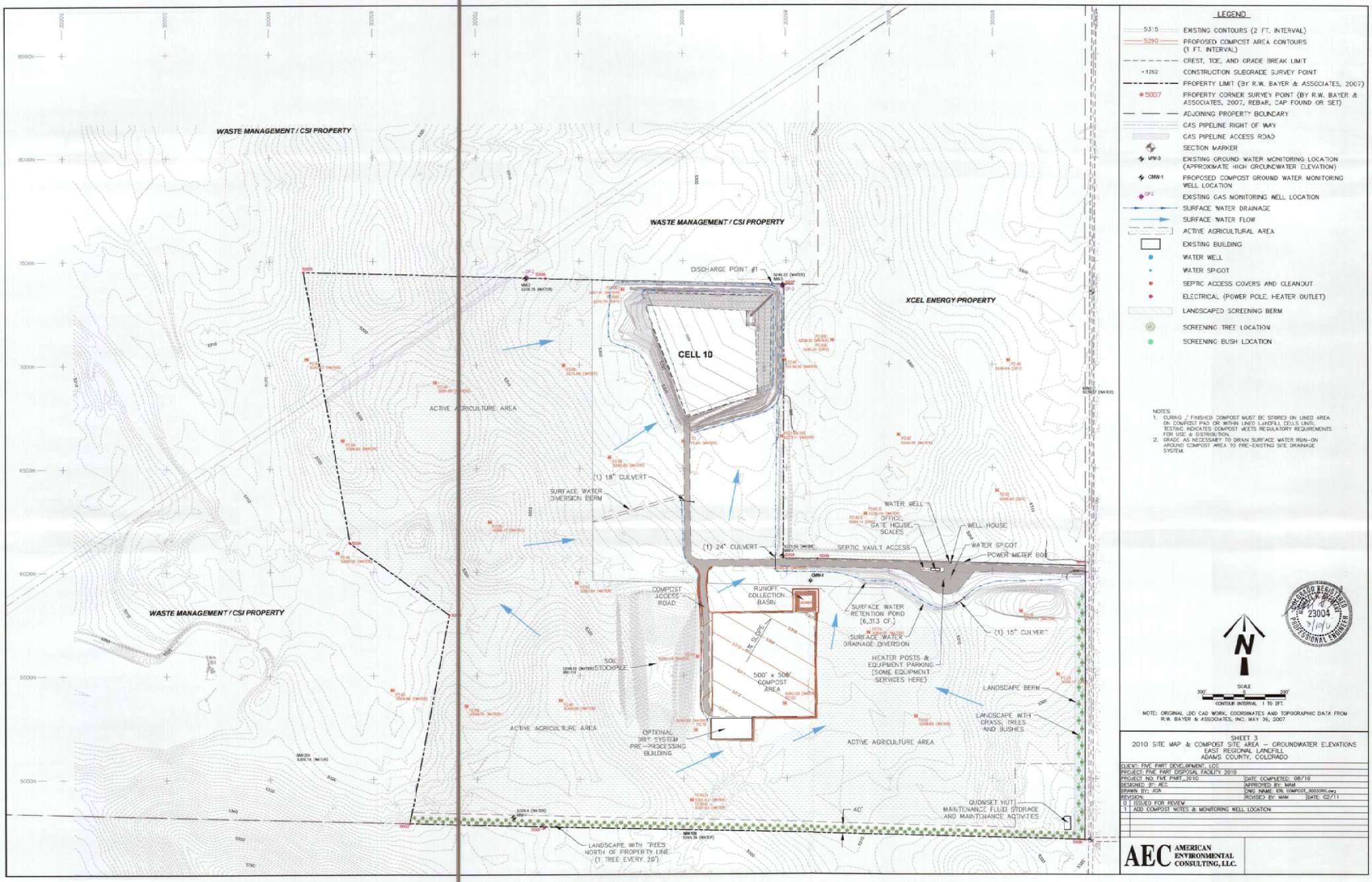
- COMPOST SUBGRADE EXCAVATION (CUT) AREA
- COMPOST SUBGRADE GRADING (FILL) AREA
- COMPOST CLAY LAYER (1 FOOT COMPACTED ≤1x10⁻⁶ cm/sec ON PAD) (3 FOOT COMPACTED ≤1x10⁻⁶cm/sec IN BASIN)
- PROTECTIVE SOIL COVER (1 FOOT ON PAD)

SHEET 2
COMPOST SITE DETAIL & SECTIONS
EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

CLIENT: FIVE PART DEVELOPMENT, LOC	
PROJECT: FIVE PART DISPOSAL FACILITY 2010	
PROJECT NO: FIVE PART_2010	DATE COMPLETED: 08/10
DESIGNED BY: AEC	APPROVED BY: MAM
DRAWN BY: JGN	DWG. NAME: ERL COMPOST_002.dwg
REVISION	REVISED BY: MAM DATE: 02/11
0 ISSUED FOR REVIEW	
1 ADD COMPOST NOTES & MONITORING WELL LOCATION	

AEC AMERICAN ENVIRONMENTAL CONSULTING, LLC.

PRELIMINARY REVIEW NOT FOR CONSTRUCTION
PE No. 23004
3/10/11
PROFESSIONAL ENGINEER



LEGEND

- 5315 — EXISTING CONTOURS (2 FT. INTERVAL)
- 5290 — PROPOSED COMPOST AREA CONTOURS (1 FT. INTERVAL)
- CREST, TOE, AND GRADE BREAK LIMIT
- ×1252 — CONSTRUCTION SUBGRADE SURVEY POINT
- PROPERTY LIMIT (BY R.W. BAYER & ASSOCIATES, 2007)
- ⊕5007 — PROPERTY CORNER SURVEY POINT (BY R.W. BAYER & ASSOCIATES, 2007, REBAR, CAP FOUND OR SET)
- ADJOINING PROPERTY BOUNDARY
- GAS PIPELINE RIGHT OF WAY
- GAS PIPELINE ACCESS ROAD
- SECTION MARKER
- MW-3 — EXISTING GROUND WATER MONITORING LOCATION (APPROXIMATE HIGH GROUNDWATER ELEVATION)
- CMW-1 — PROPOSED COMPOST GROUND WATER MONITORING WELL LOCATION
- GP-2 — EXISTING GAS MONITORING WELL LOCATION
- SURFACE WATER DRAINAGE
- SURFACE WATER FLOW
- ACTIVE AGRICULTURAL AREA
- EXISTING BUILDING
- WATER WELL
- WATER SPIGOT
- SEPTIC ACCESS COVERS AND CLEANOUT
- ELECTRICAL (POWER POLE, HEATER OUTLET)
- LANDSCAPED SCREENING BERM
- SCREENING TREE LOCATION
- SCREENING BUSH LOCATION

NOTES:
1. CURING / FINISHED COMPOST MUST BE STORED ON LINED AREA ON COMPOST PAD OR WITHIN LINED LANDFILL CELLS UNTIL TESTING INDICATES COMPOST MEETS REGULATORY REQUIREMENTS FOR USE & DISTRIBUTION.
2. GRADE AS NECESSARY TO DRAIN SURFACE WATER RUN-ON AROUND COMPOST AREA TO PRE-EXISTING SITE DRAINAGE SYSTEM.

COLORADO REGISTERED 23004 PROFESSIONAL ENGINEER

N

SCALE 200' 0 200'
CONTOUR INTERVAL 1 TO 2FT.

NOTE: ORIGINAL LDD CAD WORK, COORDINATES AND TOPOGRAPHIC DATA FROM R.W. BAYER & ASSOCIATES, INC. MAY 26, 2007

SHEET 3
2010 SITE MAP & COMPOST SITE AREA – GROUNDWATER ELEVATIONS
EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

CLIENT: FIVE PART DEVELOPMENT, LCC	
PROJECT: FIVE PART DISPOSAL FACILITY 2010	
PROJECT NO: FIVE PART_2010	DATE COMPLETED: 08/10
DESIGNED BY: AEC	APPROVED BY: MAM
DRAWN BY: JGN	DWG NAME: ERL COMPOST_SOO3DRG.dwg
REVISION:	REVISED BY: MAM DATE: 02/11
0 ISSUED FOR REVIEW	
1 ADD COMPOST NOTES & MONITORING WELL LOCATION	

AEC AMERICAN ENVIRONMENTAL CONSULTING, LLC.

HDR ENGINEERING, INC.
1670 BROADWAY, SUITE 3400
DENVER, COLORADO 80202
919-376-7777

REPUBLIC SERVICES

VICINITY MAP

1000 0 1000 2000
SCALE IN FEET

N

Conformed Drawings For:

East Regional Landfill

Compost Pad Expansion

Project No.
10418951

Adams County, Colorado
May 2025
Issued for Bid

INDEX OF DRAWINGS

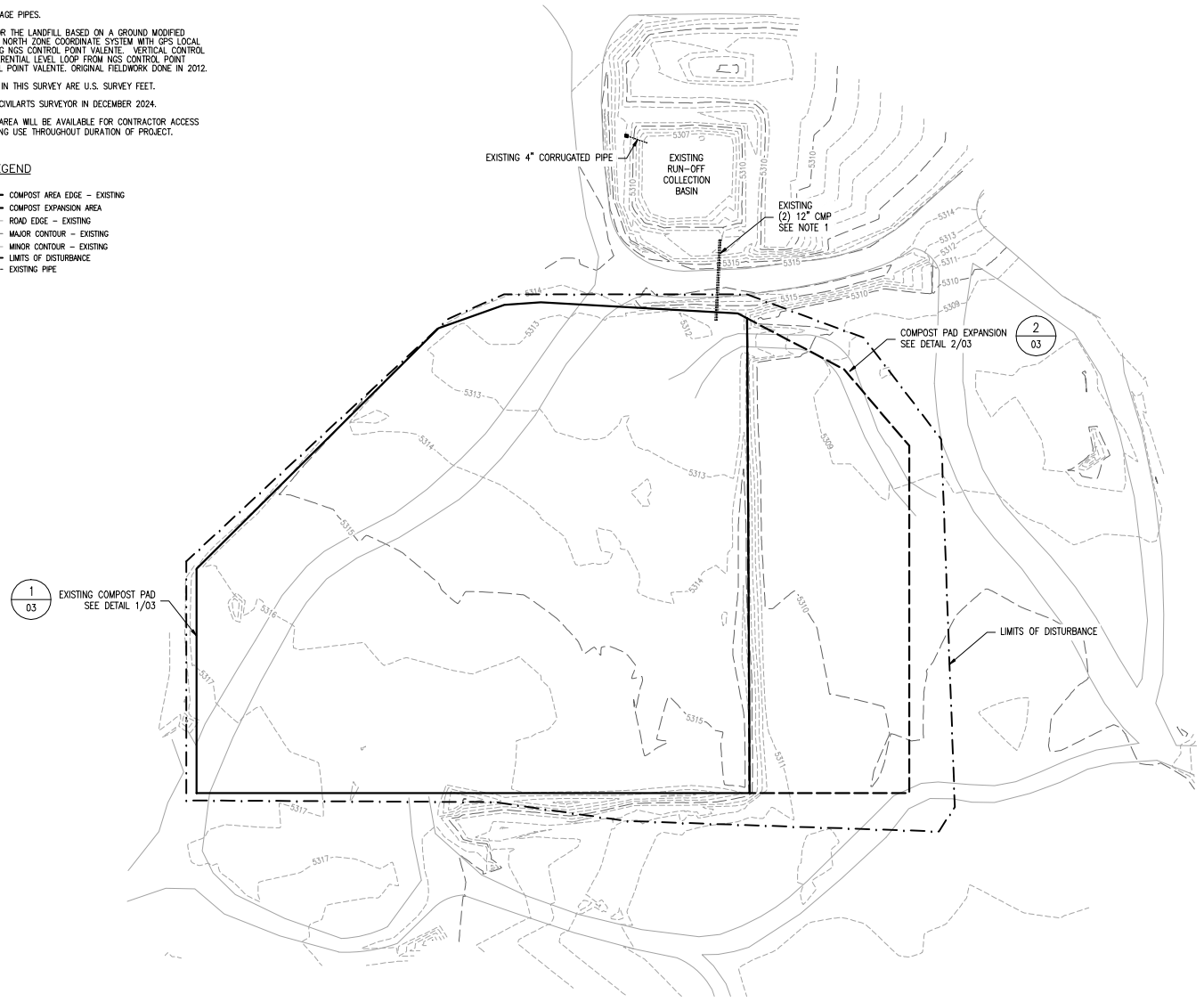
00C-00 COVER SHEET AND DRAWING INDEX
00C-01 EXISTING CONDITIONS AND SITE PLAN
00C-02 COMPOST AREA EXPANSION GRADING PLAN
00C-03 COMPOST AREA EXPANSION SECTIONS AND DETAILS

NOTES:

1. PROTECT EXISTING DRAINAGE PIPES.
2. HORIZONTAL CONTROL FOR THE LANDFILL BASED ON A GROUND MODIFIED COLORADO STATE PLANE NORTH ZONE COORDINATE SYSTEM WITH GPS LOCAL BASE STATION OCCUPYING NGS CONTROL POINT VALENTE. VERTICAL CONTROL NAVD88 BASED ON DIFFERENTIAL LEVEL LOOP FROM NGS CONTROL POINT BRYTEC TO NGS CONTROL POINT VALENTE. ORIGINAL FIELDWORK DONE IN 2012.
3. UNITS OF MEASUREMENT IN THIS SURVEY ARE U.S. SURVEY FEET.
4. SURVEY PERFORMED BY CIVILARTS SURVEYOR IN DECEMBER 2024.
5. EXISTING COMPOST PAD AREA WILL BE AVAILABLE FOR CONTRACTOR ACCESS AND STORAGE/STOCKPILING USE THROUGHOUT DURATION OF PROJECT.

LEGEND

- COMPOST AREA EDGE – EXISTING
- COMPOST EXPANSION AREA
- ROAD EDGE – EXISTING
- –100– MAJOR CONTOUR – EXISTING
- – – 99 – – – MINOR CONTOUR – EXISTING
- LIMITS OF DISTURBANCE
- EXISTING PIPE



ISSUE	DATE	DESCRIPTION
	5/8/2025	ISSUED FOR BID
0	1/16/2025	ISSUED FOR REVIEW

PROJECT MANAGER	SF
PROJECT ENGINEER	SF
DESIGNER	RS
PROJECT NUMBER	10279381

EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

COMPOST PAD EXPANSION

EXISTING CONDITIONS AND SITE PLAN

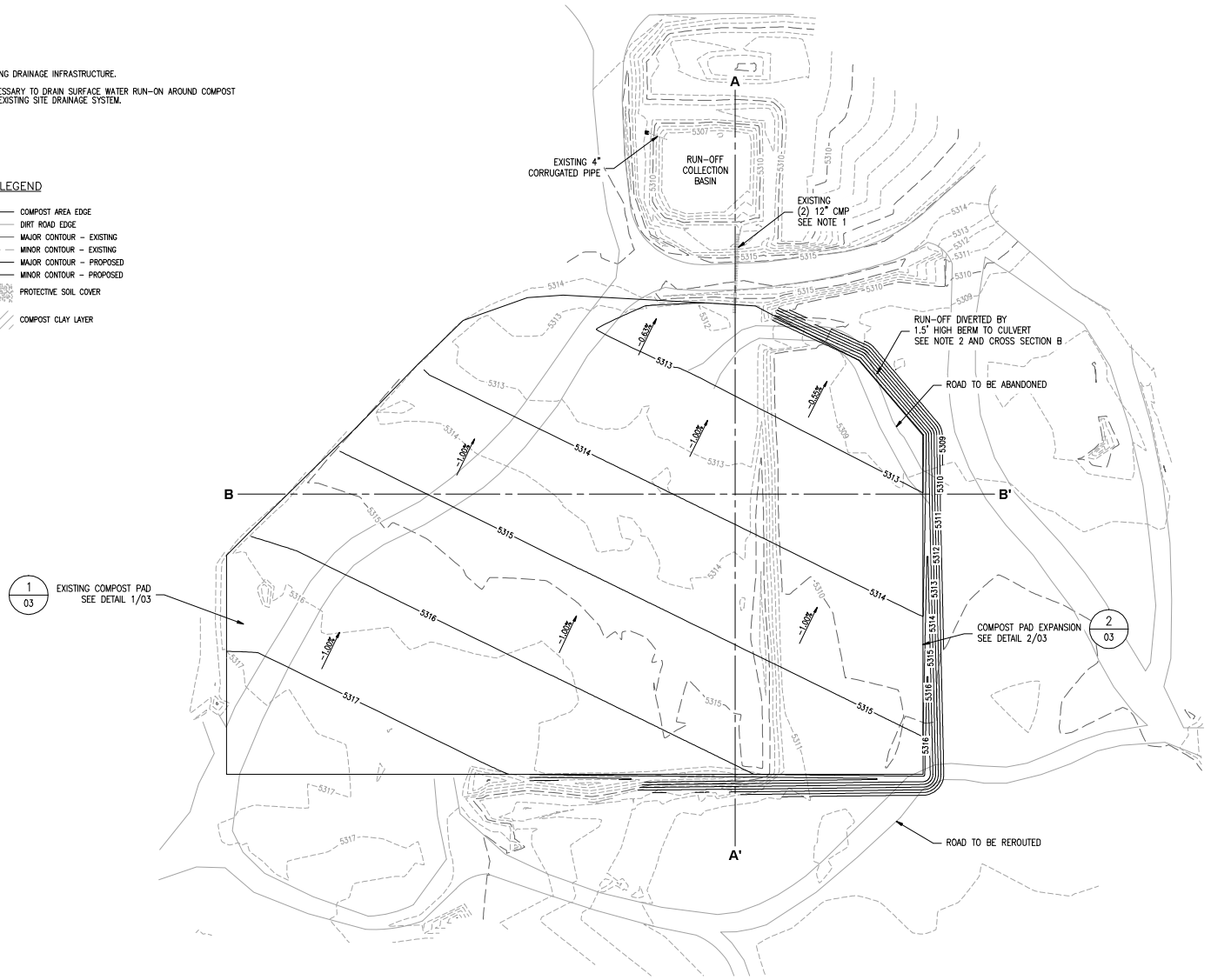
FILENAME	00C–01
SCALE	1" = 50'–0"
SHEET	01

NOTES:

1. PROTECT EXISTING DRAINAGE INFRASTRUCTURE.
2. GRADE AS NECESSARY TO DRAIN SURFACE WATER RUN-ON AROUND COMPOST AREA TO PRE-EXISTING SITE DRAINAGE SYSTEM.

LEGEND

- COMPOST AREA EDGE
- DIRT ROAD EDGE
- MAJOR CONTOUR - EXISTING
- MINOR CONTOUR - EXISTING
- MAJOR CONTOUR - PROPOSED
- MINOR CONTOUR - PROPOSED
- PROTECTIVE SOIL COVER
- COMPOST CLAY LAYER



EARTHWORK ESTIMATES (IN PLACE)	
Subgrade Fill [CY]	4215
Subgrade Cut [CY]	497
Clay Liner [CY] (FILL)	2200
Protective Soil [CY] (FILL)	10700

0 50 100 200

SCALE: 1" = 50

ISSUE	DATE	DESCRIPTION
	5/8/2025	ISSUED FOR BID
0	1/16/2025	ISSUED FOR REVIEW

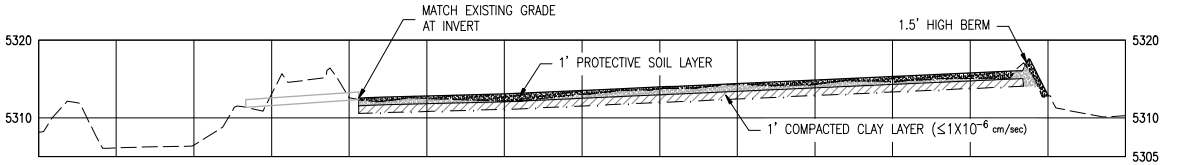
PROJECT MANAGER	SF
PROJECT ENGINEER	SF
DESIGNER	RS
PROJECT NUMBER	10279381

EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

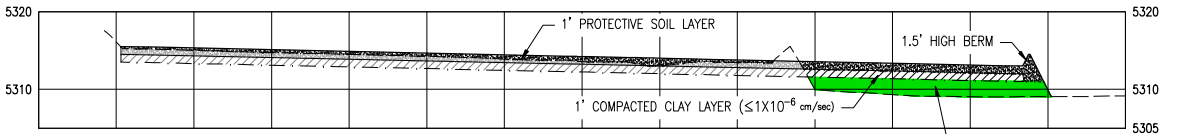
COMPOST PAD EXPANSION

COMPOST PAD EXPANSION
GRADING PLAN

FILENAME	00C-02	SHEET
SCALE	1" = 50'-0"	02



CROSS SECTION A–A'
Horizontal Scale: 1" = 40'
Vertical Scale: 1" = 8'



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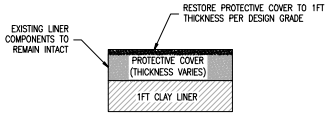
Vertical Scale: 1" = 4'



1/02 EXISTING COMPOST PAD PROTECTIVE COVER RESTORATION DETAIL

2/02 COMPOST PAD LINER EXPANSION DETAIL

NOTES:
1. AT THE TIE-IN SURFACE TO EXISTING PAD, SCARIFY AT ANGLE AND REWORK.

0 50 100 200
SCALE: 1" = 50

ISSUE	DATE	DESCRIPTION
	5/8/2025	ISSUED FOR BID
0	1/16/2025	ISSUED FOR REVIEW

PROJECT MANAGER	SF
PROJECT ENGINEER	SF
DESIGNER	RS
PROJECT NUMBER	10279381

EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

COMPOST PAD EXPANSION

COMPOST PAD EXPANSION
SECTIONS AND DETAILS

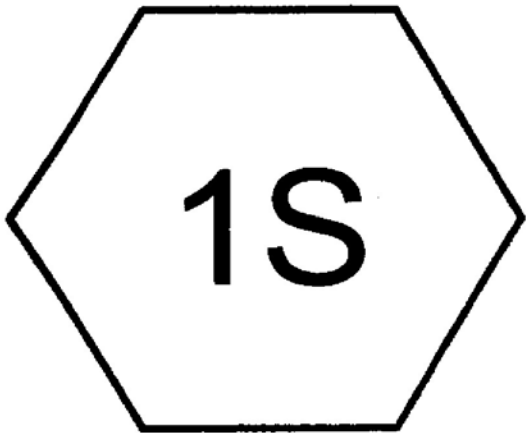
FILENAME	00C-03	SHEET
SCALE	AS NOTED	03

APPENDIX B

SURFACE WATER CALCULATIONS

Compost B
Stage Storage
Calculations

AdMapKey	ELEVATION	AREA	CAPACITY CU.FT	CAPACITY ACRE FT.	CUMMULATIVE CAPACITY ACRE FT.
9	5306.7	9528.0907460		0.147402911	1.06
			6420.9		
3	5306.0	8817.2544544		0.191918246	0.91
			8360.0		
4	5305.0	7902.6631540		0.17149619	0.72
			7470.4		
5	5304.0	7038.0848795		0.152222274	0.55
			6630.8		
6	5303.0	6223.5196309		0.1340965	0.40
			5841.2		
7	5302.0	5458.9674082		0.117118866	0.26
			5101.7		
8	5301.0	4744.4282114		0.101289374	0.15
			4412.2		
2	5300.0	4079.9020405		0.045031542	0.05
			1961.6		
1	5299.5	3766.3938397		0	0.00
			0.0		



(new Subcat)

Subcat Reach Pond Link

Drainage Diagram for East Regional Compost Cell CJArev
Prepared by AEC 9/29/2010
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Area Listing (all nodes)

Area (acres)	CN	Description (subcats)
5.969	70	Compost modeled as C&T mod infil (1S)
5.969		

Time span=1.00-30.00 hrs, dt=0.05 hrs, 581 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: (new Subcat) Runoff Area=260,000 sf Runoff Depth=0.95"
Flow Length=707' Slope=0.0150 '/' Tc=26.2 min CN=70 Runoff=5.39 cfs 0.471 af

Total Runoff Area = 5.969 ac Runoff Volume = 0.471 af Average Runoff Depth = 0.95"
100.00% Pervious Area = 5.969 ac 0.00% Impervious Area = 0.000 ac

Subcatchment 1S: (new Subcat)

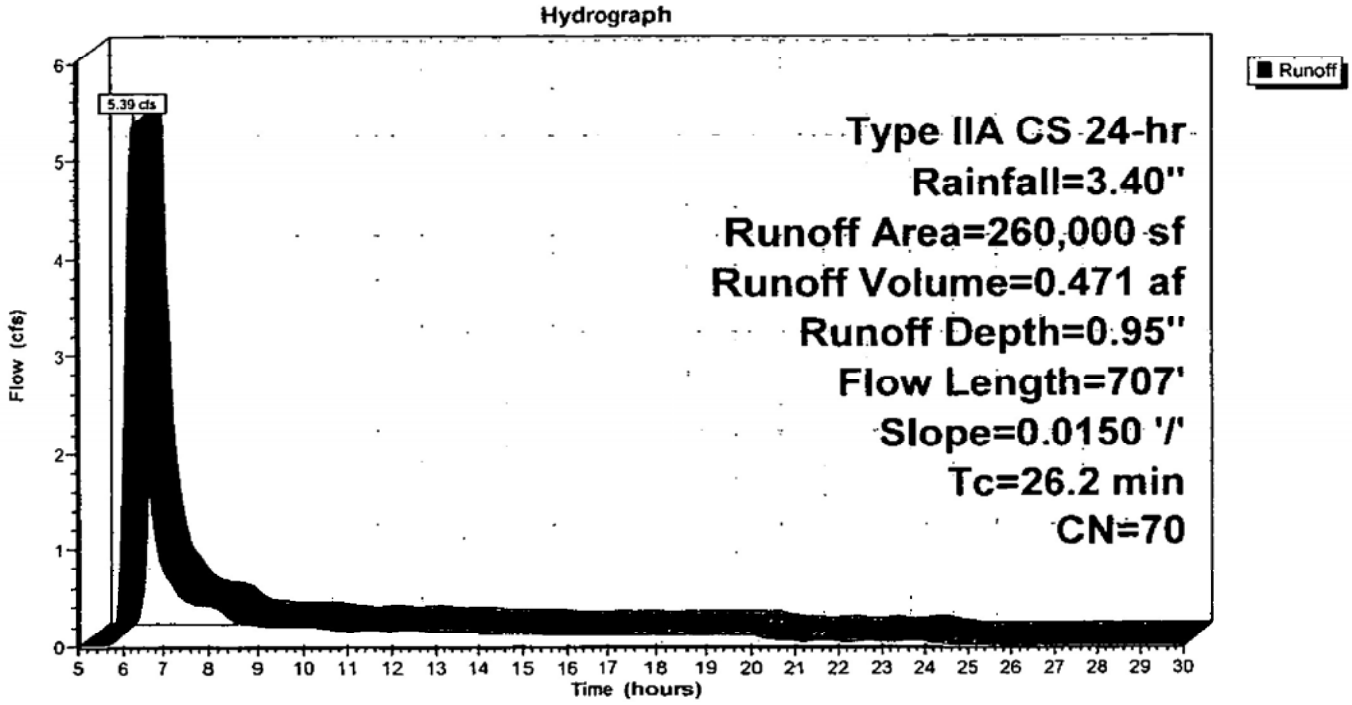
Runoff = 5.39 cfs @ 6.22 hrs, Volume= 0.471 af, Depth= 0.95"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 1.00-30.00 hrs, dt= 0.05 hrs
Type IIA CS 24-hr Rainfall=3.40"

Area (sf)	CN	Description
260,000	70	Compost modeled as C&T mod infil
260,000		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.2	707	0.0150	0.45		**Lag/CN Method, Diagonal across pad**

Subcatchment 1S: (new Subcat)



APPENDIX B.1

SURFACE WATER CALCULATIONS

Compost Pad
Stormwater Calculations Summary
East Regional Landfill

Objective

Confirm that the stormwater infrastructure associated with the Compost Pad and Compost Pad Expansion meets the minimum requirements from the 25-year, 24-hour storm event, while maintaining a minimum of 2 feet of freeboard within the stormwater containment system, measured from the lowest elevation in accordance with Section 14.4.4 (C) of the Colorado Department of Health and Environment (CDPHE) Hazardous Materials and Waste Management Division (HMWMD) regulations pertaining to solid waste sites and facilities.

The compost pad design was completed in March 2011 by American Environmental Consulting, LLC (AEC). The Compost Pad Expansion design was completed by HDR Engineering, Inc (HDR) in May 2025 with construction finished in September 2025. The Construction Quality Assurance Plan was completed by Geo-Logic Associates.

Weaver Consultants Group is responsible for preparing a calculation check of the stormwater system but did not participate in the design or construction of the Compost Pad Expansion. Accordingly, the assumptions used in this evaluation are based on a combination of information from both the 2011 design and the 2025 expansion design.

Method

- The Soil Conservation Service (SCS) TR-55 method was used to determine runoff volumes and peak flows from each subbasin.
- The SCS Curve Number was used to determine the amount of runoff from the 25-year, 24-hour storm event.
- Surface water routing was analyzed using the Storm and Sanitary Analysis (SSA) Software Package, Version 2024.1 by Autodesk.

Assumptions:

The stormwater control infrastructure design and location for the compost pad expansion are provided in the Compost EDOP (Appendix E – CQA Report Pad Expansion). Design of the compost pad expansion was completed by HDR Engineering, Inc. The Final Construction Quality Assurance Report was completed by Geo-Logic Associates.

Runoff from the compost pad is diverted by a berm that surrounds the south, north and eastern portions of the pad. The runoff from the compost operations will be routed to the stormwater pond north of the pad through two 12” CMP culverts. Slopes within the compost operations area are within 1% to convey the stormwater effectively to the pond.

A web soil survey from the Natural Resources Conservation Service shows the site containing Ascalon sandy loam soil and Weld loam soil, these soils belong in hydrologic soil groups B and C, respectively. The web soil survey is included in Appendix A. However, the compost pad was

constructed with on-site clay material which has been modeled using a hydrologic soil group of C. The low permeability soil consists of a 12-inch compacted layer of soil with a hydraulic conductivity of 1x10-6 cm/seconds or lower. A 12-inch minimum working surface is placed on top of the low permeability soil layer.

Culvert Assumptions

Based on the expansion drawings produced by HDR, two 12-inch CMP culverts, each approximately 100 feet in length, are located on the north side of the compost pad and convey flow from the compost pad to the collection basin.

Invert elevations of the culvert were estimated based on Stage Storage Calculations (2011 design) site topography (flown on 10-15-2025).

Subbasin Assumptions

An SCS curve number of 70 was assigned to the compost operations area with an average slope of 1.0%. The curve number was selected based on the 2011 design calculations. This cover description reflects similar conditions to a compacted soil liner with a working surface cover on top. An area of 5.70 acres was assigned to the subbasin, which accounts for the area of the proposed compost operations, including the hydraulically contributing area to the compost operations.

Pond and Assumptions

For the purposes of this analysis, the stage-storage assumptions and calculations from the 2011 design were used. The stage-storage relationship developed by AEC was incorporated into the SSA model and indicates a maximum storage capacity of approximately 46,170 cubic feet.

Storm Events

The 25-year, 24-hour storm depth of 3.56 inches was obtained from the National Oceanic and Atmospheric Administration (NOAA) U.S. Department of Commerce Atlas 14, Volume 8, Version 2, for Bennett, Colorado. The storm event table is included in Appendix B.

Results:

Hydraulic parameters and assumptions were entered into SSA and routed to the final discharge points. The SCS TR-55 method was used to calculate runoff the subbasin. The calculated results for the stormwater pond are summarized in the following and shown in the attached SSA output report.

Conclusion

The results calculated for the stormwater modeling of the relocated Compost Pad for the 25-year, 24-hour demonstrates that the run-off from the site is contained in the stormwater pond while allowing a minimum of 2 feet of freeboard in the pond in accordance with Section 14.4.4 (C) of the CDPHE HMWMD regulations pertaining to solid waste sites and facilities.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Adams County Area, Parts of Adams and Denver Counties, Colorado

Compost Pay Layout

April 28, 2026

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,150 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Adams County Area, Parts of Adams and Denver Counties, Colorado
Survey Area Data: Version 22, Aug 29, 2025

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AsB	Ascalon sandy loam, 0 to 3 percent slopes	1.4	25.4%
WmB	Weld loam, 1 to 3 percent slopes	4.2	74.6%
Totals for Area of Interest		**5.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Adams County Area, Parts of Adams and Denver Counties, Colorado

AsB—Ascalon sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2swl3
Landscape: Plains
Elevation: 3,870 to 5,960 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 135 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Ascalon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ascalon

Setting

Landscape: Plains
Landform: Broad, flat interfluves
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind-reworked alluvium and/or calcareous sandy eolian deposits

Typical profile

Ap - 0 to 6 inches: sandy loam
Bt1 - 6 to 12 inches: sandy clay loam
Bt2 - 12 to 19 inches: sandy clay loam
Bk - 19 to 35 inches: sandy clay loam
C - 35 to 80 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: B
Ecological site: R067BY024CO - Sandy Plains

Hydric soil rating: No

Minor Components

Olnest

Percent of map unit: 10 percent
Landscape: Tablelands
Landform: Broad, flat interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

Vona

Percent of map unit: 5 percent
Landscape: Tablelands
Landform: Broad, flat interfluves
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

WmB—Weld loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2x0hw
Landscape: Dissected plains
Elevation: 3,600 to 5,750 feet
Mean annual precipitation: 12 to 17 inches
Mean annual air temperature: 46 to 54 degrees F
Frost-free period: 115 to 155 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Weld and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Weld

Setting

Landscape: Dissected plains
Landform: Broad, flat interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Calcareous loess

Typical profile

Ap - 0 to 8 inches: loam
Bt1 - 8 to 12 inches: clay
Bt2 - 12 to 15 inches: clay loam
Btk - 15 to 28 inches: loam
Bk - 28 to 60 inches: silt loam
C - 60 to 80 inches: silt loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 14 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: C
Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

Minor Components

Adena

Percent of map unit: 8 percent
Landscape: Dissected plains
Landform: Interfluves
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

Colby

Percent of map unit: 7 percent
Landscape: Dissected plains
Landform: Gentle hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

Keith

Percent of map unit: 3 percent
Landscape: Dissected plains
Landform: Broad, flat interfluves
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

Baca

Percent of map unit: 2 percent
Landscape: Dissected plains
Landform: Interfluves
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

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NOAA Atlas 14, Volume 8, Version 2
Location name: Bennett, Colorado, USA*
Latitude: 39.8439°, Longitude: -104.4969°
Elevation: 5319 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.237** (0.191-0.296)	**0.291** (0.234-0.364)	**0.391** (0.313-0.489)	**0.483** (0.384-0.607)	**0.624** (0.486-0.828)	**0.745** (0.563-0.995)	**0.876** (0.637-1.20)	**1.02** (0.709-1.42)	**1.22** (0.817-1.75)	**1.39** (0.898-2.00)
10-min	**0.347** (0.280-0.434)	**0.427** (0.343-0.533)	**0.572** (0.458-0.716)	**0.707** (0.563-0.889)	**0.914** (0.712-1.21)	**1.09** (0.824-1.46)	**1.28** (0.933-1.75)	**1.49** (1.04-2.08)	**1.79** (1.20-2.56)	**2.04** (1.32-2.93)
15-min	**0.424** (0.341-0.529)	**0.520** (0.418-0.650)	**0.697** (0.559-0.874)	**0.862** (0.686-1.08)	**1.12** (0.868-1.48)	**1.33** (1.00-1.78)	**1.56** (1.14-2.14)	**1.82** (1.27-2.54)	**2.19** (1.46-3.13)	**2.49** (1.60-3.57)
30-min	**0.573** (0.461-0.715)	**0.700** (0.563-0.875)	**0.935** (0.749-1.17)	**1.15** (0.919-1.45)	**1.49** (1.16-1.98)	**1.78** (1.35-2.38)	**2.10** (1.53-2.86)	**2.44** (1.70-3.41)	**2.94** (1.96-4.21)	**3.34** (2.16-4.80)
60-min	**0.706** (0.568-0.881)	**0.859** (0.690-1.07)	**1.14** (0.916-1.43)	**1.41** (1.12-1.78)	**1.83** (1.43-2.44)	**2.19** (1.66-2.94)	**2.59** (1.88-3.54)	**3.02** (2.11-4.23)	**3.65** (2.44-5.23)	**4.17** (2.69-5.99)
2-hr	**0.839** (0.680-1.04)	**1.02** (0.823-1.26)	**1.35** (1.09-1.68)	**1.67** (1.34-2.08)	**2.17** (1.71-2.87)	**2.60** (1.99-3.46)	**3.08** (2.26-4.18)	**3.61** (2.53-5.01)	**4.37** (2.94-6.20)	**4.99** (3.25-7.11)
3-hr	**0.917** (0.746-1.13)	**1.11** (0.899-1.36)	**1.46** (1.18-1.81)	**1.81** (1.45-2.24)	**2.35** (1.85-3.09)	**2.82** (2.16-3.72)	**3.33** (2.46-4.50)	**3.90** (2.76-5.39)	**4.73** (3.21-6.69)	**5.42** (3.55-7.67)
6-hr	**1.09** (0.893-1.33)	**1.30** (1.06-1.59)	**1.70** (1.38-2.08)	**2.08** (1.68-2.56)	**2.68** (2.13-3.49)	**3.20** (2.46-4.18)	**3.76** (2.80-5.03)	**4.39** (3.13-6.01)	**5.30** (3.62-7.43)	**6.06** (4.00-8.50)
12-hr	**1.33** (1.10-1.61)	**1.57** (1.29-1.91)	**2.02** (1.66-2.46)	**2.43** (1.99-2.97)	**3.08** (2.46-3.95)	**3.62** (2.81-4.69)	**4.22** (3.16-5.58)	**4.87** (3.49-6.59)	**5.81** (4.00-8.04)	**6.57** (4.38-9.14)
24-hr	**1.58** (1.32-1.91)	**1.88** (1.56-2.27)	**2.40** (1.99-2.90)	**2.87** (2.36-3.48)	**3.56** (2.85-4.49)	**4.13** (3.22-5.26)	**4.73** (3.56-6.16)	**5.38** (3.88-7.17)	**6.28** (4.35-8.58)	**7.01** (4.71-9.65)
2-day	**1.83** (1.53-2.19)	**2.19** (1.83-2.62)	**2.80** (2.33-3.35)	**3.32** (2.75-3.99)	**4.06** (3.25-5.04)	**4.65** (3.64-5.84)	**5.25** (3.97-6.75)	**5.88** (4.27-7.74)	**6.74** (4.70-9.09)	**7.41** (5.03-10.1)
3-day	**2.00** (1.68-2.38)	**2.37** (1.99-2.82)	**2.98** (2.49-3.55)	**3.51** (2.92-4.20)	**4.26** (3.43-5.26)	**4.85** (3.81-6.06)	**5.47** (4.15-6.98)	**6.10** (4.45-7.98)	**6.98** (4.89-9.35)	**7.66** (5.22-10.4)
4-day	**2.14** (1.80-2.53)	**2.50** (2.10-2.96)	**3.12** (2.61-3.70)	**3.64** (3.04-4.34)	**4.40** (3.55-5.42)	**5.00** (3.94-6.23)	**5.62** (4.28-7.15)	**6.27** (4.59-8.17)	**7.16** (5.04-9.56)	**7.85** (5.38-10.6)
7-day	**2.43** (2.06-2.86)	**2.83** (2.39-3.32)	**3.48** (2.94-4.11)	**4.04** (3.39-4.78)	**4.83** (3.92-5.89)	**5.46** (4.33-6.73)	**6.09** (4.67-7.68)	**6.75** (4.97-8.72)	**7.65** (5.42-10.1)	**8.34** (5.76-11.2)
10-day	**2.69** (2.29-3.15)	**3.12** (2.65-3.65)	**3.82** (3.23-4.49)	**4.42** (3.71-5.20)	**5.24** (4.27-6.35)	**5.89** (4.68-7.22)	**6.54** (5.03-8.20)	**7.21** (5.33-9.25)	**8.11** (5.77-10.7)	**8.80** (6.10-11.7)
20-day	**3.46** (2.96-4.02)	**3.97** (3.40-4.61)	**4.80** (4.09-5.59)	**5.49** (4.65-6.41)	**6.42** (5.25-7.68)	**7.13** (5.71-8.64)	**7.84** (6.08-9.71)	**8.55** (6.37-10.8)	**9.49** (6.81-12.3)	**10.2** (7.14-13.5)
30-day	**4.09** (3.51-4.72)	**4.68** (4.01-5.40)	**5.62** (4.80-6.50)	**6.38** (5.43-7.42)	**7.42** (6.09-8.81)	**8.20** (6.59-9.87)	**8.96** (6.98-11.0)	**9.72** (7.27-12.2)	**10.7** (7.72-13.8)	**11.4** (8.05-15.0)
45-day	**4.85** (4.18-5.57)	**5.54** (4.78-6.37)	**6.65** (5.71-7.66)	**7.54** (6.44-8.71)	**8.71** (7.18-10.3)	**9.59** (7.74-11.5)	**10.4** (8.15-12.7)	**11.3** (8.46-14.1)	**12.3** (8.91-15.8)	**13.1** (9.25-17.1)
60-day	**5.47** (4.73-6.26)	**6.27** (5.42-7.18)	**7.52** (6.48-8.63)	**8.52** (7.30-9.82)	**9.84** (8.12-11.5)	**10.8** (8.74-12.8)	**11.7** (9.18-14.2)	**12.6** (9.50-15.7)	**13.7** (9.96-17.5)	**14.5** (10.3-18.9)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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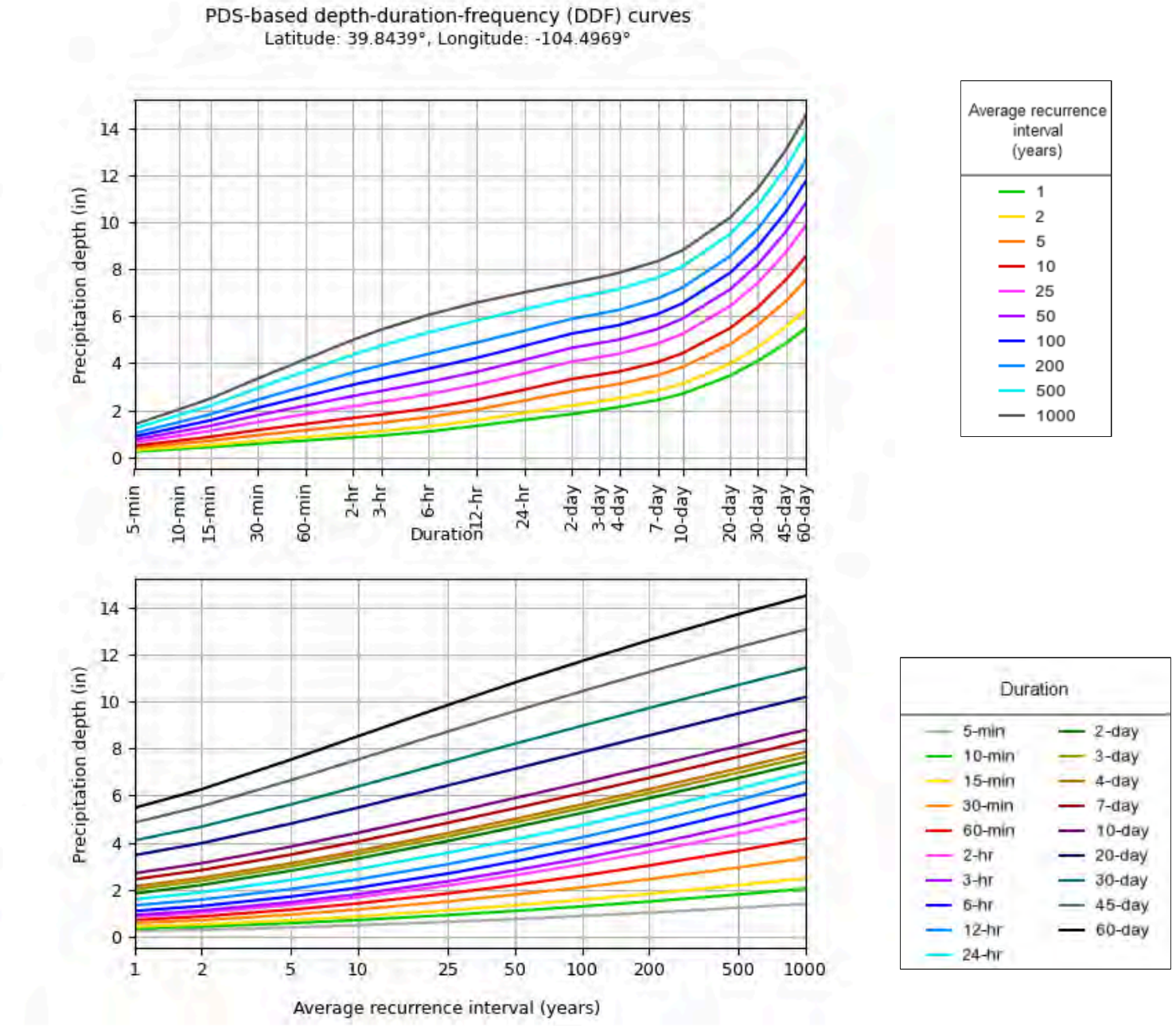
PF graphical



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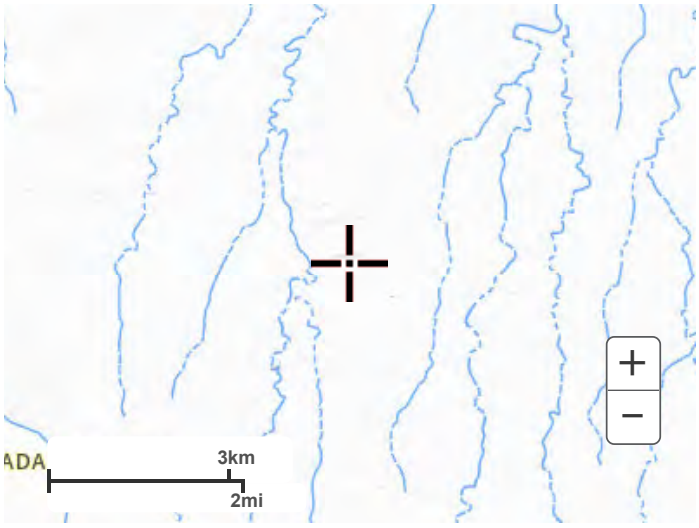
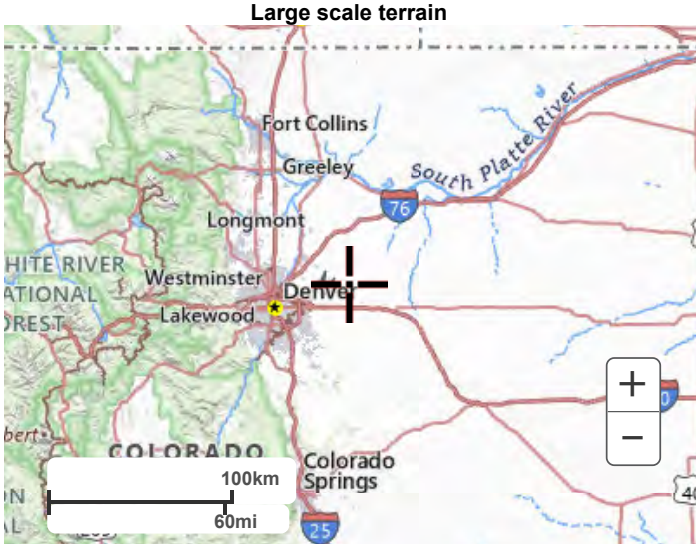
Maps & aerials

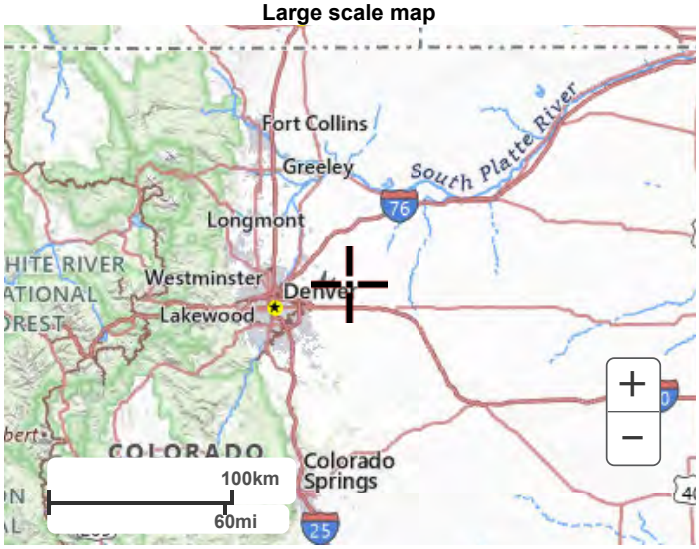
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Project Description

File Name ..... SSA ERL Compost Operations.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	SCS TR-55
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	NO
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
Start Reporting On	00:00:00	0:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	1
Nodes	3
Junctions	1
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	1
Links	2
Channels	0
Pipes	2
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	TS-01	Cumulative	inches	Colorado	Adams	25.00	3.56	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area (ac)	Peak Rate Factor	Weighted Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	Sub-01	5.70	484.00	70.00	3.56	1.05	5.96	4.36	0 00:34:37

Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft^2)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	1-Jun	Junction	5311.00	5312.00	5312.00	0.00	0.00	4.36	5311.40	0.00	0.60	0 00:00	0.00	0.00
2	Out-01	Outfall	5306.70					0.00	5306.70					
3	CollectionBasin	Storage Node	5299.50	5306.70	5299.50		0.00	4.35	5303.62				0.00	0.00

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	Artificial_Outfall	Pipe	CollectionBasin	Out-01	721.25	5299.50	5306.70	-1.0000			0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	Culvert	Pipe	1-Jun	CollectionBasin	100.00	5311.00	5299.50	11.5000			4.35	13.09	0.33	7.49	0.40	0.40	0.00	Calculated

Subbasin Hydrology

Subbasin : Sub-01

Input Data

Area (ac)	5.7
Peak Rate Factor	484
Weighted Curve Number	70
Rain Gage ID	Rain Gage-01

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Natural western desert	5.7	C	70
Composite Area & Weighted CN	5.7		70

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft^2)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

Sheet Flow Computations	Subarea A	Subarea B	Subarea C
Manning's Roughness :	0.1	0	0
Flow Length (ft) :	300	0	0
Slope (%) :	1	0	0
2 yr, 24 hr Rainfall (in) :	1.88	0	0
Velocity (ft/sec) :	0.17	0	0
Computed Flow Time (min) :	29.37	0	0

Shallow Concentrated Flow Computations	Subarea A	Subarea B	Subarea C
Flow Length (ft) :	315	0	0
Slope (%) :	1	0	0
Surface Type :	Bare & untilled	Unpaved	Unpaved
Velocity (ft/sec) :	1	0	0
Computed Flow Time (min) :	5.25	0	0

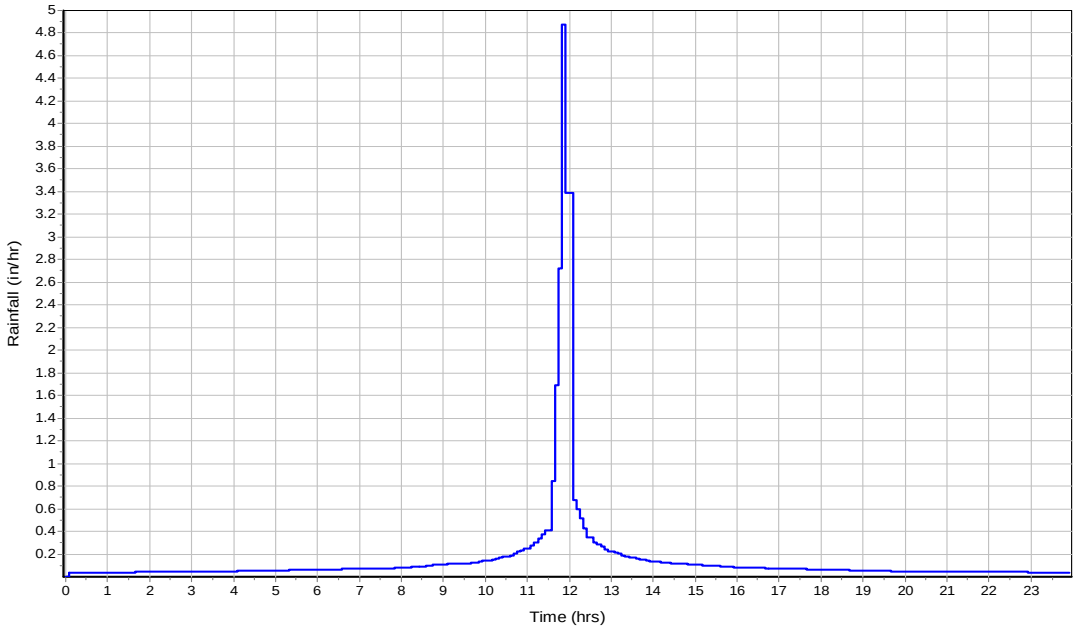
Total TOC (min) 34.62

Subbasin Runoff Results

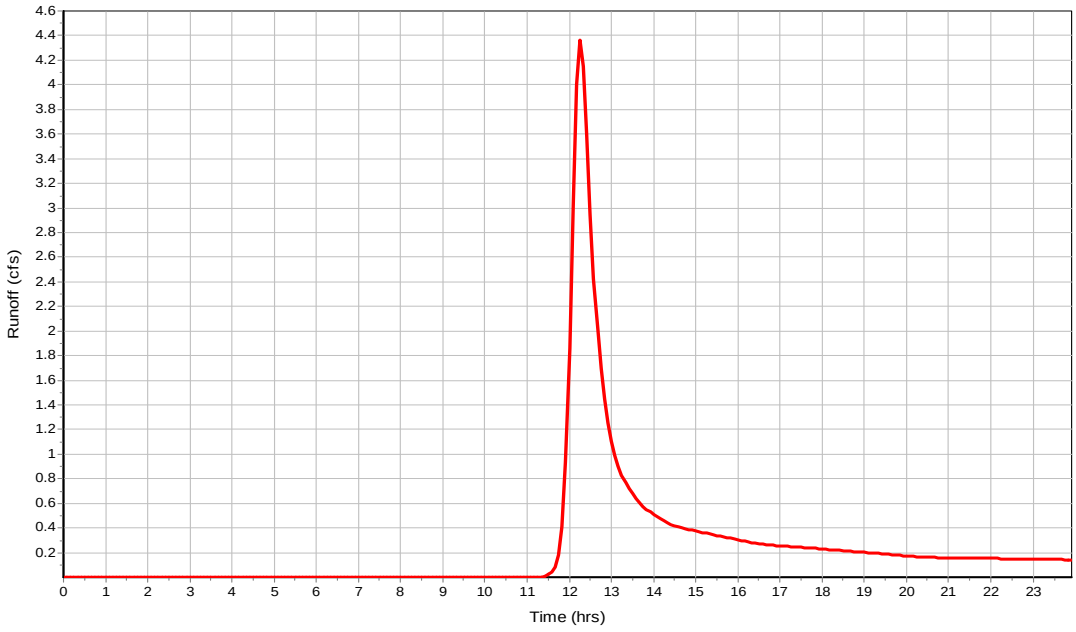
Total Rainfall (in)	3.56
Total Runoff (in)	1.05
Peak Runoff (cfs)	4.36
Weighted Curve Number	70
Time of Concentration (days hh:mm:ss)	0 00:34:37

Subbasin : Sub-01

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (in)
1	1-Jun	5311.00	5312.00	1.00	5312.00	1.00	0.00	-5312.00	0.00	

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	1-Jun	4.36	4.36	5311.40	0.40	0.00	0.60	5311.06	0.06	0 12:20	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
1	Artificial_Outfall	721.25	5299.50	0.00	5306.70	0.00	-7.20	-1.0000	Dummy								
2	Culvert	100.00	5311.00	0.00	5299.50	0.00	11.50	11.5000	CIRCULAR								

No. of
Barrels

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Artificial_Outfall	0.00	0 00:00	0.00	0.00	0.00		0.00	0.00	0.00		
2	Culvert	4.35	0 12:20	13.09	0.33	7.49	0.22	0.40	0.40	0.00		Calculated

Storage Nodes

Storage Node : CollectionBasin

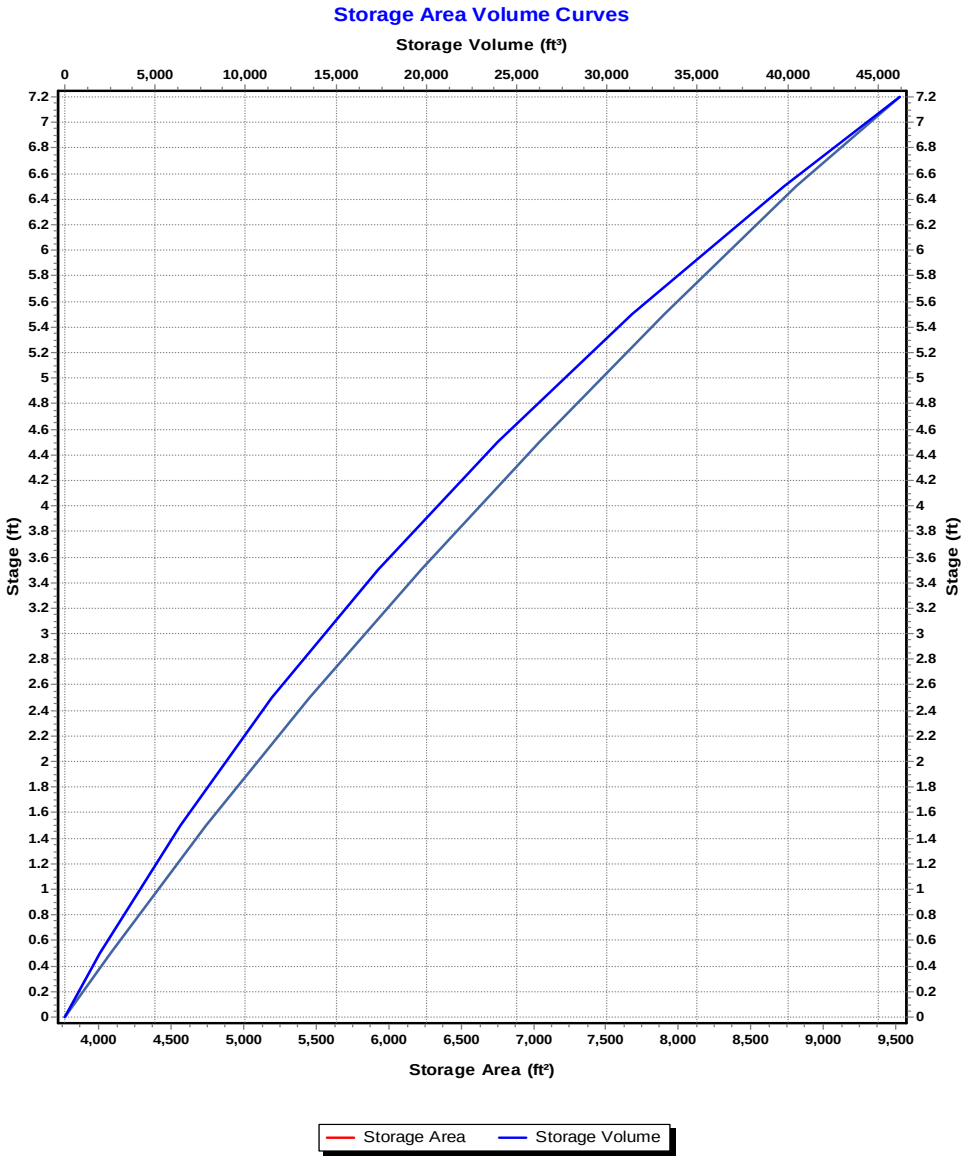
Input Data

Invert Elevation (ft)	5299.50
Max (Rim) Elevation (ft)	5306.70
Max (Rim) Offset (ft)	7.20
Initial Water Elevation (ft)	5299.50
Initial Water Depth (ft)	0.00
Ponded Area (ft^2)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Storage-02

Stage (ft)	Storage Area (ft^2)	Storage Volume (ft^3)
0	3766.3938	0
0.5	4079.902	1961.57
1.5	4744.428	6373.74
2.5	5458.967	11475.44
3.5	6223.519	17316.68
4.5	7038.084	23947.48
5.5	7902.663	31417.85
6.5	8817.25445	39777.81
7.2	9528.0907	46198.68


Storage Area Volume Curves
Storage Volume (ft³)
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
Stage (ft)
Stage (ft)
Storage Area (ft²)
4,000
4,500
5,000
5,500
6,000
6,500
7,000
7,500
8,000
8,500
9,000
9,500
Storage Area
Storage Volume

Storage Node : CollectionBasin (continued)

Output Summary Results

Peak Inflow (cfs)	4.35
Peak Lateral Inflow (cfs)	0
Peak Outflow (cfs)	0
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	5303.62
Max HGL Depth Attained (ft)	4.12
Average HGL Elevation Attained (ft)	5301.16
Average HGL Depth Attained (ft)	1.66
Time of Max HGL Occurrence (days hh:mm)	1 00:00
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

APPENDIX C

AEC 2011 COMPOST EDOP

SW/ADM/FIV 2.2

ENGINEERING DESIGN AND OPERATIONS PLAN
COMPOST OPERATIONS

EAST REGIONAL LANDFILL

Prepared for:
Five Part Development, LLC

Prepared by:

American Environmental Consulting, LLC
6885 S. Marshall St.
Suite 3
Littleton, Colorado 80128

March 10, 2011

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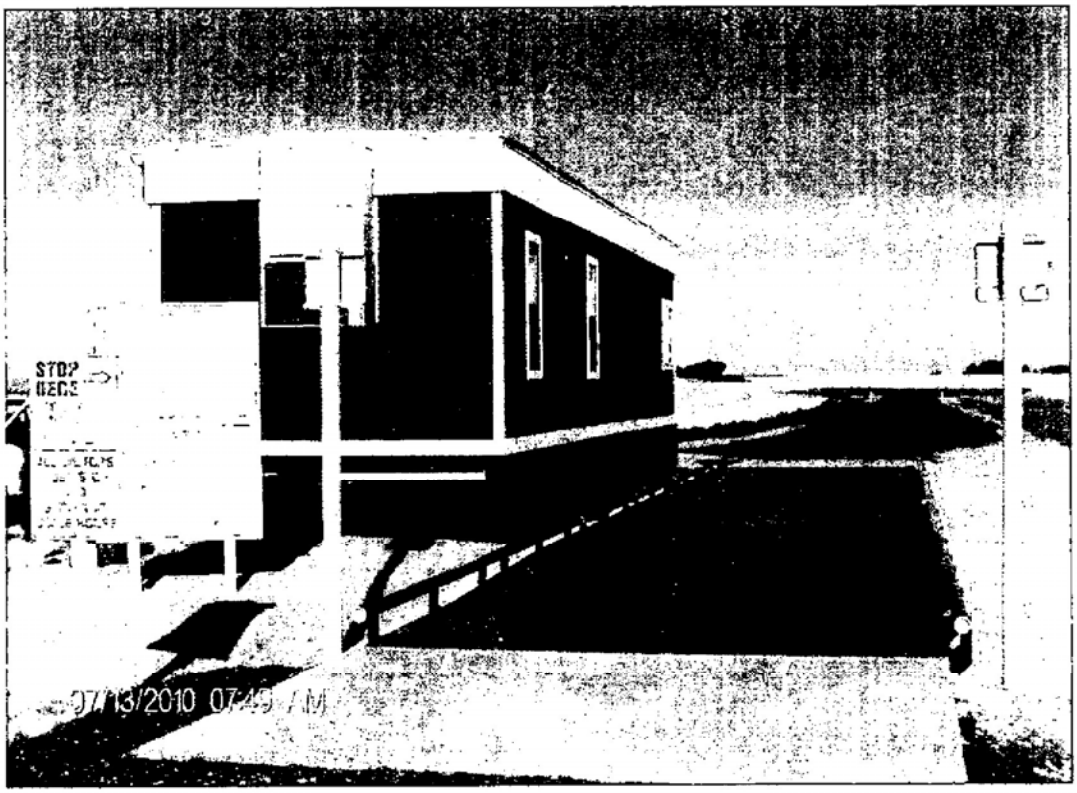
HAZARDOUS MATERIALS
AND WASTE MANAGEMENT

ENGINEERING DESIGN AND OPERATIONS PLAN
COMPOST OPERATIONS

EAST REGIONAL LANDFILL



Prepared for:
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March 10, 2011

ENGINEERING DESIGN AND OPERATIONS PLAN
COMPOST OPERATIONS

EAST REGIONAL LANDFILL

Prepared for:
Five Part Development, LLC

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American Environmental Consulting, LLC
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Mark A. McMullen, P.G.
Principal Geologist

Michael H. Stewart, P.E.
Principal Engineer

March 10, 2011

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1.0 INTRODUCTON

1.1 Background

The East Regional Landfill (ERL), owned by Five Part Development, LLC (a wholly owned subsidiary of Alpine Disposal, Inc.) and operated by Alpine Disposal, Inc., received a Certificate of Designation (CD) to construct and operate a facility to accept municipal solid waste (MSW) for disposal by burial on June 29, 2009. The facility constructed the first disposal cell in 2010 and began accepting waste in September 2010 following approval from the Colorado Department of Public Health and Environment (CDPHE), the Tri-County Health Department, and Adams County.

As an environmentally responsible waste firm committed to environmental stewardship and finding alternatives to reducing the volume of waste going into landfills, Five Part Development, LLC (Five Part) wishes to promote a method of reducing the volume of food and green waste going into landfills through composting, creating a product that can be beneficially used to improve soil conditions and promote growth. Five Part is proposing to construct and operate a Class II composting operation at the East Regional Landfill by composting a portion of the waste stream that would normally be disposed of in the landfill. The parent company of Five Part, Alpine Disposal, Inc., currently owns and controls a refuse collection division and a large recycling/transfer operation in the Denver Metro Area in addition to the ERL. As an integrated waste collection, processing, recycling, and disposal firm, the ability to remove green and food wastes from the waste stream and create a useful product is a natural fit to Alpine's conservation-oriented total waste management approach.

The facility receives mail at the site and the physical address and contact information for the site and the facility owner/operator is as follows:

Facility Address and Contact	Facility Owner/Operator
East Regional Landfill 8201 Schumaker Road Bennett, Colorado 80102 Facility Manager: Jeremy Groves 303-685-2700 site phone 303-210-6215 mobile phone jgroves@alpinewaste.com	Alpine Disposal, Inc. (operator) Five Part Development, LLC (owner) 7475 E. 84th Avenue Commerce City, Colorado Chief Financial Officer: Alek M. Orloff 303-744-9881 aorloff@alpinewaste.com

The Facility Manager will have authority to take action in the event of an emergency.

This Engineering Design and Operations Plan (EDOP) serves as an application for a minor amendment to the current CD of the ERL to permit composting operations at the landfill in accordance with a Class II composting operation as defined in the Colorado Regulations Pertaining to Solid Waste Sites and Facilities, 6 CCR 1007-2, Part 1 (the Regulations). Sections 1, 2, and 14 of the Regulations govern most composting

operations and were used to guide the development of this EDOP. This application must be submitted to Adams County and the CDPHE for consideration of approval for this amendment. As the local governing body having jurisdiction at the facility, Adams County is the permitting agency and must grant approval of this application before composting operations can begin. As the state regulatory body, the CDPHE must review this document upon request by Adams County and provide Adams County with a recommendation of approval or denial based on meeting the requirements in the Regulations, and Adams County must obtain a recommendation of approval by the CDPHE to approve of this amendment.

1.2 Regulatory Framework

Compost operations are specifically regulated by the Colorado Department of Public Health and Environment (CDPHE) under Sections 1, 2, and 14 of the Regulations Pertaining to Solid Waste Sites and Facilities (6 CCR 1007-2, Part 1). Section 1 is Administrative Information that includes definitions, scope of the regulations, process information for the application and issuance of a CD, fees, and most importantly, Financial Assurance requirements. Section 2 is the Minimum Standards for all solid waste sites and facilities, including but not limited to, general facility standards, monitoring, record keeping, and closure and post-closure requirements. Section 14 includes more detailed design and operating standards specific to compost regulations and provides many of the requirements that are documented in this EDOP. As discussed above, the facility already has a CD for solid waste disposal operations and this application is for a modification to that CD.

Section 14 of the Regulations provides for regulating five classes of compost operations, Class I through Class V, based on the specific feedstocks, volumes, and source of the feedstocks. Five Part is proposing to operate a Class II compost facility that accepts Type 1 and Type 2 feedstocks (described later in this document) from multiple generators and is not restricted to the volumes of feedstocks, bulking materials, or in-process material that may be on site at any one time. As part of this application to conduct composting, Five Part may construct a commercial "dry system" pre-processing facility at the site to reduce the particle size of the feedstock and remove contaminants such as plastics, metal foils, and large pieces of paper and cardboard prior to composting. This portion of the operation may or may not be implemented depending on need, but approval of this portion of the operation is an integral part of this application. More information on this process is provided further on in this document.

Adams County, as the permitting agency, also has regulations that are applicable to portions of the compost operations, many of which are already address in the existing CD issued by Adams County such as landscaping, access, noise, etc. As stated above, the addition of composting operations is a natural fit with the existing CD for solid waste disposal operations, adding no new wastes to the waste stream accepted at the facility, other than discarded liquid food waste, nor any new unaddressed potential nuisance conditions, and should be considered a minor amendment to the existing CD.

The existing CD was based on information provided in the Engineering Design and Operations Plan, Five Part Disposal Facility, Volumes 1 and 2 (Doty & Associates, LLC, June 1, 2006) and a number of subsequent documents issued during the application process. The June 1, 2006 EDOP provides detailed information on the site setting such as surface water features and drainage patterns, and the geologic and hydrogeologic site conditions that were necessary to characterize for the existing CD. Those details are summarized herein, and reference is made to the June 1, 2006 EDOP if more detailed information is desired.

1.3 Site Location and Setting

The East Regional Landfill is located in portions of the southeast and southwest quarters of Section 25, Township 2 South, Range 64 West of the 6th Principal Meridian in Adams County, Colorado. It is approximately seven miles northwest of the Town of Bennett, Colorado as shown on Figure 1. The property covered under the CD for the East Regional Landfill is approximately 164 acres, approximately 142 of which is designated for disposal of solid waste, commonly referred to as the waste footprint. The first disposal cell, Cell 10-Phase 1, has just been constructed in the northeast corner of the property and is located at the topographically lowest portion of the site. Future disposal cell development will progress to the west and south of Cell 10. Compost operations will be conducted on an approximate six-acre parcel located near the center of the property. This portion of the property is not anticipated to be required for disposal operations for many years into the future and the compost operations will be abandoned or moved prior to the need of this portion of the property for waste disposal.

The landfill property is immediately surrounded by currently active farming operations to the north, west, and east. The adjoining property to the north and west is owned by Waste Management of Colorado and to the east by Xcel Energy and bounded by Schumaker Road. The property to the south consists of 35-acre agriculturally-zoned rural residential properties. Sheet 2 shows the site and the location of the various site features as they currently exist and the proposed area for compost operations. The landfill and compost facility are surrounded by fencing, and is entered from the east side of the site off of Schumaker Road that has a gate that will be locked when the facility is closed. Signage at the facility entrance denotes the name of the facility and lists wastes that are allowed and restricted from disposal at the facility. All of the wastes intended for use in this compost operation are also allowed for disposal at the facility, and the list of wastes prohibited for disposal are also prohibited for use in the compost, with the exception of discarded liquid food waste that may be used in the compost operations.. A scale and scalehouse/office building is located on the main entrance road, and all vehicles arriving at the site are required to check in at the scalehouse. A water well for site operations and a pump house are also location in this area. A Quonset hut with a locking door and concrete floor is located in the far southeast portion of the site.

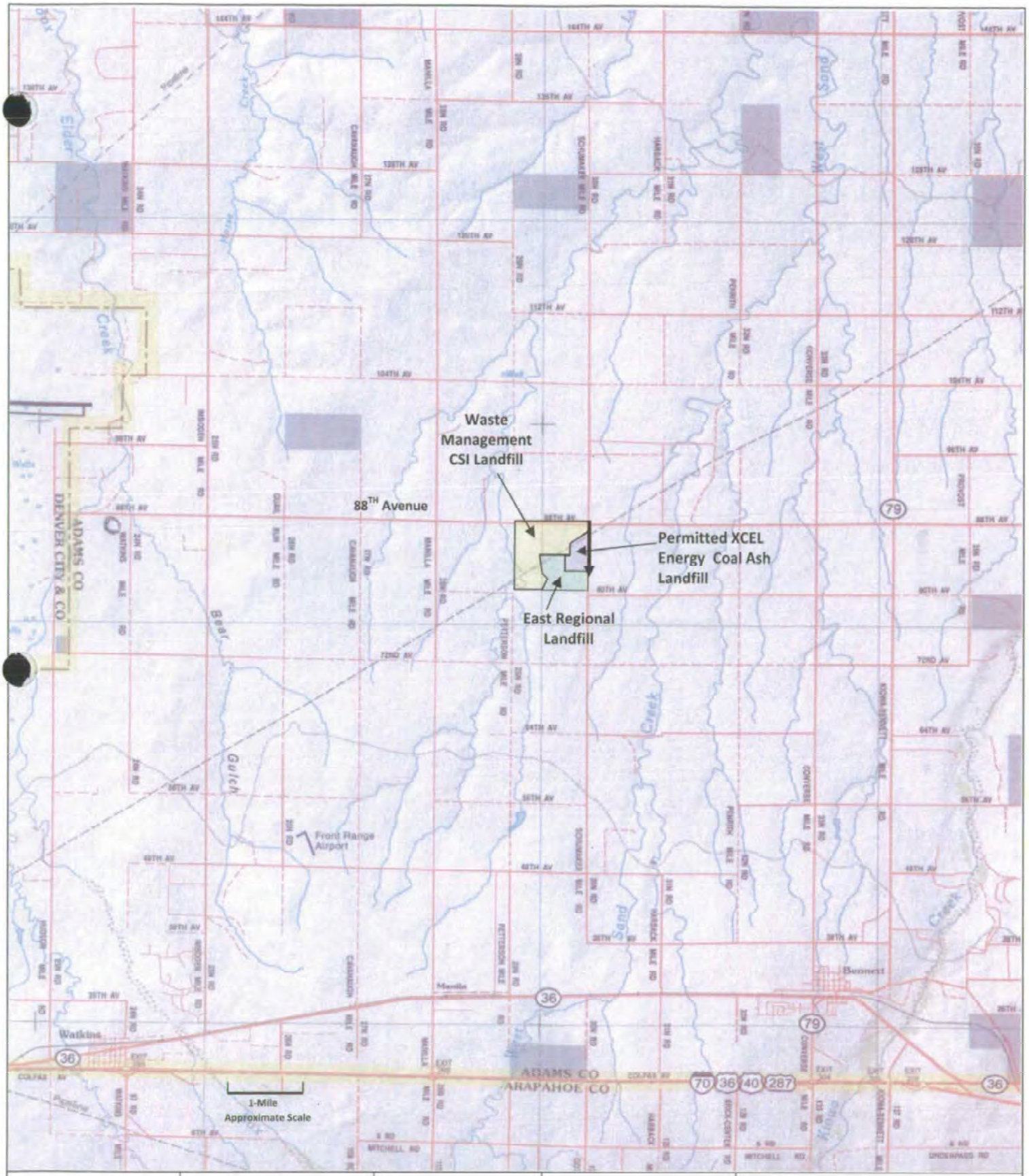
The landfill is situated in an area of very flat topography with little topographical relief and generally poorly defined drainage features. Surface water flow across the site is predominantly overland sheet flow to the northeast, but can concentrate in natural

drainage swales and constructed control features during heavy precipitation events. All surface water from the currently disturbed areas of the site exit the site near the northeast corner of the site. A portion of the surface water discharge from the site will discharge to the west, but currently only runoff from a portion of the farm operations discharges to the west. Surface water runoff that leaves the site in the northeast corner travels northward along a very gentle natural swale, passing under 88th Avenue through three culverts approximately ½ mile north of the site and eventually enters an unnamed tributary to Lost Sand Creek (also referred to as West Sand Creek on some maps) approximately 2 miles northeast of the property. Surface water exiting the site on the western site boundary enters an unnamed tributary, which is normally dry, that runs northward and then east to enter Lost Sand Creek approximately 8 miles northeast of the site. General surface water flow patterns to and from the site and known surface water features within one-half mile of the site are shown on Figure 2. All of the known surface water features within one-half mile of the site are ephemeral and only exhibit flow following heavy precipitation with the possible exception of what has been identified as a riparian habitat located approximately 2000 feet west of the compost area on Waste Management property. Trees are noted to be present in this area, but it could not be accessed for inspection because it is on, and surrounded by, private property.

There are no known public water supply wells, springs, or surface water intakes within a one-mile radius of the facility.

The ERL and compost operations are located in a geologically stable area with relatively flat lying stratigraphic features. Based on the geology and surface morphology of the area in which the compost operations will be located, slope stability, faulting, folding, rockfalls, landslides, subsidence, or erosion is not a concern. The facility is designed with very gentle slopes and small features that do not present a slope stability concern and any erosion will be minor and very local in nature.

The landfill footprint is not located within any 100-year flood plain designated by the Federal Emergency Management Agency (FEMA) as discussed in the EDOP. As stated above, the compost area is within the permitted landfill footprint and so is also outside of any flood plain. A flood plain study was conducted during the permitting of the Waste Management CSI facility north of the site by QCI Consultants (November 1989) and referenced in the EDOP for the landfill. This study estimated a 100-year, 24-hour flood plain in the unnamed tributary to Lost Sand Creek west of the site assuming the maximum probable urban development upstream. The nearest boundary of this estimated flood plain is over 1,000 feet west of the compost area.



Proj: Five Part Compost	Drawn by: CJA	AEC	AMERICAN ENVIRONMENTAL CONSULTING, LLC	FIGURE 1 LOCATION MAP EAST REGIONAL LANDFILL
e: July 28, 2010	Reviewed by: MAM			
File: vicinity map				

Proj: Five Part	Drawn by: MAM	AEC	AMERICAN ENVIRONMENTAL CONSULTING, LLC	FIGURE 2 VICINITY SURFACE WATER EAST REGIONAL LANDFILL
e: July 30, 2010	Reviewed by:			
File: Compost Fig 2	Vicinity Surface Water Flow			

2.0 GEOLOGY AND HYDROGEOLOGY

The geology and hydrogeology of the site has been studied extensively for the permitting of the Waste Management CSI facility, the Public Service/Xcel Energy site, and the East Regional Landfill site (Industrial Compliance, 1988; Industrial Compliance, 1993; Industrial Compliance/Terranext, 1996; Doty & Associates, 2006). The geology and hydrogeology discussion included herein summarizes those studies, or is excerpted directly, but for brevity does not include all of the supporting documentation such as soil boring and completion logs, permeability tests, or geotechnical and chemical testing of the soils and groundwater.

2.1 Regional Geology

The East Regional Landfill is located approximately 35 miles east of the structural axis of the Denver Basin. The geologic beds beneath the facility are located on the eastern flank of the Denver Basin, and generally strike north-south and dip gently to the west at approximately one degree (Bryant and others, 1981). The nearest major fold or faults are approximately 35 miles northwest of the site, and no indications of smaller scale folding or faulting were noted during the site characterization programs for the landfill and surrounding sites. Figure 3 is a generalized stratigraphic column showing the Tertiary and Cretaceous Age bedrock formations present beneath the site and very generalized thicknesses.

The surficial materials in the vicinity of the site include loess and eolian deposits and general pedisediments derived from erosion of the Rocky Mountains, and consist of loam, silty loam, clay loam, and sandy loams, or very fine sands. Variable percentages of gravel are typical of these deposits.

The Pierre shale is considered the basal confining unit for the major bedrock aquifers in the Denver Basin, so formations below the Pierre Shale are not discussed herein. The Pierre Shale is a marine deposit consisting primarily of shales with some interbedded siltstone and sandstone and is characterized by extremely low permeabilities and impervious clay layers. The thickness ranges up to 8000 feet across the basin.

The Fox Hills Formation is a shallow marine deposit lying above the Pierre Shale, and is a silty sandstone with some interbedded shale units. The thickness of the Fox Hills Formation reportedly varies between 50 and 300 feet across the Denver Basin.

The Laramie Formation is a coastal plain deposit overlying the Fox Hills. The Laramie is a series of alternating sandstones, claystones, and shales, with coal seams frequently occurring in the upper portion of the formation. The Laramie varies in thickness from 400 to 600 feet across the Denver Basin.

Fluvial deposits characteristic of the Arapahoe Formation overlie the Laramie Formation. The Arapahoe consists of a series if interbedded conglomerates, sandstones, siltstones, and shales, and the thickness varies between 400 and 700 feet across the Denver Basin.

The uppermost bedrock formation beneath the site is the Tertiary Upper-Cretaceous Denver Formation and is the uppermost bedrock formation beneath the surficial materials at the site. The Denver Formation is a continental-type deposit characterized by interbedded shale, claystone, siltstone, and sandstone. Across the Denver Basin, the Denver Formation ranges in thickness from 200 to 1000 feet (600-1500 feet in some sources) and commonly contains lenses of lignite.

Age	Unit	Typical Thickness	Lithologic Description
Tertiary/ Quaternary		0-20'	Surficial Weathered Materials: Silty, sandy, clayey, weathered bedrock and eolian loesses, brown to gray
Cretaceous	TKd	300'	Denver Formation: Interbedded shale, claystone, conglomerate,siltstone, gray to yellowish brown
	Ka	700'	Arapahoe Formation: Interbedded sandstone, conglomerate, siltstone, and shale, gray to yellowish brown
	Kl	200'	Laramie Formation: claystone, shale, and sandstone, light gray-brown
	Kfh	50'	Fox Hills Formation: Silty sandstone with interbedded shales, gray-brown
	Kp	6000'+	Pierre Shale: Shale, sandy shale, and some sandstone/siltstone lenses near the top, brown to dark gray brown
	Kn	350'	Niobrara Formation: Calcareous shale and limestone, gray to grayish yellow
	Kcg	450'	Carlile Shale: Silty claystone and siltstone, olive gray. Greenhorn Limestone: Limestone, claystone and siltstone, gray. Graneros Shale: Siltstone and claystone, dark gray
	Kd	230'	Dakota Group: Sandstone, siltstone, carbonaceous shale, and conglomerate near base, light to dark gray
Date:	9/16/2010		**FIGURE 3**
By:	MAM		
American Environmental Consulting, LLC			**GENERALIZED STRATIGRAPHIC COLUMN EAST REGIONAL LANDFILL**

From: Design and Operations Plan, Conservation Services, Inc. October 1991

2.2 Site Geology

The geology at the site was characterized by the completion of over 40 soil borings conducted within and surrounding the landfill site. The borings were completed as piezometers, monitoring wells, and to collect soil samples and conduct permeability tests.

The surface soils at the site have been mapped by the Natural Resource Conservation Service (NRCS), who notes that the mapped information is highly generalized and only relevant to a maximum depth of 60 inches (Sampson and Barber, 1974). The existing soil association at the site is the Weld-Adena-Colby, specifically consisting of Ascalon and Weld series soils at the site. Ascalon soils are well drained, found in nearly level to moderately sloping upland areas, and typically contain varying amounts of sand and gravel. They typically exhibit 30-50 percent of particles finer than the #200 U.S. sieve. Field infiltration rates range from $4x10^{-4}$ to $1x10^{-3}$ cm/sec. The water erosion hazard is moderate, they have low shrink-swell potential, and exhibit a severe blowing hazard in unprotected areas. The Weld series soils are found in well-drained nearly-level upland areas and typically form in wind-worked loamy material. The surface in these soils is non-calcareous loamy material, but becomes calcareous sandy loam with depth. Weld soils typically exhibit 60-90 percent of particles finer than the #200 U.S. sieve. Field infiltration rate ranges from approximately $4x10^{-5}$ to $1x10^{-4}$ cm/sec. with a high shrink-swell potential, moderate to severe erosion hazard, and a severe blowing hazard in dryland farm areas with less-than-normal precipitation.

In general the thickness of the unconsolidated surficial materials at the site increase from west to east across the site, ranging from approximately 10 feet in the western portions of the site to 50 feet in the eastern portions along Schumaker Road.

The Denver Formation was the only bedrock formation penetrated during the field characterization programs conducted in the site vicinity. The surface of the Denver Formation generally follows the surface topography across the site with a north-south trending ridge of higher bedrock mirroring the north-south topographical ridge in the western portions of the site. This relationship does not hold in the extreme southeast portion of the landfill site where the topography is higher, but the bedrock surface continues to dip eastward. The Denver Formation is encountered approximately 15 to 20-feet below the ground surface on the western portions of the site. In the central portions of the site in the vicinity of the compost operations, the top of the Denver Formation is approximately 20-feet below the ground surface. The depth to the Denver Formation ranges from approximately 40 to 45-feet below the ground surface in the eastern portion of the landfill adjacent to Schumaker Road. The upper Denver Formation characterized during the site investigations consists predominantly of claystone with interbedded lenses of sand, sandstone, siltstone, shale and lignite. These lenses generally vary in thickness from less than one inch to approximately four feet, and generally are less than 500 feet in lateral extent. Much of the upper Denver Formation in the eastern portions of the site where the bedrock is much deeper consists of a more aerially extensive sandstone above the claystone.

2.3 Regional Hydrogeology

The East Regional Landfill, including the compost operations, lies above the principal aquifers of the Denver Basin as well as within the boundaries of the Designated Lost Creek Ground-Water Basin. The uppermost aquifer beneath the landfill and compost site is the Denver Aquifer. Below the Denver Aquifer is the Arapahoe Aquifer, and beneath that the Laramie-Fox Hills Aquifer. The 6000-foot thick Pierre Shale is present beneath the Fox Hills Formation and is considered the base of the principal Denver Basin Aquifers. Because of its extensive thickness and extremely low permeability, formations below the Pierre Shale are irrelevant and will not be discussed. The principal source of groundwater in the Lost Creek Groundwater Basin is the unconsolidated alluvial materials of upland deposits, valley-fill deposits, and dune sands. Each of these aquifers is discussed in more detail below, particularly the Denver Aquifer since it is the uppermost aquifer beneath the site.

The Laramie-Fox Hills Aquifer occurs in a confined state in the lower sandstones of the Laramie Formation and the Fox Hills Sandstone. These units are considered to be a single aquifer since they are hydraulically connected. The aquifer is approximately 1200 feet below the site and has an average thickness of 160 feet (Robson and Romero, 1981). Insufficient water level data in the central part of the Denver Basin precludes direct definition of the potentiometric surface at the proposed, but extrapolation of indirect data from Robson and Romero (1981) indicates a north-northeasterly flow in the vicinity of the site. Water from this unit is a sodium bicarbonate type and generally of good chemical quality.

The Arapahoe Aquifer occurs in the sandstone and conglomerate beds that are characteristic of the Arapahoe Formation. The depth to the top of the Arapahoe Formation is approximately 450 feet with a total thickness of the sandstone and conglomerate beds ranging up to 150 feet in the vicinity of the site. The aquifer is considered confined beneath the site. Robson and Romero (1981) estimate the potentiometric surface elevation of the Arapahoe Aquifer at 5175 in the immediate vicinity of the site with flow to the north-northeast. Water from the Arapahoe Aquifer is of a sodium bicarbonate type and classified as acceptable in quality.

The Denver Aquifer is the uppermost aquifer beneath the site and is of the most interest to site operations. Robson and Romero (1981) indicate a saturated thickness of less than 50 feet for this aquifer with the base of the aquifer in the vicinity of the site at approximately 160 feet below the ground surface, implying that the top of the aquifer is approximately 110 feet below the surface.

The water bearing strata are described as irregular lenses of interbedded sandstone and siltstone that are hydraulically separated by thick sequences of claystone. Robson and Romero (1981) report a potentiometric surface elevation of approximately 5250 feet with a northerly flow direction, and wells in the aquifer generally yield from 0.05 to 1.0 gallons per minute per foot of drawdown. The water is classified as either a sodium

sulfate or sodium bicarbonate type of acceptable quality, although not as good as water from the Arapahoe or Laramie-Fox Hills Aquifers.

2.4 Site Hydrogeology

Based on the field characterization work done for the CSI facility to the north and for the East Regional Landfill facility, an extensive amount of site specific information is available. Most of the 40+ soil borings installed for permitting of this site were drilled to a depth that encountered groundwater and provide a comprehensive picture of the groundwater regime beneath the site. As stated at the beginning of Section 2.0, the supporting field documentation is not provided in this EDOP for brevity, but can be reviewed in the October 27, 1988 Conservation Services Incorporated, Design and Operations Plan, (Industrial Compliance, Inc., October 27, 1988) and the Engineering Design and Operations Plan, Five Part Disposal Facility, Volumes 1 and 2 (Doty & Associates, LLC, June 1, 2006).

The groundwater regime in the area of the ERL has been loosely segregated into three different zones based on differences the most common occurrence of groundwater in each zone to simplify discussion. These three zones are described as follows:

- Alluvial Aquifer Zone. The alluvial aquifer zone is predominantly located outside of the permitted landfill facility in the broad, shallow ephemeral drainage feature that is tributary to Lost Sand Creek. The eastern boundary of the Alluvial Aquifer Zone roughly coincides with the westernmost portions of the landfill facility. Shallow groundwater is present in the alluvium associated with this drainage feature and is characterized by groundwater depths generally ten feet below the ground surface or less.

- The Perched Groundwater Zone underlies the majority of the permitted landfill property and entirely underlies the area planned for the compost operations. Groundwater in the Perched Groundwater Zone is mostly present in laterally and vertically discontinuous sands, sandstone, and silty sand lenses within the extremely low permeability clays and claystone of the Denver Formation. Groundwater is also occasionally present in very localized areas within the upper weathered bedrock where the bedrock surface is slightly depressed compared to the surrounding bedrock surface. Since this is the Perched Groundwater Zone is most pertinent to the compost operations, it will be discussed in more detail below. The Perched Groundwater Zone is characterized by a north-south trending ridge of claystone bedrock that controls groundwater occurrence and movement in this area.

- The Denver Aquifer Zone is only present on the extreme eastern portion of the northern part of the landfill facility and beneath the northeast corner of the portion of the landfill where the entrance road and scalehouse are located. Groundwater in the Denver Aquifer Zone is generally deeper than that in the other two zones, and generally greater than 40-50 feet below the ground surface. In the Denver

Aquifer Zone, the bedrock is much deeper than in the Perched Groundwater Zone as described above and groundwater in this zone tends to infiltrate down to the top of this deeper bedrock surface.

Sheet 3 shows the locations of the piezometers that have been installed in and around the landfill facility. These piezometers were installed in the early 1990s when characterization of this landfill site began. Based on the boring logs and groundwater measurements in these piezometers, the saturated materials within the Perched Aquifer Zone either occur immediately above the claystone bedrock, or within interbedded, discontinuous sand and sandstone lenses within the claystone bedrock.

Water levels were measured at regular intervals for up to 1.5-years to determine static groundwater elevations. The approximate highest groundwater elevation recorded during this monitoring period is shown on Sheet 3. Beginning with the original CSI characterization efforts conduct in the late 1980s and after additional groundwater information was obtained during the ERL characterization, numerous attempts have been made to construct a realistic groundwater contour map of the groundwater beneath the CSI and ERL sites without success. The reason for this, as stated above, is that much of the groundwater in the Perched Aquifer Zone exists in relatively isolated discontinuous lenses of sand, sandstone, and silty sand within a claystone matrix. These lenses appear to only have a loose hydraulic connection among them or with deeper saturated materials, making any correlation of saturated materials from one piezometer to the next suspect. While it is difficult to establish a reliable hydraulic connection between saturated intervals at the site, this condition is environmentally beneficial to the siting of a landfill and compost facility because the movement of groundwater, if any, is extremely slow because the rate is controlled by the permeability of the claystone matrix in which these lenses exist. Review of the groundwater elevations on Sheet 3 indicate a possible groundwater flow direction to the north-northeast, in general agreement with the published groundwater flow direction of the Denver Aquifer as reported by Robson and Romero (1981).

As can be seen on Sheet 3, the groundwater elevations in the area of the compost operations range from approximately 20 to 30 feet below the working elevation of the compost pad and also indicate a potential northerly flow direction beneath the compost area.

Permeability testing was conducted on the various unsaturated and saturated materials during characterization for the ERL site. The permeability of the unsaturated materials was evaluated by packer tests conducted in open boreholes completed near two of the site piezometers and the results are shown in Table 1. Packer test PK-46 was located approximately 50-feet north of PZ-46 and conducted in the unsaturated surficial materials (silty, clayey sands) above the claystone bedrock. Packer test PK-47 was conducted approximately 50-feet south of PZ-47 in the unsaturated claystone bedrock materials. It should be noted that during the test conducted in PK-47, the flow meter recorded a one-time jump of .03 gallons, but did indicate continued water flow into the subsurface materials. It is believed that the .03 gallons shown on the flow meter represented an

instrument anomaly, but was used for purposes of calculating a permeability. The actual permeability of the claystone bedrock materials tested by PK-47 is probably much lower than that shown in Table 1.

TABLE 1
IN-SITU PACKER TEST DATA
(Unsaturated Materials)

Boring #	Permeability	Notes
PK-46	5.6 x 10-4 cm/sec	20 psi water pressure
PK-47	3.4 x 10-8 cm/sec	Conservative estimate assuming loss of 0.001 gal/min to formation

The permeability of representative saturated materials was conducted by the slug test method in a number of potential future monitor wells installed in and around the ERL site. Table 2 shows the results of both slug in and slug out testing of these monitoring wells.

TABLE 2
IN-SITU SLUG TEST RESULTS
(Saturated Materials)

Well #	Slug Out Permeability	Slug In Permeability
MW-204	1.1×10^{-3} cm/sec	6.8×10^{-4} cm/sec
MW-114	2.4×10^{-5} cm/sec	3.8×10^{-5} cm/sec
MW-109	3.6×10^{-5} cm/sec	3.4×10^{-6} cm/sec
MW-111 (aka MW-304)	1.8×10^{-4} cm/sec	1.4×10^{-4} cm/sec
MW-112 (aka MW-311)	5.2×10^{-5} cm/sec	Not Conducted

Each of the groundwater regimes identified at the facility are represented by one or more of the slug tests shown in Table 2. The saturated materials tested in MW-204 represent the alluvial aquifer materials west of the site, and as would be expected from alluvial materials exhibit the highest permeability tested. The saturated materials tested in MW-114 and MW-109 represent the permeability of the saturated materials present in the Perched Groundwater Zone. The materials tested in MW-111 and 112 represent the saturated materials present in the Denver Aquifer Zone.

Flow rate calculations in for the saturated materials in the Perched Groundwater Zone are problematic due to the isolated and discontinuous nature of many of the saturated materials encountered in this zone. A groundwater time of travel calculation was included in the Doty EDOP and is summarized as follows. Lohman (1979) provides an estimate of specific yield for the Denver Formation of 0.2, which is used to approximate the effective porosity in Darcy's equation. Using this estimate of specific yield for the effective porosity, a typical saturated hydraulic conductivity of 1.8×10^{-4} cm/sec (slug test results in MW-111), and an average groundwater gradient of 0.0027 ft./ft. between the water elevations in PZ-67 and PZ-41R (not shown on Sheet 3), a groundwater flow velocity of 2.5 feet per year was calculated for the Denver Formation, assuming Darcy's law is valid for this system.

3.0 COMPOST OPERATIONS PLAN

A Class II compost operation will be conducted by the windrow method on an approximate 500 ft. by 500 ft. lined pad located in the approximate center of the East Regional Landfill permit boundary as shown on Plate 2. The compost windrows will be actively managed by adding moisture and turning as necessary to maintain acceptable moisture content, distribute moisture evenly throughout the windrow, and ensure aerobic conditions to provide oxygen to the process and minimize odors. The pad will be graded to the northeast at a 1.5 percent grade toward a collection/retention basin at the northeast corner of the pad designed to contain the runoff volume from the 25-year 24-hour storm event from the compost pad plus two feet of freeboard. The pad and collection basin will be elevated above the surrounding ground surface, preventing stormwater from the 25-year 24-hour storm event from entering the compost pad and basin. Surface water runoff to the compost area will be diverted around the pad and basin to the site surface water control system. More detailed information on the design of the compost area and associated surface water controls is discussed in Section 4.0.

The collection basin will be pumped periodically and the water collected will generally be used for moisture control of the compost materials. In accordance with regulations, water will be removed from the collection basin at a rate sufficient to maintain a minimum of two feet of freeboard. A minimum 10,000-gallon tank will be installed in the processing portion of the compost area to hold fresh water and/or water collected from the collection basin for use in the compost operations. Should the capacity of the tank prove insufficient, the ERL may also re-circulate water pumped from the collection basin into the active portions of the landfill under the same criteria that the landfill leachate is recirculated (i.e., areas that do not have final cover and stormwater is controlled within the lined landfill).

During the compost process, naturally occurring microorganisms utilize various nutrients present in the feedstocks and bulking materials to break down these individual materials into a material that can be used as a soil amendment and nutrient rich growth media. While water is the prime nutrient required by all living organisms, it can be controlled relatively easily during the compost process. Typically, the moisture should be maintained as high as possible without substantially reducing the pore space that provides oxygen to the organisms. The appropriate moisture content is dependent on the physical nature of the feedstocks and the void space (porosity) of the composting material, and should be higher in the initial stages to promote bacterial activity. During the majority of the composting period, moisture content should generally be maintained between 45-60%; however, again this depends on the physical nature of the feedstocks and the pore space within the windrows. Microbial activity will substantially slow or cease at moisture contents of around 12-15%, so this can be considered a absolute minimum moisture content that any microbial activity will occur. Once the compost has finished, it needs to cure for a period and the moisture content of the compost should initially be raised to promote repopulation of the microorganisms to replace those killed during the high temperature stage of active composting.

Other than water, the major nutrients used by these microorganisms to create compost suitable for these uses are carbon and nitrogen, and the carbon to nitrogen ratio (C:N) is a critical factor in determining the efficiency of the composting process. A target C:N ratio of 25:1 to 30:1 is generally an ideal ratio for an efficient compost operation, but C:N ratios between 20:1 and 40:1 can also be effective. C:N ratios outside of these limits may still produce an acceptable compost, but may take a much longer time. The C:N ratios of individual feedstocks and bulking materials ranges widely, so a "recipe" for mixing the feedstocks is developed based on the respective volumes and physical attributes of the individual feedstocks. Most of the nitrogen in the feedstock is readily available for use by the microorganisms. Carbon on the other hand must be in a form available to the microorganisms. Carbon sources consisting of lignins (wood) and many forms of cellulose (some paper) are not readily available for use and can slow down the compost process in the absence of sufficient available carbon. The physical attributes of a feedstock are important because the available carbon / nitrogen content of the material can be increased by reducing the particle size of the feedstock, providing more surface area accessible to the microorganisms. Feedstocks and bulking materials that provide a source of carbon, such as wood, leaves, straw, and stems, can generally increase the amount of carbon available as a nutrient source by grinding to result in smaller particle sizes; however, generally wood and paper should not be considered to provide an appreciable amount of available carbon to the process.

3.1 Feedstocks

Five Part will operate a Class II composting operation as defined in Section 14 of 6 CCR 1007-2 Part 1 as follows:

A Class II composting facility is one that:

(A) Is permitted to receive only Type 1 and Type 2 feedstocks;

(B) Is not restricted as to the volume of feedstocks, bulking material or in-process material that may be present on the site at any given time, and

(C) May accept feedstocks from multiple generators at one location for processing.

Consequently, the facility will accept any of the following feedstocks for composting:

Type 1: Agricultural crop residues, manure, untreated wood wastes, yard, paper and green wastes.

Type 2: Animal material, animal mortalities and source separated food wastes (liquids and solid).

The facility will not accept any Type 3 feedstocks for composting without further approved modifications to the CD, which include biosolids, solid waste (excluding any

Type 1 or Type 2 feedstocks listed above), or processed solid waste and sludges. The facility will not accept liquids (those failing the paint filter test) other than discarded liquid food waste (ie., beer, soda, etc.) or treated wood waste, and in accordance with the Regulations the facility will not accept asbestos or asbestos containing materials, infectious waste, hazardous waste, PCB waste or lead-acid batteries for composting.

Alpine Disposal, Inc. currently collects and receives approximately 300 tons per month, or 3600 tons per year, of source separated food waste at its waste transfer station. This waste stream would normally be disposed of at the landfill, but instead will be delivered to the ERL for composting and is expected to comprise the majority of the feedstocks to be composted. The content of the food waste will vary substantially depending on the source (restaurants, grocery stores, etc.) and will contain varying quantities of whole and partial vegetables, fruits, breads, and meats. Depending on the proximity of the source of the food waste, some food wastes may also be delivered directly to the facility without going through the waste transfer station, but will only be accepted if they are separated from other wastes at the source and relatively clean of other materials that are unacceptable for composting in accordance with this plan.

The ERL is located in a rural agricultural area, and anticipates that it will also receive some volume of agricultural crop residues, manure, yard, and other green wastes acceptable for composting. Yard waste such as leaves, grass clippings, and ground woody material (trees and brush) can be either a source of carbon, nitrogen, or both depending on the structure of the material and the season. Yard wastes collected during the winter months typically have lower nitrogen and higher carbon content since they are generally not in a growing phase and there are less grass clippings; however, they typically have more structure and can be a good bulking material to improve aeration in the compost. Additionally, some of the yard waste collected in the winter months such as dead leaves can provide a source of readily available carbon. During the spring and summer months when vegetation is actively growing and grass clippings may be abundant, yard waste will exhibit a much higher nitrogen content and lower carbon content and more amenable to the compost process, but will be an inadequate bulking material. To make more carbon available to bacteria, the particle size of some woody and leafy feedstocks can be reduced by grinding. The facility has a tub grinder on site that can be used to reduce the size of certain feedstocks to enhance the composting process.

3.2 Bulking Materials

The primary purpose of incorporating bulking materials into the compost process is to provide porosity to the compost windrows to promote air circulation, which is necessary to enhance the aerobic compost process and minimize odors due to anaerobic conditions. The typical compost operation uses ground wood chips as a bulking material, and wood chips and untreated construction or demolition lumber ground on site or transported to the site are anticipated to provide the majority of bulking material used at the facility. The facility has a tub grinder on site that produces chips of approximately two-inches in size and will serve as an adequate bulking material. While most woods have a relatively

high C:N ratio, only a small percentage of the total carbon is available in chips of this size and so should not be counted on to provide an appreciable amount of available carbon. Although the various feedstocks and bulking materials will be mixed during turning of the windrows, certain feedstocks may be run through the tub grinder along with lumber and wood to provide some level of mixing prior to being placed in windrows.

Table 3 shows typical C:N ratios of some of the more common feedstocks and bulking materials that are anticipated to be processed at the facility. The C:N ratios shown in Table 3 are general guidelines for preparing a compost mix based on the feedstocks used and the physical nature of the feedstock. Bulking materials in the form of two-inch chips, while providing adequate porosity to the compost, are not expected to decompose to any degree within a reasonable period of time and so the C:N ratio of the chips can be largely discounted when determine the proper mix.

TABLE 3
TYPICAL NITROGEN CONTENT AND C:N RATIOS
OF SELECTED FEEDSTOCKS AND BULKING MATERIALS

MATERIAL	% NITROGEN	C:N RATIO
Cardboard	0.10 [1]	400-563 [1]
Coffee Grounds	---	20[1]
Cow Manure	2.4[1] 1.7[2]	19[1] 18[2]
Corn Stalks	0.6-0.8[1]	60-73[1]
Farmyard Manure	2.25[1]	14[1]
Fish Scrap	10.6[1]	3.6[1]
Fruit	1.4[1]	40[1]
Grass Clippings	2.4[1] 3-6[2]	12-19[1] 12-15[2]
Hardwoods (Ave)	0.09[1]	560[1]
Hay (General)	2.10[1]	---
Horse Manure	1.6[1] 2.3[2]	25-30[1] 25[2]
Leaves	0.9[1]	54[1]
Lettuce	3.7[1]	---
Meat Scraps	5.1[1]	---
Newsprint	0.06-0.14[1]	398-852[1]
Paper	---	100-800[1]
Pig Manure	3.8[2]	---
Poultry Manure	6.3[2]	15[2]
Raw Sawdust	0.11[1] 0.1[2]	511[1] 200-500[2]
Softwoods (Ave)	0.09[1]	641[1]
Sheep Manure	3.8[2]	---
Straw (Wheat)	0.3-0.5[2]	128-150[2]
Straw (General)	0.7[1]	80[1]
Tomato	3.3[1]	12[1]
Vegetable Produce	2.7[1] 2.5-4[2]	19[1] 11-12[2]
Whole Carrot	1.6[1]	27[1]

[1] www.weblife.org, Humanure Handbook, Chapter 3

[2] Biocycle Guide to The Art and Science of Composting, Edited by Biocycle, Journal of Waste Recycling, 1991

3.3 Compost Operations Process

3.3.1 Receipt of Materials

The facility will receive bulk feedstocks and bulking materials at the site in a variety of vehicles including, but not limited to, transfer trailers, roll-offs, farm trucks, pick-up trucks and possibly passenger vehicles. Some wastes, particularly yard wastes received from the general public, may arrive in plastic yard or garbage bags and the customer will be required to empty the bags and dispose of them. Signage at the facility entrance denotes the name of the facility and lists wastes that are allowed and prohibited from disposal at the facility. All of the wastes intended for use in this compost operation are also allowed for disposal at the facility, and the list of wastes prohibited for disposal are also prohibited for use in the compost operation with the exception of discarded liquid food waste such as beer, soda, etc. All vehicles carrying waste or material to be incorporated into the compost operation will pass through the scales and check in with the scalehouse attendant. The attendant will question the vehicle driver about the material being transported and examine the waste load if necessary based on the description of the waste given by the driver. The attendant will direct the driver to either the disposal area or the compost area, as appropriate. Additional signage on the facility access road will direct vehicles to either the disposal area or the compost area. A facility employee will be present during offloading of all compost feedstocks to ensure only appropriate and acceptable materials are offloaded in the compost area. If materials inappropriate for composting are discovered to have been offloaded in the compost area, such as garbage or materials contaminated with excessive amounts of inappropriate material, the material will be removed and transported to the landfill for disposal. If material is identified that is neither appropriate for composting or disposal, the driver of generator will be contacted to remove the material from the site.

The compost area is located adjacent to the south of the main facility entrance road as shown on Sheet 1 and is very accessible to arriving vehicles. Some innocuous dry wastes such as lumber, yard and tree trimmings, grass clippings, and dry manure will be offloaded either on or off of the compost pad depending on their volume and anticipated time until needed. For example, lumber, yard waste, and manure may safely be stored off of the compost pad without creating environmental concerns. Other wastes with the potential to release liquids onto the ground (such as food wastes), that contain sufficient paper and other contaminants that can create a windblown debris problem, or those that present a potential odor concern will be offloaded directly on the compost pad or inside the dry pre-processing building as discussed in Section 3.3.3.

3.3.2 Materials Processing

As stated earlier, the facility may implement a commercial "dry system" pre-processing facility to prepare some of the wastes for composting and remove contaminants such as large pieces of paper and cardboard, plastics, and metal foil from the material prior to mixing and placing in windrows. This Section 3.3.2 discusses the compost process

regardless of the implementation of the pre-processing system. The pre-processing system is discussed in detail in Section 3.3.3 below.

The level of processing and mixing of feedstocks and bulking material is very highly dependent on the chemical and physical nature of the feedstocks to be composted, and this discussion is intended to be general in nature. The actual processing, mixing, moisture conditioning, and grinding process will necessarily be adjusted based on the feedstocks and bulking materials available on site.

After receipt of the materials, they will be processed and mixed with other feedstocks and bulking materials with the goal of creating a compost mix with a C:N ratio of around 25 to 30:1. Bulking materials will be added if necessary to increase the porosity of the mix to be composted. Depending on the nature and moisture content of the feedstocks, a 2:1 ratio by volume of bulking material to feedstock may be a good place to start; however, again, this is dependent of the chemical and physical nature (moisture content, particle size, etc). The C:N ratios shown in Table 3 can be qualitatively used because they are only representative values and may not represent the actual feedstock used and the carbon values shown are total carbon, not available carbon. However, using Table 1 as a reference with vegetable produce as a feedstock and an average softwood as a carbon source (depending on the wood chip size, only a portion of the total carbon shown is available), the proper mixing ratio of feedstock to bulking material could be anticipated to be between 1 to 1 up to 3 to 1. In addition, as the decomposition process proceeds during composting, the compost material settles, reducing the original pore space available for oxygen and increasing the bulk density of the composting material. Among other factors, this condition is highly dependent on the extent of grinding of the feedstocks. Data on composting of supermarket organics indicates that the density of the material increases substantially with an attendant reduction in oxygen concentration if the feedstocks are too finely ground, even at a bulking material (yard trimmings and cardboard) to feedstock (produce debris) ratio over 4:1 (*Composting Source Separated Organics,* Edited by the Staff of Biocycle, Journal of Composting and Recycling, Chapter 32, 1994). The various feedstocks, and bulking materials if needed, will be mixed on the south end of the compost pad using a loader. Water may be added during the mixing process, if necessary, to create a relatively moist mixture. Water may be obtained from the storage tank, stormwater retention basin, the on-site well, or using landfill leachate from the ERL if water quality testing indicates that 1) no organic constituents from the Appendix 1B list in 6 CCR 1007-2, Part 1 are present, and, 2) the leachate meets Colorado agricultural standards (Table 3 of 5 CCR 1002-41). Landfill leachate to be used for the composting operations will be tested for suitability at the frequency of once per every 10,000 gallons used. A qualitative check for the proper moisture content is to provide sufficient water to create a sheen in the mixture but not so much that it runs off after it is mixed in. It should be noted that the actual percentage of moisture required will change during the compost process as the pore space is reduced and the compost settles.

After the desired mix is achieved, it will be hauled to the appropriate location on the compost pad and placed into windrows. The operator intends to construct approximately 400-feet long windrows oriented in an east-west direction, starting at the north end of the

pad and working toward the south. The windrows will be approximately five-feet high and 14-feet wide at the base, based on the anticipated turning equipment to be used. If different windrow turning equipment is used in the future, the windrow size and configuration may be adjusted provided that the equipment can adequately mix and turn the pile. A 16-foot wide fire lane will be maintained in between compost rows. A schematic of the anticipated compost pad and windrow configuration is shown on Sheet 2. As stated earlier, the feedstocks may be processed prior to placing them in windrows to reduce their particle size and provide more surface area available to the composting process. The feedstocks may be processed through the tub grinder alone, or with the bulking material, which will provide an initial level of mixing. If additional mixing is required, the windrow may be turned using the compost turning equipment immediately following windrow formation. Additional water may also be added during this initial turning if needed.

3.3.3 Dry Pre-Processing System Option

Five Part has identified a commercial pre-processing system that may be used to reduce the size of certain feedstocks, particularly commercial food wastes, and remove incidental amounts of contaminants such as paper and cardboard. The system is manufactured by Doda USA, Inc., a subsidiary of an Italian-based company that designs organic waste separation equipment. If feasible, Five Part may implement this system as a method to pre-process organic feedstocks, particularly food waste, by grinding and chopping to reduce the particle size and removing contaminants such as large pieces of paper, cardboard, metal foil, and plastic typically associated with many discarded food wastes. The system is called a dry system because it can be used without the addition of water, but water can also be added if needed to facilitate the removal of the processed feedstock from the system.

If implemented, the system will be enclosed in a building constructed adjacent to the southwest corner of the compost pad as shown on Sheet 1. The entire system, including all mechanical components and storage tanks will be enclosed in a building to shield the operations from weather and prevent any liquids used, or resulting from, the process from freezing. The floor of the building will be concrete and incorporate a tipping area for offloading feedstocks from the transport vehicles and a push wall to facilitate loading the feedstocks into a hopper.

Vehicles will enter the building and offload the feedstock onto the concrete tipping floor. Once offloaded, the feedstock will be picked up with a loader and loaded into a hopper equipped with an auger. The auger moves the feedstock out of the hopper into a macerator, and in the process reduces the size of the larger particles (such as large whole fruits and vegetables) for movement through the system. Once in the macerator, a series of blades, similar to a hammer mill, chop the material into finer particles and moves them into a rotating screen. The screen is perforated with 15 millimeter holes to allow the chopped feedstock to pass through the screen. A suction vortex is created in the rotating screen, which removes the drier contaminants such as paper cardboard, plastic, and foil and deposits them into a container for disposal, while the wetter, more dense feedstock

passes through the screen to a reservoir. Once in the reservoir, the processed feedstock flows into a holding tank. If the feedstock is not wet enough at this point to flow into the holding tank, water can be added to facilitate flow into the tank. The moisture content of the processed feedstock once it enters the tank varies and is dependent on the particular feedstock, but the system manufacturer states that typically the moisture content is around 10-15 percent. The processed feedstock is then removed from the tank and transported to the compost pad for further processing and/or mixing and windrowing as described above. The contaminants removed from the feedstock are transported to the landfill disposal cell. If this system is implemented, additional information on the system design and any liquid containment will be submitted to the CDPHE, TCHD, and Adams County.

3.3.4 Windrow Management

The moisture content and temperature of all actively composting windrows will be monitored and logged on a regular basis. To evaluate the progress of new windrows as they are constructed, they will initially be monitored on a daily basis each day that the facility is open until a pattern of the speed and efficiency of the compost process becomes evident. The moisture content and pore space will be qualitatively evaluated and the temperature measured by the operator and will be adjusted as deemed necessary. Different populations of microorganisms are active under different environmental conditions within the compost. The main conditions affecting the particular microbial population that are of interest to the operator during windrow management are aerobic vs. anaerobic, and mesophilic vs. thermophilic temperature zones.

The operator will qualitatively assess the aerobic condition of the compost by visual and olfactory examination. An initially aerobic windrow can become anaerobic if there is either too much moisture in the windrow (water fills the pore space rather than oxygen), or there is not sufficient pore space to maintain a minimum level of oxygen necessary to support the microbial population. As stated above, one indicator of excessive moisture content is that moisture is draining out of the windrow, which can sometime be observed as the windrow settles and the amount of pore space is reduced. The generation of ammonia is the predominant qualitative indicator of anaerobic conditions (which can also be caused by an excessively low C:N ratio, i.e., too much nitrogen). Because the outer layer of the windrow is exposed to the environment, anaerobic conditions may be present deeper in the windrow and not evident until the interior of the windrow is exposed. Aerobic conditions can also be locally restricted within the windrow, usually due to poor mixing of a particular feedstock. Depending on the causes of an anaerobic condition, it can be remedied by one or a combination of the following; 1) decreasing the moisture content, 2) increasing the available carbon content, 3) mixing in additional bulking material, and/or, 4) turning the pile to more thoroughly mix the feedstocks and bulking material and introduce oxygen.

The terms mesophilic and thermophilic refer to optimum temperature ranges at which a particular microorganism is active, and various sources cite different ranges. The optimum temperature range for mesophilic organisms is generally reported in the range

of 10-15°C (50-59°F) to 40-45°C (104-113°F) and for the thermophilic organisms between 40-45° C (104-113°F) to 70° C (158°F). Given the compost is managed properly to support microbial activity and reduce pathogens, as nutrients in the compost are used by the microbes and converted to energy and reproduction increases, the temperature moves through the mesophilic range. The temperature will continue to increase, killing off the mesophilic organisms and move into the thermophilic temperature range, promoting the growth of thermophilic microorganisms. It is important to note that the compost process occurs in either of these temperature ranges, but the compost must reach temperatures in the thermophilic range for a period of time to kill most pathogens. In accordance with 6 CCR 1007-2, Part 1, 14.3.3(K)(1) the temperature of actively composting windrows must be maintained at 55°C (131°F) or higher for fifteen days or longer as a method of pathogen reduction. The fifteen days do not need to be consecutive, and the windrow will be turned a minimum of five times when the temperature is 55°C (131°F) or higher. If any feedstocks that have not begun the composting process are added to materials that are actively composting, the temperature monitoring and requirements shall start over (i.e., no "credit" is given for days that have met or exceeded the temperature requirements). The temperature in the windrow should reach the thermophilic range for a period of time until the microbial activity slows down due to

1) the available nutrients begin to deplete; or
2) the moisture content becomes too low to support microbial activity; or
3) the available oxygen is depleted either through microbial activity, too much moisture, or excessive settling of the windrow.

at which point the temperature will begin to drop. The windrow should be turned at this time, and moisture added if necessary, to incorporate the un-decomposed materials from the outside of the windrow into the interior of the windrow for composting. It is generally beneficial to turn the windrow when the internal temperature reaches 160°F because higher temperatures are detrimental to the thermophilic microorganisms. Because of the relatively small size of these windrows, overheating should not be a problem as the interior of the windrow is relatively exposed to the outside temperature. According to the University of Minnesota Extension office (2000), no documented cases of spontaneous combustion have been reported in windrows less than seven feet high. If the temperature of the interior of the windrow continues to climb outside of the thermophilic range, the pile should be turned and aerated.

After meeting the above minimum requirements for maintaining the thermophilic temperature range for 15 days with a minimum of five turnings, the windrows will continue to be managed, including monitoring the temperature and moisture content on a regular basis (initially) and turned as necessary to maintain the moisture content and temperature. Turning not only manages the temperatures and microbial activity in the interior of the windrow, but the exterior layer of the windrows needs to be incorporated into the interior so that it can be subjected to the composting and pathogen reduction processes. When the compost begins to stabilize, microbial activity will slow and a reduction in the temperature increases will occur. Monitoring frequency of the windrows

can be reduced concurrently with increasing stability of the windrow. Once one or more of the windrows appear to have begun to stabilize based on the inability to reach a thermophilic temperature zone, the windrow(s) will be placed into a large pile and allowed to cure for a period estimated to range from 40-60 days before it is tested and distributed. Additional composting (curing) of the materials will occur by mesophilic microorganisms at this stage. Additional periodic temperature monitoring of the curing compost pile will be conducted to verify that the compost temperatures are not reaching the thermophilic stage, which would indicate incomplete composting. Prior to distribution, a sample of the compost will be collected and tested as discussed in Section 3.3.5. and will be screened to remove any remaining large particles of bulking material for reuse.

Each windrow will be provided a unique identifying number or letter so that the particular stage of composting of each windrow can be tracked (e.g. A, B, C, etc.) as indicated on Sheet 2. To simplify tracking the compost process, maintenance of each windrow (moisture conditioning, turning, etc.) will generally be conducted over an entire windrow when feasible. It is entirely possible that portions of individual windrows will be in different stages of the compost process due to the variability of feedstocks and their reaction to the compost process and the rate that they are received by the facility. Maintenance of partial windrows is allowed if a physical marker is used to distinguish between portions of windrows that are maintained on a different schedule and each portion will be provided a unique identifier to distinguish it from adjacent portions within the windrow (e.g. A1, A2, A3, etc.). The daily compost monitoring logs will reflect the distinction between these different portions of the windrows.

3.3.5 Monitoring and Testing

It will generally not be necessary to conduct testing of any feedstocks prior to processing and incorporation into windrows because their properties are expected to vary quite a bit. At the operator's discretion, certain feedstocks may be tested for various parameters nutrient, chemical, and physical parameters that can facilitate proper mixing ratios and for evaluation of the effectiveness of the compost process.

During the active composting process, the operator will monitor the temperature and moisture content of the windrows frequently to ensure that the temperature of the compost meets the minimum requirements for the reduction of pathogens and the windrows maintain conditions optimum for the compost process. Monitoring in newly constructed windrows will be conducted daily during facility operating hours until the effectiveness of the compost process with the particular mix of feedstocks in that windrow can be evaluated, at which point in time monitoring of that windrow may be reduced or increased as necessary.

Moisture will be monitored quantitatively at a frequency necessary to ensure optimum moisture is maintained within the windrow. The operator will examine samples from materials at least three feet into the windrow by removing the overlying material to visually evaluate the moisture content within the windrow where composting is active.

Alternative methods such as coring may also be used. Sample locations will be selected randomly across the top and sides of the windrows at a minimum frequency of one location for every 100 linear feet of windrow. Since a given windrow may contain materials at different stages in the composting process, portions of an individual windrow may be monitored at an increased frequency.

Temperature measurements will be collected on a regular basis using a compost thermometer capable of penetrating into the windrow at least three feet. Temperature measurements will be collected from materials at least three feet into the windrow and randomly across the top and sides of the windrows at a minimum frequency of every 50 feet along a windrow. As with moisture measurements, the temperature readings of newly constructed windrows may be conducted more frequently until a pattern of temperature changes can be observed at which point a reduced monitoring frequency may be acceptable. For materials that are in the thermophilic pathogen reduction stage, temperature measurements will be collected daily at a minimum to demonstrate that pathogen reduction requirements have been met. The windrow will turned at least five times when the windrow temperature is at least 55°C (131°F) or greater and the turning date will be recorded along with the temperature to ensure regulatory pathogen reduction requirements are met. All temperature readings and turnings will be recorded on a log and maintained in the site operating record.

After active composting is complete and the temperature will no longer approach the thermophilic range, the compost will be placed into large piles on the compost pad or on an interior slope within the lined portion of the active landfill as noted on Sheet 1 and allowed to cure and stabilize. Compost placed within the limits of the lined landfill will be placed in a location such that stormwater runoff is controlled and collected. Once it has stabilized as evident by its inability to reach the mesophilic temperature range, it will be sampled and tested in the laboratory to ensure it is stable and ready for distribution. Based on the laboratory analysis, adjustments to the compost operations will be made if necessary to achieve stability. A sample of finished compost will be collected at the rate of one sample for every 10,000 cubic yards to be distributed, or once annually (whichever is more frequent) and tested for the constituents shown in Table 4 in accordance with Section 14.5 of 6 CCR 1007-2, Part 1. Testing of finished compost in which landfill leachate was used and is distributed for off-site use shall be tested at the rate of one sample for every 5,000 cubic yards or once annually, whichever is more frequent, for all constituents listed in Table 1, Colorado soil Evaluation Values-December 200 ("CSEV") and must meet "Residential" standards.

A representative sample will be collected at the required rate from a location at least five feet below the surface of the pile with a clean stainless steel sampling implement. It can be collected with a sampling shovel, coring tube or other suitable stainless steel implement and will be placed immediately into clean sample containers supplied by the laboratory. All sampling equipment will be cleaned with site well water and rinsed with deionized or distilled water following the collection of each sample to avoid cross contamination. Each sample will be given a unique identifying number or name, and the location where the sample was collected will be recorded for future reference if needed.

If a sample fails to meet the requirements of Table 4, additional samples may be collected and tested to delineate the failing compost, and once delineated, the failing compost will be reintroduced into the compost process or properly disposed of. Alternatively, the entire pile from which the sample was collected will be reintroduced to the compost process or disposed of. No compost will be removed off of the compost pad or lined landfill area until testing indicates acceptable results for distribution or off-site use as shown in Table 4.

TABLE 4
MAXIMUM CONSTITUENT CONCENTRATION FOR COMPOST SOLD OR DISTRIBUTED FOR OFF-SITE USE (mg/kg dry weight basis)

CONSTITUENT	MAXIMUM LEVEL
INORGANICS [1] (mg/kg)	
Arsenic	41
Cadmium	39
Copper	1500
Lead	300
Mercury	17
Nickel	420
Selenium	100
Zinc	2800
BIOLOGICAL [2]	
Fecal Coliform	< 1000 Most Probable Number per gram of total solids on a dry weight basis
Salmonella sp.	< 3 Most Probable Number per 4 grams of total solids (dry weight basis) at the time the compost is to be sold or otherwise distributed for use.

[1] Inorganic Methodology: Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846) Third Edition, December 1996: As, Cd, Cu, Pb, Ni, Se and Zn by Method 6010 or 7000. Hg by 7471.
[2]Testing may include either Fecal Coliform or Salmonella sp. bacteria. Both are not necessary to demonstrate pathogen reduction.

Finished compost meeting the limits set forth in Table 4, or as discussed above for compost in which landfill leachate was used, will be considered finished compost and acceptable for unrestricted use.

3.3.6. Mass Balance Evaluation

A definitive mass balance of the proposed compost operation cannot be defined because the physical and chemical nature of the feedstocks will vary. The ultimate volumes and types of feedstocks that will be accepted for composting is not known; however, since the majority of feedstock will be food waste that is currently collected by the operator, the anticipated initial volume of this feedstock can be estimated relatively well. Aside from the various volumes and types of feedstocks to be composted, the physical nature of the feedstocks, as well as bulking materials, will dictate the optimum ratio of feedstock to bulking material, which in turn affects the mass balance evaluation. Based on a number of assumptions as shown, Table 5 presents a conceptual mass balance for planning

purposes. Based on these assumptions, including the feedstocks, bulking materials, and mixing ratios, the maximum capacity of compost that can be processed on an ongoing basis is approximately 1,000 cubic yards per month or two windrows. The actual volumes of compost produced may differ substantially from these numbers. If the volume of feedstock or bulking materials arriving at the facility is more than can be accommodated based on this design and operations, the facility has the option of disposing of the material in the landfill (if acceptable in accordance with the landfill permit) or transported to another compost or landfill operation.

TABLE 5
CONCEPTUAL MATERIAL BALANCE AND SPACE NEEDS

Material	Quantity	Basis
Food Waste	300 tons/month	Receipt records at recycling facility
Initial Density of Food Waste	700 lbs/cy	Average weight as received at transfer station
Volume of Food Waste	860 cy/month	Calculation
Bulking Material to Feedstock	2:1 (v:v)	Ratio can vary widely
Bulking Material Needed	1,720 cy/month	At 2:1 v:v ratio
Volume Compost after mixing	2,580 cy/month	To be windrowed
Cubic Yards capacity/windrow	670 cys	Based on windrow 400 ft long x 5 ft high at 1:1 slope
Windrows constructed/month	4	Calculation
Estimated water needs	5,000-12,000 gals	Can vary widely. Assume 50%-120% w:w ratio
Anticipated Compost time	2-5 weeks	Discussions with composters
Anticipated curing and/or finished compost	600-1,000 cys/month	Assumes 50% volume reduction from initial volume
Windrow Capacity of Pad	13 windrows and approximately 8,700 cys	
Conclusion	Compost pad is sufficiently sized for maximum anticipated operation	

3.3.7 Compost Leachate Management

Liquids that have had contact with the feedstocks (with the exception of innocuous feedstocks such as grass, leaves, etc) or actively composting materials will be referred to as leachate and must be handled appropriately. All compost leachate will remain on the lined work pad or drain to the collection basin. The operator will also have a tank on site for storage of fresh water and leachate for use in the compost operation.

The collection basin is sized to retain anticipated volume of runoff from the compost pad resulting from the 24-hour 25-year storm event, plus two feet of free-board. In accordance with Section 14.3.1 of 6 CCR 1007-2, Part 1, the collection basin will be dewatered within 30 calendar days of a storm event so that full runoff storage capacity is maintained and that a minimum of two-feet of freeboard is maintained at any given time.

Compost leachate removed from the collection basin can be managed in a number of ways, including:

1) Direct application back onto the compost;
2) Transferred to the storage tank for later use, or,
3) Sprayed onto the active landfill face for evaporation and recycling through the landfill leachate collection and removal system.

3.4 Nuisance Conditions

The compost operation has the potential to create nuisance conditions, with odor being of most concern. Most nuisance conditions are a result of improper management of the composting process from receipt of the feedstocks and bulking materials at the facility through removal of the finished compost off of the site. Fortunately, most nuisance conditions can be eliminated, minimized, or mitigated by instituting proper management techniques. The potential nuisance conditions and methods to eliminate or mitigate the conditions are discussed below.

3.4.1 Dust

Dust may be created by vehicles transporting feedstocks and bulking materials to the facility. The addition of the compost operation to the site landfill operations is not expected to increase site vehicle traffic by any appreciable amount since most of the vehicles arriving with compost materials would normally still be arriving at the facility for disposal purposes if the compost operation was not available. The landfill has a current Construction Permit that includes a dust control plan to minimize the generation and migration of particulate emissions. That plan includes such items as incorporating crushed asphalt paving on portions of the site access roads, compaction and revegetation of soil stockpiles, and the use of water or other dust suppressants as needed on site to control dust generation. These same control measures are applicable to the dust suppression measures resulting from the compost traffic and will be implemented to control particulate emissions resulting from traffic associated with the compost operation. The facility has a water well for ready access to water and a water truck for watering roads, stockpiles, and other disturbed areas on an as-needed basis.

Dust may also be generated by the tub grinder as feedstocks, and particularly bulking materials, are ground in preparation for composting. The majority of the feedstocks anticipated to be accepted by the facility are food wastes that will have a substantial moisture content during grinding and will not create any dust. The tub grinder is equipped with a water spray system that will be used in the event dust suppression is necessary during grinding operations. Dust may also be generated during the screening of finished compost. Neither the grinding or screening operations will be conducted on an ongoing basis and will be necessary only periodically as they are needed in the processing of feedstocks and bulking materials or on completed compost.

The potential for dust emissions from the grinding and screening operation will require an air pollution emission notice (APEN) be submitted to the CDPHE Air Pollution Control Division (APCD), and may result in the issuance of a Construction Permit by the APCD. An APEN will be prepared and submitted to the APCD, and if necessary obtain a Construction Permit, prior to conducting any grinding or screening operations at the site.

3.4.2 Odors

The compost operations are situated in the center of the site approximately 550 feet from the southern property boundary and well within the landfill footprint. The nearest residence is located approximately 1,000 feet to the southeast of the proposed compost operation. The next nearest residence is approximately 1/3-mile southwest, with other properties ½-mile or more away from the compost operations. Odors from the compost operation are expected to generally dissipate within a short distance, and the generation of most compost odors can be eliminated or reduced through proper operational techniques and adjustments.

Odors may be generated from the feedstocks themselves or from adverse conditions within the compost itself. The best method to minimize odors from feedstocks with particularly strong odors is to process, mix, and windrow the feedstock as soon as it arrives at the facility. If the dry system pre-processing system is installed, offloading the processing the feedstock within the building will also help minimize nuisance odors. The compost process will begin and odors will decrease as soon as the proper mix of feedstocks, providing an acceptable C:N ratio, is complete and bulking materials are added to provide access to oxygen.

The most predominant odor resulting from the compost operation, and that of the most concern, is due to the increase of ammonia generation. Ammonia generation is generally the result of two conditions that can be remedied relatively easy. The first and most common cause of ammonia odors is the lack of oxygen in the compost windrow as a result of too little porosity and access to oxygen, causing the windrow to become anaerobic. Causes of anaerobic conditions include too much water, which fills the pore spaces, or too little or the wrong type of bulking material, which creates pore spaces. Either of these causes can be mitigated by turning the windrow, which allows it to dry a little (if needed) and introduces oxygen to the materials. During turning, additional bulking materials can be added to the windrow to create additional pore space if needed. Another potential cause of ammonia odors is an excessive low C:N ratio (too much nitrogen). This cause can also be mitigated by turning the windrow and mixing in an additional source of available carbon. Localized sources of ammonia odor within the windrow can usually be mitigated simply by turning and mixing the compost materials. This is most common with high nitrogen materials such as grass cuttings that can easily "mat" and become anaerobic.

If a particular odor that cannot be mitigated by the procedures discussed above becomes a problem, expert resources are available and will be used to evaluate the cause of the odors and implement an appropriate remedy. These remedies can include commercial

chemical masking agents, odor destroying compounds (such as lime), or a change to operational procedures. Care must be taken when adding odor controlling to the compost because some of these can change characteristics of the finished compost. For example, the additional of lime to the compost can mitigate odors, but will lower the pH of the compost to a range where it limits its usefulness as a growing media.

3.4.3 Windblown Debris

Windblown debris is a very minimal concern with the compost operations. Only small quantities of paper, plastic, and cardboard will be present in the compost and with proper mixing should be incorporated into the compost. In addition, the landfill has a litter control plan that includes regular patrols of the facility and surrounding public property and extends to the compost operation.

3.4.4 Vectors

The compost operations have the potential to provide a food source for vectors such as birds and rodents. Rodents are not expected to be a major concern because of the frequency of activity associated with the compost operations. If the dry pre-processing system is instituted, rodents can be controlled within the building using standard traps and poisons. Controlling the rodent population removes one potential food source for birds. If necessary, professional extermination services will be obtained to reduce vectors that attract birds, such as rodents.

The compost operation can potentially be a bird attractant because the feedstocks can provide a food source for birds. The expected frequency of activity on the compost pad should be sufficient to discourage bird landings in the compost area. Solid waste landfills are very familiar with the potential for bird attraction and are used to implementing bird control measures. The landfill facility also has an approved Bird Mitigation Plan that was developed with input from the Federal Aviation Administration (FAA) and the Wildlife Services Division of the United States Department of Agriculture (USDA) and reviewed by the FAA, USDA, Denver International Airport, and the Front Range Airport. The Bird Mitigation Plan includes actions to be taken to mitigate any bird concerns, including the use of hand-fired pyrotechnic shells, and will be implemented for the compost operations if birds become problematic.

Other types of bird repellent devices are available and can be used in varied combinations with pyrotechnic methods and include such items as decoys of bird predators, automated cannons which periodically release a loud blast and squawk boxes which make continuous high pitched irritating noises. If the above methods are not effective, a professional bird control service will be obtained to assist in this effort.

3.4.5 Mud

The compost pad is sloped to drain toward the collection basin, but the planned windrow placement will intercept much of the surface water runoff. This configuration is beneficial in that it reduces the required size of the collection basin, but also provides a ready source of water for moisture conditioning of the compost. Since the surface of the compost pad is compacted soil, it will be muddy at times. Good housekeeping practices such as periodic grading to eliminate low spots will reduce the impact of mud on the compost operations. Typically, only landfill equipment that does not leave the site will travel on most of the compost pad. Most vehicles traveling to the site with feedstock or bulking material will be restricted to the southern portions of the pad for offloading, but all areas subject to traffic will be paved with recycled asphalt. If mud becomes problematic, the operator may place a bed of wood chips over the protective soils to mitigate mud issues and one foot of protective soils will be maintained at all times.

3.4.6 Fire Hazards and Protection Plan

The fire hazard for a properly operated compost operation with windrows of the size planned for this facility is minimal. As discussed earlier in this document, there is no documentation of spontaneous combustion in compost windrows less than seven feet high. Temperature monitoring of the windrows will allow excess temperature generation to be identified and the windrows will be turned to cool down should the windrow temperature continue to climb above 160°F.

A 16-foot wide fire lane is provided between each windrow to provide access to site equipment to fight small fires and for larger fire-fighting equipment in the event a large fire occurs. The relatively small size of the windrows simplifies any fire-fighting efforts. If smoke or small fire from a windrow is observed, access to the compost area to anyone other than site personnel will be restricted. Site personnel will create a buffer around the smoking portion of the compost using the site front loader, dozer, or other suitable equipment to remove other potentially combustible materials to a safe distance from the smoke or fire. Soil will be placed on the compost in an effort to extinguish the fire. When safe to do so, the soil and compost will be mixed to provide a non-combustible mixture and the material will be allowed to cool to ambient temperature. Alternatively, a nearby source of water, such as the compost collection basin, storage tank, or water truck may be used in an attempt to distinguish the fire. Once the fire is extinguished and the material has cooled to ambient temperature, the material may be re-introduced to the compost operation or disposed of in the landfill. Although fire extinguishers will not likely be effective if a fire starts in the compost, all site equipment is outfitted with a fire extinguisher. A fire extinguisher will also be installed in the dry pre-processing system building if it is constructed.

In the event of a larger fire or one that facility personnel do not feel comfortable dealing with, the Bennett Fire Department or 911 will be contacted immediately. All non-essential personnel will be prohibited from entering the compost area and required to remain a safe distance. If the fire is large enough, the entire landfill facility will be

closed and no one other than site or emergency personnel will be allowed into the property.

The Bennett Fire Department will be notified of these operations and give the opportunity to provide comments or recommendations to these plans. The facility will comply with all local fire codes.

3.5 Training

Facility personnel that are responsible for operational aspects of the compost operations will be required to read and understand the information and requirements provided in this EDOP. In particular, the training will place emphasis on compost processing, windrow management, recordkeeping, and mitigation of nuisance conditions. At least one employee knowledgeable in the compost operations will be on site at all times that compost feedstocks are delivered to the facility or when processing or windrow management activities are occurring.

All employees will be trained to identify prohibited materials and potential problems that could occur when the compost is not being attended to, including the presence of smoke or fires, odors, or windblown debris. Emergency contact numbers will be posted in a conspicuous location in the gatehouse, and will include the facility manager's phone number, the corporate office phone number, and the local police and fire department phone numbers.

3.6 Contingency Plan

The procedures and protocol in this EDOP provide procedures and protocols to manage the delivery of unapproved feedstock, bulking materials or other unapproved wastes, potential actions to be taken if surface water or groundwater is contaminated, and control of nuisance conditions.

As a part of the ERL landfill operation, materials arriving at the facility that are not acceptable for composting can generally be easily disposed of in the landfill. Signage at the entrance gate of the site lists prohibited wastes that are not acceptable for the compost operation or landfilling. All vehicles entering the facility with compost or waste materials are required to pass over the scales and check in with the scalehouse attendant. The scalehouse attendant will identify the materials and direct the vehicle to the appropriate location; either the landfill or the compost facility. During offloading, the compost materials will be examined for the presence of unacceptable materials. If identified, the vehicle driver will be requested to haul it over to the landfill for disposal, or remove it from the site, as appropriate. Records are maintained of all vehicles arriving at the facility, so if any unacceptable compost materials are discovered after the driver has left the site, the driver or generator will be contacted and asked to remove the materials. If the driver or generator cannot be contacted, landfill personnel will remove the waste themselves and either transport it to the landfill for disposal or arrange for transport to an alternative appropriate facility.

As described in this EDOP, there is little potential for contamination of surface or groundwater as a result of the compost operations. If compost leachate breaches the pad or collection basin, the affected soil will be excavated and either disposed of in the landfill or incorporated into the compost operation. If the leachate enters the site drainage system, the potential of the leachate to discharge from the facility will be evaluated and the appropriate sampling and remedial efforts will be implemented. In the very unlikely event that groundwater contamination occurs from the compost operations, the source and causes behind the contamination will be evaluated and repaired, either through repair of damaged structures, or changes in the facility design or operations. The extent and severity of the contaminated groundwater will be evaluated and the operator will take all steps required by regulations to correct the problem. If a release occurs that results in potential environmental harm the CDPHE, TCHD, and Adams County will be notified.

The control of nuisance conditions is discussed in detail above. The most effective step to control nuisance conditions is by implementing proper operational procedures and good housekeeping practices. If nuisance conditions develop, the appropriate actions will be taken to mitigate the nuisance condition, including modifications to the receipt and processing of compost materials (i.e., immediate mixing of certain feedstocks, maintaining proper mix ratios, moisture, and temperature conditions, etc), and obtain Professional assistance if needed. The operator will respond to any valid complaints within 24 hours after receiving the complaint.

4.0 FACILITY DESIGN

The compost operations area and structures are designed in conformation with Section 14.3.1 of 6 CCR 1007-2 assuming that a low permeability work pad is required for this operation.

4.1 Compost Pad, Collection Basin, and Processing Area

An approximate 500-foot by 500-foot low permeability work pad is designed for these operations. All feedstocks and bulking materials with the potential to adversely affect surface soils or groundwater will be processed on the compost pad, or within the dry pre-processing building if constructed. Innocuous feedstocks such as grass, untreated lumber and wood wastes, and leaves/brush may be ground outside of the compost pad. If the dry pre-processing system is implemented, it will be constructed adjacent to the pad to the southwest as shown on Sheet 1. Since this system will be constructed inside a building with a concrete floor, there is no need to place this operation on the compost pad.

The compost pad is located to take advantage of the surface topography as much as possible and designed with an approximate 1% slope to the northeast portion of the pad. Precipitation and liquids generated through the compost process will flow northeastward to an approximate 100-foot by 100-foot by 4-foot deep collection basin located on the northeast corner of the pad.

The pad will be constructed with a minimum of one-foot of clay recompacted to a permeability of $\leq$1x10-6 cm/sec. as is potentially required by Section 14.3.1 of 6 CCR 1007-2. There is sufficient suitable clay on site (site clay is used to construct the landfill liner with a permeability of $\leq$1x10-7 cm/sec.). The clay liner on the compost pad will be protected from desiccation and damage with a minimum of one-foot of protective site soils. Sheet 2 provides a cross section of the compost pad and associated collection basin. Although not shown on Sheet 2, the portions of the compost pad that will be subject to traffic will be paved with recycled asphalt to prevent rutting during wet periods.

The collection basin is located on the northeast corner of the compost pad and will be constructed with a minimum of three-feet of site clay compacted to a permeability of 1x10-6 cm/sec in compliance with Section 14.3.1 of 6 CCR 1007-2. The collection basin is designed to retain the water volume runoff from the compost pad resulting from the 24-hour 25-year storm event plus an additional two-foot of freeboard. The clay liner in the basin are also protected with a minimum one-foot of protective site soils.

4.2 Surface Water Evaluation and Design

The collection basin is slightly oversized to contain the water volume resulting from runoff from the compost pad from a 24-hour 25-year storm event plus two feet of freeboard. The basin was conservatively designed in that it assumes a 1.5% slope on the compost pad. A furrowed surface was substituted for the affect of the compost windrows

on the flow. The resulting water volume from a 24-hour 25-year storm event is 0.469 acre-feet (af) at a rate of 5.39 cubic feet per second (cfs). The collection basin is sized to contain 0.55 af at an operational elevation of 5304.0-feet msl (mean sea level) plus three feet of freeboard equivalent to the top of the clay liner on the berm at an elevation of approximately 5307-feet msl.

The entire compost pad (and collection basin) are built above the surrounding grade and are surrounded by a berm designed to prevent surface water runon to the pad from the peak discharge from the 24-hour 25-year storm event. Surface water at the site will flow overland toward the compost pad from a relatively small (approximately 13 acres) area from the south and west. The berm is a minimum of 1.5-feet above the top of the compost pad and three to four feet above the surrounding grade on the south, east, and north sides of the area. Based on the existing topography, surface water runoff toward the compost area will naturally be directed around the compost pad to enter the site drainage north of the compost area as shown on Sheets 1 and 2. There is no need to construct additional surface water drainage around the perimeter of the compost area with the exception of the west side, where a small (approximately 1-foot deep by 2-feet wide bottom) drainage is designed on the west side of the access road to route surface water runoff toward the pad northward to the site drainage system as shown on Sheets 1 and 2. Based on site observations following construction, the south, east, and north perimeters of the compost area can be graded as necessary to direct surface water around and away from the pad and basin. Surface water calculations are included in Appendix A.

4.3 Construction Quality Assurance Plan

A Construction Quality Assurance Plan (CQAP) has been developed to provide assurance that the compost pad and collection basin are constructed in accordance with the approved design as discussed above and shown on the attached drawings. The CQAP is included in Appendix B. The operator will contract a qualified third-party CQA firm to oversee, test, and document the construction, and CQA activities will be conducted under the supervision of a Professional Engineer (P.E.) registered in the State of Colorado. Following construction, the CQA firm will prepare a CQA Documentation Report that will be submitted to the CDPHE, TCHD, and Adams County for review and approval prior to beginning compost operations. The P.E. will certify in the report that the construction was completed in substantial compliance with all approved plans and specifications in conformance with 6 CCR 1007-2.

The report will be submitted a minimum of 60 calendar days prior to the acceptance of any feedstocks for composting, although based on the timing of construction and need to begin operations, the ERL may request a waiver and expedited review and approval to begin compost operations. Some innocuous bulking material such as lumber, yard, and green wastes may be accepted and processed prior to regulatory approval of the construction so that it is available for use immediately upon receipt of feedstocks. In addition, the presence of the landfill provides a disposal option if it becomes necessary to dispose of the bulking materials should any unforeseen delay occur with approval of the construction.

5.0 ENVIRONMENTAL MONITORING

The design of the compost facility and the composting methods and operations discussed in this EDOP should have a negligible impact on the groundwater, air quality, or surface water quality and requires minimal environmental monitoring outside of that already conducted for the landfill operations.

5.1 Groundwater Quality Impacts and Monitoring

Five Part will install a groundwater monitor well immediately adjacent to, and in a downgradient direction from, the collection basin to for the specific purpose of monitoring the uppermost groundwater beneath the basin for potential impacts due to compost operations. The well will be named CMW-1 and is shown on Sheet 1. Potential environmental impacts to the groundwater from the compost operations are much less than those from the landfill, and there are no regulatory criteria for groundwater monitoring of compost operations; therefore, a less strict protocol for the compost groundwater monitoring program is warranted. The ERL will sample CMW-1 once prior to initiating compost operations and then on a quarterly basis until at least 8 sampling events have been completed. The sampling protocol (including the field parameters) currently conducted for the landfill groundwater monitoring wells will be adhered to, but the sample will only be submitted for laboratory analysis for the major anions and cations listed in Appendix IA of 6 CCR 1007-2, Part 1, and for fecal coliform and salmonella sp. The data will be reviewed and submitted to the CDPHE, TCHD, and Adams County following each sampling episode and will be maintained in the site Operating Record.

The compost pad is lined with one-foot of low permeability clay overlain by a minimum of one-foot of protective soils. The collection basin is lined with three-feet of low permeability clay and also protected with one foot of protective soils. The area of the compost pad includes a numbers of piezometers that were installed in the early 1990s for purposes of characterizing the groundwater water beneath the site and gathering groundwater levels for the original design of the landfill facility. The water levels in the piezometers were monitored numerous times over a 1.5-year period following installation. Sheet 3 shows the locations of these piezometers and the highest recorded groundwater elevations. None of the piezometers shown in the area of the compost operations are present any longer except for PZ-79 located approximately 50 feet southwest of the southwest corner of the pad. The groundwater level in PZ-79 was recently measured at an elevation of approximately 5292 feet above mean seal level (msl), approximately 20 feet below the southwest corner of the working surface of the compost pad. Water elevations recorded in the other piezometers are closer to 30 feet, or more, below the working surface of the compost area as well as the bottom of the lined collection basin.

The environmental protection features of the compost pad and collection basin design, along with active management and water removal from the collection basin makes it highly unlikely that the compost operations will affect groundwater.

5.2 Air Quality Impacts and Monitoring

As discussed in Section 3.4.1, the compost operations have the potential to generate dust and odors. Dust may be generated on site haul roads from traffic as well as the grinding and screening operations associated with the compost facility. Odors may be created by the compost feedstocks themselves and the compost operation.

The landfill facility has a current Construction Permit that includes provisions for minimizing dust generation and migration from site traffic, including crushed asphalt pavement on portions of the site haul roads, compaction and revegetation of soil stockpiles, and watering as necessary to minimize dust generation. The facility has a well on site for ready access to water and a water truck for watering roads, stockpiles, and other disturbed areas on site on an as-needed basis. These control methods will continue to be implemented for the compost operation. Dust may also be generated from the grinding and screening activities associated with the compost operations. The tub grinder is equipped with a mister that will be used to suppress dust if necessary during grinding. Misting may also be implemented during the screening process if necessary. Control measures for mitigation odor generation from the feedstocks and compost operations are discussed in Section 3.4.2 and include immediate mixing of particularly offensive or strong feedstocks, and maintaining acceptable moisture, aeration, temperature, and C:N ratios of the compost.

The landfill facility's current Construction Permit (#07AD1030) for control of particulate and landfill gas emissions will be revised appropriately to include emissions associated with the compost operation. There should be no specific air quality monitoring requirements for the compost operation and we anticipate that the dust and odor control measures stipulated in this EDOP will limit dust generation and odors. Once approval of the compost operations is obtained, a revised APEN will be prepared and submitted to the CDPHE APCD, who will issue a Construction Permit for the facility if appropriate. The construction permit will contain a dust control plan that must be followed to minimize dust generation by the compost operations, most particularly the grinding and screening operations. The Construction Permit will include performance standards that must be met in order to remain in compliance with the permit.

5.3 Surface Water Quality Impacts and Monitoring

Since the compost facility is designed to retain all water that comes in contact with the compost, no discharge of potentially contaminated water is expected. Water collected in the collection basin will be re-incorporated back into the compost directly, or stored in the water storage tank for later use. Water collected from the collection basin will not be discharged to the site surface water control structures, so these operations should have no impact on surface water quality and there is no need for monitoring of water collected as a result of these compost operations.

The landfill facility has a Storm Water Discharge Permit (#COR 020519) for discharges associated with heavy industrial activities and a Storm Water Management Plan (SWMP)

that discussed the site stormwater control system and methods to minimize the potential for stormwater impacts due to site operations. The SWMP and discharge permit require the site surface water control systems to be inspected at a minimum of twice per year (spring and fall) and for a sample of stormwater discharge to be collected and analyzed annually. Following approval of the compost operations, the SWMP will be revised to add these compost operations to the facility stormwater controls and inspections. In the unlikely event that water associated with the compost operations breaches the controls designed to contain it, it will enter the site stormwater system and, if it exits the site, will be sampled. If the release is sufficient in size to warrant action (i.e., of sufficient volume that it does not immediately infiltrate into the subsurface) the affected soils will be excavated and introduced into the compost operation.

6.0 RECORDKEEPING AND REPORTING

The facility will be required to maintain an operating record for the facility to include the following records as required by Section 14.7.1 of 6 CCR 1007-2:

- The type and amount of feedstocks and bulking materials received and processed;
- Amount of finished compost sold, used on-site, or distributed off-site. This information, in conjunction with the type and amount of feedstocks and bulking materials received on site and processed, will provide an estimate of the volumes of finished compost present on site at any one time;
- Water quality monitoring data. Water quality data specific to the compost operation includes groundwater from the monitoring well, stormwater (if collected) and leachate from the landfill (if used for compost purposes). These records will be retained in the Operating Record. Water quality data for purposes of the landfill is also maintained in the Operating Record;
- Feedstock analytical data (if any);
- Compost analytical data;
- Operational monitoring data including time and temperature readings;
- Windrow aeration and turning data;
- Financial assurance documentation;
- Design and Operations Plan
- Certificate of Designation and regulatory approvals
- Waiver demonstration documentation;
- Personnel training records, and;
- The annual reports discussed below.

The facility will submit an annual report by May 1st of each year to Adams County, TCHD, and the CDPHE. The report will include data from January 1 through December 31 of each year and will include the following information.

1) The quantity of finished product used on-site, sold, or distributed off-site;
2) The quantity and type of feedstocks and bulking material received and processed;
3) The quantity of material currently undergoing processing, and;
4) The quantity of finished compost staged on site.

The records shown above will be maintained in the Operating Record at the facility and made available to Adams County and the CDPHE upon request during business hours.

7.0 CLOSURE AND POST-CLOSURE CARE AND MAINTENANCE

Closure and Post-Closure Care and Maintenance of the compost operation is simplified because of its location at a solid waste landfill. As stated earlier in this document, the compost facility is within the ultimate waste footprint of the landfill and so will need to be closed or moved to accommodate future landfilling operations. Presumably the landfill will still be open when it becomes necessary to close or move the compost operations, and all of the feedstocks, bulking materials, actively composting materials, and finished compost are suitable for disposal in the landfill.

7.1 Closure

In accordance with Section 14.8.2 of 6 CCR 1007-2, if at any time the composting facility ceases operations, including discontinued receipt, processing, and sale or use of materials for more than 180 days, the owner or operator shall notify the CDPHE, TCHD, and Adams County and begin closure of the facility unless otherwise approved by the CDPHE and Adams County. Closure activities shall not exceed 90 days unless otherwise approved by the CDPHE and Adams County. The following steps will be taken to close the compost facility:

1. A notice will be placed at the landfill entrance notifying customers that the compost operations is no longer accepting materials for composting.

2. All stored raw feedstock and bulking material will be transferred to the ERL for disposal, or to another appropriate solid waste disposal facility. The materials may also be transported to another facility for beneficial use with approval from the CDPHE and Adams County.

3. All other wastes associated with the compost operations will likewise be transferred to the ERL or another permitted solid waste disposal facility for disposal.

4. All tanks, buildings, equipment, and other structures will be removed from the compost facility and reused or disposed of at an appropriate facility.

5. The work pad and collection basin soils will be sampled to ensure that no contaminants, particularly pathogens, remain in the soil. The soils will remain in place if they are free of contaminants associated with the compost operations and are suitable for successful revegetation. If testing indicates that pathogens remain in the soil or that they are otherwise not suitable for a successful revegetation program, they will be removed and disposed of at an appropriate solid waste disposal facility.

6. The collection basin will be filled in with site soils and the entire compost area will be regraded and revegetated to restore it to pre-development conditions. Clean site soils will be used as necessary to bring the compost facility to

approximate the original grades and the area will be prepared and seeding in accordance with recommendations by the Natural Resource Conservation Service (NRCS) of other qualified vegetation specialist.

7. All storm water control and collection structures will be removed, regraded, and revegetated as described above unless specifically approved to remain on site by the CDPHE and Adams County.

8. All partially composted feedstocks and bulking material will be disposed of at the ERL or other appropriate solid waste disposal facility. These materials may also be transported to another compost facility with approval from the CDPHE and Adams County.

9. Finished compost will be distributed off-site or used on site for closure of the facility or in reclamation activities at the ERL.

Within 14 calendar days of initiating the steps listed above, the facility shall provide written notification of the initiation of closure activities to the CDPHE and Adams County.

Within 30 calendar days of completing closure activities, the facility shall provide written notification to the CDPHE and Adams County to document that all the requirements and conditions of the closure plan have been achieved.

Following closure of the compost operations, a notation must be placed on the deed notifying any potential purchaser that the property has been used as a composting facility. This requirement shall not apply if subsequent landfill operations are conducted in the compost area.

7.2 Post-Closure Care and Maintenance

There is no need to conduct post-closure care and maintenance of the compost facility if landfill operations extend through the compost area since the surface soils directly beneath the compost facility will be excavated to accommodate the landfill design.

If the compost area is not used for landfilling following its closure, the compost area will be inspected and maintained for a minimum post-closure care and maintenance period of five years following closure. If requested, the post-closure period may be reduced by the CDPHE after consulting with Adams County, or may be extended by the CDPHE after consulting with Adams County if it is determined that the lengthened period is necessary to protect human health and the environment.

Sampling and testing of the reclaimed compost area is not necessary unless agricultural testing of the soils is required to develop a specific fertilizer or amendment program to aid in establishing vegetation.

The compost facility will be inspected twice per year for the post-closure period to verify that the revegetation program is successful and to identify potential problem area such as erosion. Because of the nearly flat grades after closure of the compost facility, erosion is not expected to be a problem. Each inspection will be documented and the results will be included in an inspection report submitted annually to the CDPHE and Adams County.

Following the end of the post-closure care and maintenance period, the owner or operator must submit a certification signed by an independent Colorado registered P.E. verifying that the post-closure care has been completed in accordance with the post-closure plan and has been placed in the operating record.

7.3 Financial Assurance

Engineering cost estimates for closure and post-closure of the compost operations will be developed during the CD amendment approval process. The ERL will amend their financial assurance engineering cost estimates and financial assurance mechanism to reflect the cost associated with implementation of this Closure and Post-Closure Care and Maintenance Plan, and will submit the revised estimates and mechanism to the CDPHE at least 60 days prior to beginning compost operations to provide sufficient time for financial assurance to be in place before operations begin.

8.0 REFERENCES

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APPENDIX D

CONSTRUCTION QUALITY ASSURANCE PLAN

CONSTRUCTION QUALITY ASSURANCE PLAN

COMPOST PAD AND COLLECTION BASIN

EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

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1.0 INTRODUCTION

These are the construction quality assurance (CQA) procedures for construction of the compost pad and collection basin at the East Regional Landfill located in Adams County, Colorado. The goals of these procedures are to provide mechanisms for:

1. assuring that proper construction techniques and procedures are used,

2. assuring that the intent of the design is met, and

3. resolving problems that may arise during construction

2.0 DEFINITIONS

2.1 Construction Quality Assurance and Construction Quality Control

The CQAP is a site-specific document which addresses the following: (i) CQA personnel responsibilities, authorities, and qualifications; (ii) inspection, monitoring, and testing activities necessary to ensure that the compost pad and collection basin are constructed to meet or exceed design criteria, plans, and specifications; and (iii) CQA documentation requirements.

Compacted Clay Liner - An engineered barrier layer constructed of clay soil material processed with moisture and compacted to achieve a low design permeability.

Construction Quality Assurance (CQA) - A planned and systematic pattern of the means and actions designed to provide adequate confidence that items or services meet contractual and regulatory requirements, and will perform satisfactorily in service.

In the context of this document Quality Assurance Plan (QAP) refers to means and actions employed by the CQA Engineer to assure conformity of clay liner system preparation, production, and installation with this CQA Plan and the approved design. CQA is provided by a party independent from the product Manufacturer and Contractor.

Construction Quality Control (CQC) -Those actions, which provide a means to measure and control the characteristics of an item or service to meet contractual and regulatory requirements.

CQC refers to those actions taken by Manufacturers, Suppliers, Contractors, or Owners, including their designated representatives, to ensure that the materials and the workmanship meet the requirements of the Specifications, and the Construction Drawings. In the case of soils, and within this CQA Plan, CQC is typically made a part of the CQA requirements and is provided by the CQA Engineer. In the case of geosynthetic and other non-soil components, the Manufacturers and installers of the various geosynthetics provide CQC.

Earthwork - An activity involving the use of soil or rock materials for construction purposes.

Earthwork Contractor - The person or firm responsible for earthwork related activities.

CQA Engineer – The individual or firm responsible for oversight of all CQA activities required by the design drawings, specifications, and this CQA Plan and may or may not be the same as the Design Engineer. The duties and responsibilities of the CQA Engineer are separate and distinct from those of the Design Engineer and include certification of the construction as described in this CQA Plan. The CQA Engineer shall be a Professional Engineer (P.E.) registered in the State of Colorado, and may be represented by other personnel variously referred to as the CQA Monitor, CQA Resident Engineer, or Project Manager, etc., who shall work under the direction and supervision of the CQA Engineer. The CQA Engineer may not approve any substantive changes to the approved design or specifications.

CQA Monitor – Typically the field representative of the CQA Engineer. The CQA Monitor conducts oversight and field testing of the construction to verify that it is conducted in accordance with the approved design, CQA Plan, and specifications. The CQA Monitor works under the supervision and authority of the CQA Engineer, but may not make any independent changes to the requirements of the approved CQA Plan, Design, or specifications.

Design Engineer – The individual or firm responsible for the development of the design and specifications for the construction project and may or may not be the same as the CQA Engineer. The duties and responsibilities of the Design Engineer are separate and distinct from those of the CQA Engineer. Any substantive changes to the design and specifications must be approved by the Design Engineer.

General Fill – Compacted soil fill used for purposes of providing a firm base surface for construction components, the perimeter berms, or other fills not specified elsewhere. In general, General fill characteristics are specific to the intended use and are installed under specific compaction and often moisture requirements.

Project Construction Drawings & Specifications - These are all project related drawings and specifications developed to guide the construction and ensure it is constructed in accordance with the design.

Project Documents - These include construction drawings, record drawings, construction quality control and quality assurance plans including specifications, quality assurance documentation, safety plans, and project schedules.

Project Manager - The official representative of the Owner responsible for construction of the project.

Protective Soils - Soils approved by the engineer and placed over a compacted clay liner to protect the low permeability characteristics of the compacted clay liner from physical and weather damage.

Record Drawings - Drawings recording the dimensions, details and coordinates of the facility after construction is completed (as-built drawings).

Compacted Soil Liner – An engineered constructed barrier layer of natural soil materials intended to control migration of liquids inside of the compost area. Also referred to as Compacted Clay Liner.

3.0 MEETINGS

In order to facilitate construction and to clearly define construction goals and activities, close coordination between the Engineer, Owner, CQA Monitor and the various Contractors is essential. To meet this objective the following meetings will be held.

3.1 Pre-Construction Meetings

A pre-construction meeting may be held at the site prior to the start of construction at the discretion of the Owner. The CQA Engineer, Project Manager, CQA Monitor, Earthwork Contractor, and others designated by the Owner will attend this meeting. The purposes of this meeting are as follows:

- Provide all parties with relevant documents
- Review the project construction drawings, specifications, and CQA plan
- Review and assign responsibilities for each party
- Identify key personnel
- Define lines of communications
- Establish reporting and documenting procedures
- Establish work area security and safety protocols
- Establish testing protocols and procedures for correcting and documenting construction deficiencies
- Conduct a site inspection to discuss work areas, work plans, stockpiling, laydown areas, access roads, haul roads, and related items.
- Review the project schedule
- Develop any required addenda to the project documents

This meeting will be documented by the Project Manager or his designee and copies of the minutes will be distributed to all parties.

3.2 Progress Meetings

Progress meetings may be held weekly during the period of the work. The CQA Monitor, Project Manager, and the Contractors will attend these meetings and the following topics may be discussed:

- Scheduled work activities

- Problems encountered or expected
- Recent CQA test results
- Other appropriate matters

3.3 Problem Resolution Meetings

As required, special meetings will be held to discuss problems or deficiencies. At a minimum, the CQA Monitor and appropriate Contractor will be in attendance. If the problem requires a design modification, the Project Manager, CQA Engineer, and Design Engineer will also be present. Documentation of the meeting will be kept by the CQA Monitor and, if appropriate, the Design Engineer.

4.0 EARTHWORK

4.1 General

Construction must be conducted in accordance with the project construction drawings and specifications. To monitor compliance, a two part quality assurance testing program will be implemented that includes material evaluation and construction testing. Material evaluation includes borrow areas and other pre-construction investigations. Construction testing includes those activities that occur during material placement. All quality assurance testing shall be conducted in accordance with this CQA plan and the project construction drawings. Where there is a discrepancy, the document that requires the most frequent number of tests or the more stringent test requirement will govern unless otherwise specified by the CQA Engineer. All in - situ testing and sampling will be observed by the CQA Monitor. Documentation shall meet the requirements of this CQA plan.

The soils used in the compost work area construction include materials for general fill components both within and outside of the lined area, compacted clay liner, and protective soils. Definitions of these materials are provided herein and material uses are shown either on the drawings or will be identified by the Owner or CQA Engineer. Prior to the start of construction, sources for each material shall be identified and samples tested to determine that they meet project specifications. Additional sources may be identified during the course of construction and must be tested and approved by the CQA Engineer prior to their use.

Samples shall be obtained in a manner to best ensure the sample is representative of the materials to be used in construction. Tests to confirm required properties shall be performed on each material used in the construction. All test results shall be thoroughly documented. Testing frequency for each material is presented in Tables 2 through 4.

4.2 Surveying

Site survey requirements include performing periodic and record surveys to confirm that the disposal cells are constructed in accordance with approved design plans. Periodic surveys are conducted as necessary during construction to guide excavation, clay liner installation, and

protective soil layer placement activities. Record surveys are considered final surveys of a specific constructed element demonstrating compliance with approved plans. Record surveys require Professional Land Surveyor certification and will be included in the CQA certification report.

Surveys will be required both within the portion of the compost area being constructed, and outside of the compost construction area (generally for surface water drainage structures). Elevations and x,y coordinates shall be determined and recorded on a minimum 50-foot centers as well as construction limits and at major grade breaks at each of the following surfaces and at locations shown on the drawings:

- Top of excavated subgrade
- Top of compacted liner
- Top of protective layer

All applicable constructed features shall comply with the tolerances shown on Table 1 unless otherwise approved by the Design Engineer.

TABLE 1
SURVEY TOLERANCES

Horizontal, All Points	plus or minus 0.50 feet of design coordinates (± 0.50 feet)
Vertical, Subgrade	plus 0.00 to minus 0.20 feet of design (+ 0.00 to – 0.20 feet)
Vertical, Top of Soil Liner	plus 0.20 to minus 0.00 feet of design (+0.20 to – 0.00 feet)
Vertical, Top of Protective Soils	Plus 0.20 to minus 0.00 feet of design (+0.20 to -0.00 feet)

All constructed layers for which a minimum thickness is specified shall be constructed to that minimum thickness. Nothing in Table 1 shall be construed to allow a layer to be constructed at less than the minimum required thickness.

4.3 Soil Materials Evaluation and Construction Quality Assurance Testing

Tables 2 through 4 present the required soil materials testing, including the frequency, acceptable test methods, and geotechnical parameters.

TABLE 2
MINIMUM FREQUENCY OF TESTING FOR CQA EVALUATION OF GENERAL FILL

Test	Standard Test Method	Construction Frequency	Preconstruction Frequency
Standard Proctor	ASTM D 698	As needed for material [1]	1 per 5,000 cy
Grain Size	ASTM D 422	As needed for material [1]	1 per 5,000 cy
Atterberg Limits	ASTM D 4318	As needed for material (1)	1 per 5,000 cy
Compacted Density-nuclear methods	ASTM D 2922	1 per 10,000 ft^2 per 12-inch thickness (area fills)	
Compacted Moisture Content – nuclear methods	ASTM D 3017	1 per 10,000 ft^2 per 12-inch lift (area fills)	

[1] The CQA Monitor will determine if additional testing of materials is required due to a change in material characteristics based on visual observation or comparing field moisture density testing with existing Proctor information

TABLE 2A
CQA REQUIRED PROPERTIES FOR CONSTRUCTION OF GENERAL FILLS

Property	Requirement
Grain Size	>95% smaller than 3/8-inch; min 15% passing U.S. Standard #200 sieve
Atterberg Limits	Liquid Limit $\geq$ 20; Plasticity Index $\geq$ 6
Compacted Density	Equal or greater than 95% of Maximum Standard Proctor Density
Compacted Moisture Content	$\pm$ 5% of Optimum Moisture defined by Standard Proctor Test

TABLE 3
MINIMUM FREQUENCY OF TESTING FOR CQA EVALUATION OF SOIL LINER

Test	Standard Test Method	Construction Frequency (minimum)	Preconstruction Frequency
Standard Proctor	ASTM D698	1 per 5,000 cy	1 per 10,000 cy
Grain Size	ASTM D422	1 per 1,000 cy	1 per 10,000 cy
Atterberg Limits	ASTM D4318	1 per 1,000 cy	1 per 10,000 cy
Permeability	ASTM D5084	1 per 5,000 cy	1 per 10,000 cy
Compacted Density-nuclear methods	ASTM D2922	1 per 10,000 ft^2 per lift (min 5 per acre per lift)	
Compacted Moisture-nuclear methods	ASTM D3017	1 per 10,000 ft^2 per lift (min 5 per acre per lift)	
One-Point Proctor	ASTM D 698	1 per 5,000 cy and for each change in material type	

TABLE 3A
CQA REQUIRED PROPERTIES FOR CONSTRUCTION OF SOIL LINER

Property	Requirement
USCS Class.	CL, CH, SC
Plasticity Index	> 10
Grain Size	< 20% greater than U.S. No. 4 Sieve > 30% passing the #200 Sieve No particles greater than 1 inch after compaction
Hydraulic Conductivity	$\leq 1 \times 10^{-6}$ cm/sec after compaction on pad $\leq 1 \times 10^{-6}$ cm/sec after compaction in collection basin
Compacted Density	≥ to 95% of maximum Standard Proctor Density
Compacted Moisture Content	0 to +4 percent of Optimum Moisture defined by Standard Proctor Test

TABLE 4
MINIMUM FREQUENCY OF TESTING FOR CQA EVALUATION OF PROTECTIVE SOIL LAYER

Test	Standard Test Method	Construction Frequency	Preconstruction Frequency
Grain Size	ASTM D422	1 per 5,000 cy	1 per 10,000 cy
Atterberg Limits	ASTM D 4318	1 per 5,000 cy	1 per 10,000 cy
Standard Proctor	ASTM D 698	1 per 5,000 cy	1 per 10,000 cy
Compacted Density-nuclear methods	ASTMD 2922	1 per 10,000 ft^2 per 12-inch thickness (traffic areas)	
Compacted Moisture Content – nuclear methods	ASTM D 3017	1 per 10,000 ft^2 per 12-inch thickness (traffic areas)	

TABLE 4A
CQA REQUIRED PROPERTIES FOR CONSTRUCTION OF PROTECTIVE SOIL LAYER

Property	Requirement
Grain Size	Max nominal size 3-inches. Occasional up to 2 inches with CQA approval ≥ 20% passing the #200 sieve
Atterberg Limits	PI ≥ 6
Compacted Density	Equal or greater than 90% of maximum Standard Proctor Density on travel areas Firm and stable to satisfaction of CQA Monitor on non-travel areas
Compacted Moisture Content	± 5% of Optimum Moisture defined by Standard Proctor Test on travel areas Visually consistent with travel area soils as determined by CQA Monitor

4.4 General Fill

General Fill soils are used in backfilling of over-excavated materials to design subgrade prior to constructing the clay liner system and to construct the perimeter berms around the pad and collection basin. General Fill shall be tested and meet the requirements as specified in Tables 2 and 2A above and approved by the CQA Monitor. General Fill shall be constructed in lifts not to exceed 12 inches in compacted thickness.

All surfaces prior to placing the General fill shall be approved by the CQA Monitor and shall not included any vegetation, roots, excessive soft or moist areas, or other deleterious materials. No General Fill shall be placed without the approval of the CQA Monitor.

Compaction of General Fill may be conducted with heavy construction equipment as directed by the CQA Monitor, and shall be uniformly conducted to provide consistency throughout the component. General Fill shall be placed and compacted in individual maximum 12-inch thick compacted lifts to the lines and grades in accordance with the approved design plans and tolerances.

4.5 Compacted Soil Liner

No frozen or partially frozen clay materials may be placed, spread, or compacted for construction of the soil liner. Soil liner may not be constructed over frozen or partially frozen materials. No clay soil containing any roots, rock, refuse, plant material or other deleterious material shall be used.

Materials used for compacted soil liner shall be tested as shown in Tables 3 and 3A. Where field density or moisture contents fail to meet specified values, the failing area will be determined by the CQA Monitor based on the locations of passing test data, and the failing area will be reworked ½ of the distance to the nearest passing data or the material removed at the discretion of the Earthwork Contractor. If the Earthwork Contractor chooses to rework areas that do not meet moisture content, requirements, the area will be scarified, moisture conditioned, and recompacted.

Prior to placing the first lift of clay liner, the subgrade shall be proof-rolled under the direction and observation of the CQA Monitor using heavy equipment to determine if it will provide a firm base for the lining system. Of particular concern are areas that are excessively soft. To evaluate the subgrade, the CQA Monitor will, at a minimum, provide continuous visual observation during proof-rolling. If materials are excavated below the design subgrade and backfilled in accordance with this plan using approved General Fill, the CQA Monitor shall verify that the backfill materials have been tested and approved prior to placing clay liner.

Soil liner materials shall be moisture conditioned to near optimum moisture content prior to placing in the construction area. They shall be spread and compacted in lifts of loose thickness required to result in compacted lifts of no more than approximately six inches thick, and in no cases shall the resulting compacted lift be thicker than the length of the pads or feet on the

compactor. The soil liner shall be compacted with a sheepsfoot, tamper-foot, or similar penetrating foot compactor approved by the CQA Engineer to properly knead the clay materials and break up clods. No clods with dry centers, stones, or other deleterious materials greater than one inch in the longest direction shall be allowed following compaction of the soil.

The surface of each lift shall be scarified or roughed up with the sheepsfoot compactor to the satisfaction of the CQA Monitor prior to placing the next lift of soil liner in order to provide continuous bonding between lifts.

Samples of the clay liner material will be collected during construction and tested at the laboratory to verify continued suitability of the clay liner materials and the CQA Monitor will conduct field moisture density testing to ensure compliance with the test frequencies and results indicated in Tables 3 and 3A. Permeability verification tests will be collected from the constructed soil liner following CQA approval of the laboratory and field testing. Samples will be collected from the constructed soil liner using Shelby tubes and submitted to the laboratory for testing in accordance with Tables 3 and 3A to verify that the permeability requirements are met. The required testing frequencies shown in Table 3 can be increased at the direction of the CQA Monitor when visual or other observations indicate a potential problem. Examples of conditions that may warrant additional tests include the following:

- Compactors slip during operations
- Excessive pumping or cracking of the fill
- Lift thickness is greater than specified
- Dirt clogged rollers are used to compact the fill
- The compactor is improperly ballasted
- Adverse weather
- Equipment breakdown
- Work conducted in difficult areas
- A high frequency of failed tests

All perforations of the constructed low hydraulic conductivity soil elements including nuclear density device probe holes, permeability sampling locations, and grab sample locations shall be repaired. Perforations shall be repaired by backfilling the holes with bentonite and hydrating until the water reaches the soil surface. Granular bentonite shall be used to backfill smaller diameter penetrations such as those from the nuclear density tests, and either granular, pelletized, or chips may be used to fill larger penetrations such as those created by verification permeability sampling.

The final surface of the soil liner shall be graded and smoothed with a smooth-drum roller to the lines and grades within the tolerances specified in the plans. The overlying protective soils shall not be placed prior to verification and approval of the grades and elevations and approval of the soil liner and surface by the CQA Monitor.

4.6 Protective Soil Layer

A minimum 12-inch thick protective layer of soils meeting specific criteria shall be placed above the clay liner system on the pad and collection basin to the lines and grades shown on the plans. Protective layer soils must be tested and meet the requirements shown on Tables 4 and 4A.

Protective layer soils will be placed in a uniform fashion, compacted, and graded using standard construction equipment. The soils shall be approved for use by the CQA Monitor and shall be uniformly moisture conditioned prior to placement. Soils may be placed in a single lift if compaction requirements can be achieved throughout the entire thickness. Compaction may be conducted using heavy construction equipment to uniformly compact the materials across the compost pad travel area.

The moisture and density of the protective soils over travel areas of the compost facility shall be tested by the CQA monitor at randomly selected locations at minimum frequencies shown in Tables 4 and 4A.

Non-travel areas do not require specific compaction values, but the protective soils on non-travel areas shall be moisture conditioned and compacted in a uniform manner across the construction area to the satisfaction of the CQA Monitor and shall be graded to conform with the design grades within the tolerances of this plan.

5.0 DOCUMENTATION

The quality assurance plan depends on thorough monitoring and documentation of all construction activities. Therefore, the CQA Monitor shall document that all quality assurance requirements have been addressed and satisfied. Documentation shall consist of daily record keeping, construction problem resolutions, photographic records, design and specification revisions, weekly progress reports, and a certification and summary report.

5.1 Daily Record Keeping

At a minimum, daily records shall consist of field notes, summary of the daily meeting with the Contractor, observation and data sheets, and construction problem and resolution reports. At least one photograph of each work area shall be taken on each day of construction. If possible, this information shall be submitted daily to the Project Manager for review and approval.

5.2 Observation and Test Data Sheets

Observation and data sheets shall include the following information:

- Date, project name, and location
- A description of the location of the work area including sample and test locations
- A description of ongoing construction
- A summary of test results identified as passing, failing, or in the event of a failed

test, retest results
- Test equipment calibrations, if applicable
- Off-site materials received including the source and any required certificates
- A summary of decisions regarding acceptance of the work and/or corrective actions taken
- The signature of the CQA Monitor

5.3 Construction Problems and Resolution Documentation

This report identifies and documents construction problems and resolutions. This report is intended to document problems involving significant rework and is not intended to document items that are easily corrected unless the problems are reoccurring. At a minimum this report shall include:

- A detailed description of the problem
- The location and cause of the problem
- How the problem was identified
- How the problem was resolved
- Personnel involved
- Signature of the CQA Monitor and Project Manager

5.4 Photographs

All construction activities will be recorded, including significant problems and remedial actions. The photographs will be identified by location, time, date, and person taking the photograph. Digital copies of the photographs will be given to the Project Manger weekly or more frequently.

5.5 Design and Specifications Changes

Design and specification changes may be required during construction. In such cases, the CQA Monitor shall notify the Project Manager and the CQA Engineer. Design and specification changes shall only be made with written agreement of the Design Engineer.

5.6 Certification Report

At the completion of the project, the CQA Engineer shall prepare a certification report. This report shall certify that the work has been performed in compliance with the approved design and specifications. At a minimum, this report shall contain:

- A summary of all construction activities
- Observation and test data sheets required for documentation of compliance with this plan
- Sampling and testing location plans
- A description of significant construction problems and the resolution of these problems
- A list of changes and deviations from the approved construction drawings and specifications and the justification for these changes

- Documentation of inspections by the CQA Engineer
- Representative photographs of the construction
- Record drawings
- A certification statement signed and sealed by an engineer registered in the State of Colorado

The record drawings shall accurately locate all construction items including the extent and thickness of the soil liner, protective soils layer, and the perimeter berm and ditch. All surveying required for the development of the record drawings shall be conducted under the supervision of a licensed surveyor.

APPENDIX E

CONSTRUCTION QUALITY ASSURANCE REPORT

COMPOST PAD EXPANSION

Final Construction Quality Assurance Report
Compost Pad Expansion
East Regional Landfill
Bennett, Colorado

Submitted to

Five Parts Development, LLC
Bennett, Colorado

Prepared by

Geo-Logic ASSOCIATES

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AU25.1108

March 6, 2026

Signature Page

Geo-Logic Associates (GLA) provided construction quality assurance (CQA) services during the Compost Pad Expansion at the East Regional Landfill. The following final CQA Report was prepared by GLA and is hereby submitted to the Colorado Department of Public Health and Environment and Adams County.

This report was prepared in accordance with generally accepted civil and geotechnical engineering practices applicable at the time the report was prepared. GLA makes no other warranties, either expressed or implied, as to the professional advice provided under the terms of this agreement, and as described in this report. Our recommendations consist of professional opinions and conclusions based on our testing and inspection program performed during construction.

The purpose of this report is to certify that, in our professional opinion, the Compost Pad Expansion at the East Regional Landfill has been constructed and completed in general accordance with the approved Construction Drawings and Technical Specifications. During the construction, GLA conducted observations and testing in accordance with the approved CQA Plan to determine that the construction was conducted in general accordance with the Construction Drawings, Technical Specifications, and CQA Plan. The conclusions of our observations and testing, together with a written narrative describing the personnel, scope, methods, procedures and results of our CQA services, have been included in this certification report.

GEO-LOGIC ASSOCIATES

Jacob Russell, PE
Principal Engineer

Bryan Fritzler, PE
CQA Project Manager

Date signed: March 6, 2026

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1. Introduction

This report summarizes the construction quality assurance (CQA) services provided by Geo-Logic Associates (GLA) during the construction of the Compost Pad Expansion at the East Regional Landfill. The project is located at 8201 Schumaker Road, Bennett, Colorado. The Compost Pad Expansion comprises of a plan area of approximately 1.4 acres and is shown on Sheet 02 in Appendix F.

This final report contains detailed documentation that the construction and CQA activities associated with Compost Pad Expansion were conducted in general accordance with the following documents:

- Technical Specifications – East Reginal Landfill Compost Pad, dated May 2025 by HDR
- Construction Drawings – East Regional Landfill Compost Pad Expansion, dated May 2025, by HDR
- CQA Plan – Compost Pad and Collection Basin, East Regional Landfill, Adams County Colorado, dated March 2011, by American Environmental Consulting, LLC
- East Regional Landfill Engineering Design and Operations Plan, dated August 2006, by Doty and Associates

2. Project Description

2.1 Project Components

The Compost Pad Expansion consists of the following constructed layers from bottom to top:

- Prepared subgrade
- 1-foot compacted clay liner
- 1-foot protective cover Layer

2.2 Project Construction Summary

Grading and general fill placement began on September 3, 2025. Construction of the clay liner began on September 5. Substantial completion of the projects was by September 16, 2025. The following are key work tasks performed during the construction:

- Excavation and subgrade preparation
- Placement of general fill
- Placement of clay liner layer
- Placement of the protective cover layer

At the present time, the construction of Compost Pad Expansion at the East Regional Landfill is complete, and constructed in general accordance with the Construction Drawings, Technical Specifications, CQA Plan, and applicable regulations.

2.3 Project Personnel

The following personnel participated in the construction of the Compost Pad.

Project Role	Organization	Name
Owner	Five Parts Development, LLC	Melissa Montgomery Steve Derus
Earthworks Contractor	4X Construction, Inc.	Keith Ruf Jose Varela
Contractor's Surveyor	Cardinal Points Surveying, Inc.	Matthew A. Cordova, PLS
Design Engineer	HDR	
CQA Certifying Engineer/ CQA Project Manager	GLA	Jacob Russell, PE Bryan Fritzler, PE
Lead CQA Monitor	GLA	Emily Abbott
Earthworks Laboratory	GLA Advanced Terra Testing	Phillip Plant Brandon Ferro

2.4 Design Modifications and Clarifications

There were no design modifications for this construction.

3. Construction Quality Assurance Program

3.1 Construction Components

GLA provided CQA services on the earthworks components of the Compost Pad Expansion construction. The earthwork tasks included excavation, subgrade preparation, clay liner placement and protective cover layer placement.

3.2 CQA Documentation

CQA documentation was prepared by GLA as part of the prescribed CQA duties and consisted of a system of daily record keeping including daily progress reports and a record of various test data sheets pertinent to the soil and geosynthetic components of the construction. Copies of the original records are being maintained by GLA and can be made available upon request.

Table 1 summarizes the testing requirements per the CQA Plan and Technical Specifications. Within the table, information on the construction material type, the total quantity of material placed on the project, the test designation to be performed, the specified testing frequency, the required number of tests to be conducted, the actual number of tests conducted, and the actual testing frequency is listed. As shown in the table, the actual materials testing frequency on the project satisfies the number of tests required by the CQA Plan. This table is part of GLA's internal quality control program to ensure that the testing and required testing frequencies are satisfied on the project.

Other CQA documentation with respect to test data and observation sheets are discussed within the following sections. Copies and summaries of the data for the soil's components monitored and physically tested by GLA are included in the appendices of this report.

A listing of the documentation logs and reports compiled as part of the CQA services includes the following:

- Daily construction reports (including daily photographic log)
- General fill moisture density relationships (Proctor)
- General fill grain size analysis and Atterberg limits
- Compacted clay liner soil moisture density relationships (Proctor)
- Compacted clay liner soil grain size analysis and Atterberg limits
- Laboratory permeability tests
- Field density test summaries
- Protective cover soil moisture density relationships (Proctor)
- Protective cover soil grain size analysis and Atterberg limits

Table 1. Earthworks Testing and Frequency

Material	Actual Quantity	Test Designation	Specified Frequency	No. Required	No. Performed	Actual Testing Frequency
General Fill (Pre-Construction)	4,200 cy	Standard Proctor (D698)	1 per 5,000 cy	1	1	1 per 4,200 cy
		Grain Size (D6913)	1 per 5,000 cy	1	1	1 per 4,200 cy
		Atterberg Limit (D4318)	1 per 5,000 cy	1	1	1 per 4,200 cy
General Fill (Construction	4,200 cy 59,400 ft^2	Nuclear Density & Moisture (D6938)	1 per 10,000 ft^2 per 12-inch lift	12	14	1 per 8,486 ft^2 and 1 per lift (2 lifts placed)
Compacted Clay Liner (Pre-Construction)	2,200 cy	Standard Proctor (D698)	1 per 10,000 cy	1	1	1 per 2,200 cy
		Grain Size (D422/D6913)	1 per 10,000 cy	1	1	1 per 2,200 cy
		Atterberg Limits (D4318)	1 per 10,000 cy	1	1	1 per 2,200 cy
		Permeability (D5084)	1 per 10,000 cy	1	1	1 per 2,200 cy
Compacted Clay Liner (Construction)	2,200 cy 59,400 ft^2 1.4 acres	Standard Proctor (D698)	1 per 5,000 cy	1	1	1 per 2,200 cy
		Grain Size (D422/D6913)	1 per 1,000 cy	3	3	1 per 733 cy
		Atterberg Limits (D4318)	1 per 1,000 cy	3	3	1 per 733 cy
		Permeability (D5084)	1 per 5,000 cy	1	1	1 per 2,200 cy
		Nuclear Density & Moisture (D6938)	1 per 10,000 ft^2 per lift (min 5 per acre per lift)	14	16	5.7 per acre per lift
Protective Cover Layer (Pre-Construction)	2,200 cy	Standard Proctor (D698)	1 per 10,000 cy	1	1	1 per 2,200 cy
		Grain Size (D422/D6913)	1 per 10,000 cy	1	1	1 per 2,200 cy
		Atterberg Limits (D4318)	1 per 10,000 cy	1	1	1 per 2,200 cy

Material	Actual Quantity	Test Designation	Specified Frequency	No. Required	No. Performed	Actual Testing Frequency
Protective Cover Layer (Construction)	2,200 cy 59,400 ft^2	Standard Proctor (D698)	1 per 5,000 cy	1	1	1 per 2,200 cy
		Particle Size (D422)	1 per 5,000 cy	1	1	1 per 2,200 cy
		Atterberg Limits (D4318)	1 per 5,000 cy	1	1	1 per 2,200 cy
		Nuclear Density & Moisture (D6938)	1 per 10,000 ft^2 per 12-inch lift	6	7	1 per 8,486 ft^2

cy = Cubic yards
ft^2 = square feet

3.3 Final Report

Preparation of this final report documenting the project CQA activities was the final task of the CQA program for the East Regional Landfill, Compost Pad Expansion project. This report includes discussions of the findings and observations of GLA's on-site CQA personnel regarding the activities identified above. The documentation of construction and CQA activities are presented on the field logs, which are included as appendices to this final report. Also presented in the appendices of this final report are the results of laboratory conformance tests conducted on earthworks components.

The report contains a discussion of the CQA procedures performed by GLA, a discussion of the construction activities, and a description of the liner system components observed and tested by GLA. Photographic documentation of this project was maintained by GLA throughout the construction period and a photographic log is presented in the daily field reports. Daily field reports of CQA activities were created by GLA throughout construction and are included in Appendix A. Earthworks documentation is included in Appendices B, C, and D. Certification survey data, as-built drawings, and construction drawings are included in Appendices E and F.

4. Earthworks Construction

As the earthworks construction was implemented, GLA performed CQA monitoring. This section of the final documentation report describes the CQA tasks associated with the construction of the earthworks components of the project. The elements monitored by GLA and discussed

within this section include excavation, subgrade preparation, general fill placement, clay liner layer placement, and protective cover layer placement.

The earthworks CQA activities performed by GLA for the construction included:

- Monitoring and testing of general fill placement
- Monitoring subgrade preparation
- Monitoring and testing of compacted clay liner placement
- Monitoring of protective soil layer placement
- Reviewing geotechnical laboratory testing results for compliance with Technical Specifications

4.1 Excavation, General Fill Placement, and Berm Construction

Excavation, placement of general fill and shaping were required to achieve the design lines and grades. Prior to excavation, clearing and grubbing activities were conducted for removal of all deleterious materials such as grass, roots, or other organic vegetative materials. The material used for general fill was excavated and hauled directly to the general fill placement area and perimeter berm. The compaction of the general fill was performed using a CAT sheepsfoot compactor. The general fill material was placed in loose lifts (8 inches) and tested by the CQA technician with the nuclear gauge at the frequency listed in Table 1. The general fill laboratory and field testing is included in Appendix B.

Upon completion of the excavation and general fill placement, the Contractor's surveyor, Cardinal Points Surveying, Inc. (Cardinal), surveyed the as-built subgrade. The survey was reviewed by GLA for completeness and conformance with the Construction Drawings and Technical Specifications. Certified survey data for the subgrade is included in Appendix E.1. Comparison of the as-built survey data vs. the design grades is also included in Appendix E.1.

4.2 Compacted Clay Liner

Evaluation of Compacted Clay Liner Materials

In order to ensure that the material from the on-site borrow area was suitable as a clay liner, GLA's CQA Monitor performed testing on the soils. Atterberg limits (ASTM D-4318), grain size distribution (ASTM D-6913), and standard Proctor (ASTM D-698) tests were performed on the materials. These test results are included in Appendix C.1, C.2, and C.3, respectively.

Testing was completed to ensure compacted clay liner placement in accordance with the Technical Specifications as shown by the passing nuclear density tests and passing permeability tests.

Compacted Clay Liner Placement

A 1-foot-thick compacted clay liner layer was placed within the Compost Pad Expansion area as shown on the Construction Drawings. Approximately 2,200 cy of material was utilized to construct the compacted clay liner. Subgrade preparation was performed as described in Section 4.1 prior to construction of the compacted clay liner. The materials were transported to the cell using scrapers. The compaction of the liner soils was performed using a CAT sheepsfoot compactor. The clay liner material was placed in loose lifts (8 inches) and a minimum of two passes was applied with a sheepsfoot compactor. GLA's CQA Monitor observed that the surface of the lift was scarified and not smooth to assure that no distinct layers developed within the clay liner and that the specified lift thickness was achieved. GLA's CQA Monitor observed that the surface of each lift was scarified to a depth of approximately 3 inches.

GLA's CQA Monitor performed in-place density tests during clay liner construction, using a nuclear density gauge. The compacted clay liner was placed at a minimum of 95 percent of the maximum dry density and optimum to 4% above optimum moisture contents as determined by ASTM D-698.

The nuclear density locations were repaired by placing clay material in the holes and compacting the material by hand. Summaries of the field moisture/density testing are included in Appendix C.4. The nuclear moisture/density and permeability sample locations are shown in Appendix C.5.

Since the amount of clay liner material required was only 2,200 cy and the standard Proctor was collected in the borrow area directly prior to clay placement, it was determined that the need for a one-point Proctor to determine the correct Proctor material was not warranted. CQA Monitor observed that all the compacted clay soils came from the same borrow area and observed no change in material type.

The compacted clay liner was initially placed and compacted to a minimum 1-foot thickness and rough-graded. Drive tube samples were collected during placement and compaction of the liner material and tested for permeability in GLA's geotechnical laboratory. Sample tubes were driven into the compacted clay material using a slide hammer sampler. GLA's CQA Monitor verified that the sampler was vented and that the tube was not driven below the ground surface to avoid

disturbing or increasing the density of the sample. Falling head, rising tail water tests were performed in the laboratory according to the procedures outlined in ASTM D-5084. The permeability of the samples met the specified value of 1.0 x10^{-6} cm/s or lower. A summary of the laboratory permeability test results is presented in Table 2. Details of the laboratory permeability test results from the compacted clay liner are presented in Appendix C.6. The drive tube sample locations were repaired by placing clay material in the holes and compacting the material by hand. This process involved placing the clay material into the hole in 3-inch lifts and compacting with an approximate 5-pound hammer. After the holes were compacted by hand the sheepsfoot compactor made several passes over the locations prior to placement of the next lift. GLA's CQA Monitor observed that all test locations were properly repaired. Construction of compacted clay liner layer was deemed complete after all of the specified properties were tested and observed by GLA's CQA Monitor.

When the Contractor and GLA's CQA Monitor determined that the required thickness and grade had been accomplished, the top of the clay liner was fine-graded using a dozer. Verification of the liner thickness was performed by Cardinal. The survey was reviewed by GLA for completeness and conformance with the Construction Drawings and Technical Specifications. Review of the final survey indicated that the compacted clay liner was a minimum of 1-foot thick and that the minimum slope grade was achieved. Certified survey data for the compacted clay liner is included in Appendix E.2. A comparison of the as-built compacted clay liner survey data vs. the as-built subgrade survey is also included in Appendix E.2.

Table 3. Compacted Clay Liner Permeability Test Summary

Sample Number	Permeability (cm/s)
CP-1A	1.0E-07
CP-1B	3.4E-08

4.3 Protective Cover Layer

Soils utilized for the protective cover layer over the clay liner were obtained from the existing borrow area. The Contractor placed approximately 2,200 cubic yards of protective cover layer material over the clay liner. To confirm requirements were met and that the placement of the protective soil layer followed the Technical Specifications.

The CQA Monitor observed that the material source was suitable, free of organics or other deleterious materials. GLA's CQA Monitor performed testing on the soils. Atterberg limits (ASTM D-4318), grain size distribution (ASTM D-6913), and standard Proctor (ASTM D-698) tests were

performed on the materials. These test results are included in Appendix D.1, D.2, and D.3, respectively.

GLA's CQA Monitor performed in-place density tests during protective cover placement, using a nuclear density gauge. The protective cover was placed at a minimum of 90 percent of the maximum dry density and +/- 5% of optimum moisture content as determined by ASTM D-698. Summaries of the field moisture/density testing are included in Appendix C.4.

When the Contractor and GLA's CQA Monitor determined that the required thickness and grade had been accomplished, the top of the protective cover was fine-graded using a dozer. Verification of the liner thickness was performed by Cardinal. The survey was reviewed by GLA for completeness and conformance with the Construction Drawings and Technical Specifications. Review of the final survey indicated that the protective cover was a minimum of 1-foot thick and that the minimum slope grade was achieved. Certified survey data for the protective cover is included in Appendix E.3. A comparison of the as-built compacted protective cover survey data vs. the as-built clay liner survey is also included in Appendix E.3.

4.4 As-Built Surveys

Surveys to verify the elevations and grades of the earthworks were conducted by Cardinal, under the direction of a professional land surveyor registered in the State of Colorado. The earthwork components surveyed include the following:

- Top of prepared subgrade
- Top of clay liner layer
- Top of protective cover layer

Subgrade points 1003, 1010 and 1031 were out of tolerance by +0.01, +.0.07, and +0.01 feet, respectively. Although they were slightly out of tolerance they were found to be acceptable as long as the same surveyed compacted clay points were shown to be a minimum of 1-foot thick. The survey on the compacted clay for point nos. 1003, 1010, and 1031 verified a minimum 1-foot thickness. Additionally, the compost pad maintained the proper flow.

As-built surveys for the prepared subgrade, clay liner layer, and the protective cover layer are presented in Appendices E.1, E.2, and E.3 respectively.

5. Conclusion

Construction of Compost Pad Expansion at the East Regional Landfill was substantially completed on September 16, 2025. Based on our observations and testing during the construction, it is GLA's professional judgment that the construction was completed in general accordance with the Construction Drawings, Technical Specifications, CQA Plan, and applicable regulations.

Appendix A

Daily Reports

Geo-Logic ASSOCIATES

Geo-Logic ASSOCIATES

DAILY CONSTRUCTION FIELD REPORT

Project Name: East Regional LF Compost Pad Expansion	Project No. AU25.1108	Daily Field Report Sequence OC Number: 1	
Location of Work: Bennett, Colorado	Client Or Manager Republic Services	Date: September 3, 2025	Day of The Week: Wednesday
General Contractor: 4X Contractors	Liner Contractor: -	Project Engineer: Bryan Fritzler	
General Foreman: Jose Varela	Liner Superintendent: -	CQA Engineer: Bryan Fritzler	
Source and Description of Fill Material: Onsite native soils	Weather: Sunny with a slight breeze, 58-84°F	CQA Technician: Emily Abbott	
Equipment on site: Water Truck, (2) CAT Scraper, CAT Dozer, Sheepsfoot Compactor, Smooth Drum Compactor, Hitachi Excavator, Xtreme Roller Boom			

4X Contractors (4X):

- Began placement of subgrade fill. Material was obtained from the soil stockpile to the south of the compost pad expansion. Soil was placed in 8-inch lifts, moisture conditioned, and compacted according to specifications.
- Began preparation for surveyor scheduled to come in two days.

Geo-Logic Associates (GLA):

- Observed and documented construction activities.

Figure 1. 4X personnel fill, moisture condition, grade, and compact subgrade as seen from the north edge of the compost pad expansion

Prepared by: Emily Abbott	Reviewed by: Bryan Fritzler

Geo-Logic ASSOCIATES

DAILY CONSTRUCTION FIELD REPORT

Project Name: East Regional LF Compost Pad Expansion	Project No. AU25.1108	Daily Field Report Sequence OC Number: 2	
Location of Work: Bennett, Colorado	Client or Manager: Republic Services	Date: September 4, 2025	Day of the Week: Thursday
General Contractor: 4X Contractors	Liner Contractor: -	Project Engineer: Bryan Fritzler	
General Foreman: Jose Varela	Liner Superintendent: -	CQA Engineer: Bryan Fritzler	
Source and Description of Fill Material: On-site native soils	Weather: Clear, 62-84°F	CQA Technician: Emily Abbott	
Equipment On-Site: Water Truck, (2) CAT Scraper, CAT Dozer, CAT Sheepsfoot Compactor, Hamm Smooth Drum Compactor, Hitachi Excavator, Xtreme Roller Boom			

4X Contractors (4X):

- Continued preparing for surveyors scheduled to come in one day. Placed flags for certification points and marked boundaries with spray paint.
- Continued fine grading and compaction of the subgrade.

Geo-Logic Associates (GLA):

- Performed nuclear density/moisture tests on the subgrade. Results met the project's specifications regarding percent compaction and moisture content.
- Observed and documented construction activities.

Figure 1. Prepared subgrade as seen from the northwest corner of the compost pad expansion

Prepared by: Emily Abbott	Reviewed by: Bryan Fritzler

Figure 2. GLA personnel inspect subgrade at compost pad expansion

Prepared by: Emily Abbott	Reviewed by: Bryan Fritzler

Geo-Logic ASSOCIATES

DAILY CONSTRUCTION FIELD REPORT

Project Name: East Regional LF Compost Pad Expansion	Project No. AU25.1108	Daily Field Report Sequence OC Number: 3	
Location of Work: Bennett, Colorado	Client or Manager: Republic Services	Date: September 5, 2025	Day of the Week: Friday
General Contractor: 4X Contractors	Liner Contractor: -	Project Engineer: Bryan Fritzler	
General Foreman: Jose Varela	Liner Superintendent: -	CQA Engineer: Bryan Fritzler	
Source and Description of Fill Material: On-site native clay soils	Weather: Overcast, 53-62°F	CQA Technician: Emily Abbott	
Equipment On-Site: Water Truck, (2) CAT Scraper, CAT Dozer, CAT Sheepsfoot Compactor, Hamm Smooth Drum Compactor, Hitachi Excavator, Xtreme Roller Boom			

4X Contractors (4X):

- Observed surveyor activity.
- Began placement of clay liner in the expansion area after receiving authorization from Keith Ruf. Material was obtained from the soil stockpile to the southeast of Cell 6, moisture conditioned, and compacted according to specifications.

Geo-Logic Associates (GLA):

- Observed surveyor activity.
- Observed and documented construction activities.

Figure 1. 4X personnel begin placement of clay liner following surveyor activity, as seen from the northwest corner of the compost pad expansion area

Prepared by: Emily Abbott	Reviewed by: Bryan Fritzler

Figure 2. 4X and GLA personnel observe Cardinal Points Surveying, Inc.

Prepared by: Emily Abbott	Reviewed by: Bryan Fritzler

Geo-Logic ASSOCIATES

DAILY CONSTRUCTION FIELD REPORT

Project Name: East Regional LF Compost Pad Expansion	Project No. AU25.1108	Daily Field Report Sequence OC Number: 4	
Location of Work: Bennett, Colorado	Client or Manager: Republic Services	Date: September 6, 2025	Day of the Week: Saturday
General Contractor: 4X Contractors	Liner Contractor: -	Project Engineer: Bryan Fritzler	
General Foreman: Jose Varela	Liner Superintendent: -	CQA Engineer: Bryan Fritzler	
Source and Description of Fill Material: On-site native clay soils	Weather: Clear, 48-79°F	CQA Technician: Emily Abbott	
Equipment On-Site: Water Truck, (2) CAT Scraper, CAT Dozer, CAT Sheepsfoot Compactor, Hamm Smooth Drum Compactor, Hitachi Excavator, Xtreme Roller Boom			

4X Contractors (4X):

- Continued placement of clay liner in the expansion area. Material was obtained from the soil stockpile to the southeast of Cell 6. Material was placed in 6-inch lifts, moisture conditioned, and compacted according to specifications.

Geo-Logic Associates (GLA):

- Observed and documented construction activities.

Figure 1. 4X personnel continue placement of clay liner, as seen from the northwest corner of the compost pad expansion area

Prepared by: Emily Abbott	Reviewed by: Bryan Fritzler

Geo-Logic ASSOCIATES

DAILY CONSTRUCTION FIELD REPORT

Project Name: East Regional LF Compost Pad Expansion	Project No. AU25.1108	Daily Field Report Sequence OC Number: 5	
Location of Work: Bennett, Colorado	Client or Manager: Republic Services	Date: September 8, 2025	Day of the Week: Monday
General Contractor: 4X Contractors	Liner Contractor: -	Project Engineer: Bryan Fritzler	
General Foreman: Jose Varela	Liner Superintendent: -	CQA Engineer: Bryan Fritzler	
Source and Description of Fill Material: On-site native clay soils	Weather: Partly cloudy, 59-84°F	CQA Technician: Emily Abbott	
Equipment On-Site: Water Truck, (2) CAT Scraper, CAT Dozer, CAT Sheepsfoot Compactor, Hamm Smooth Drum Compactor, Hitachi Excavator, Xtreme Roller Boom			

4X Contractors (4X):

- Completed placement of clay liner in the expansion area. Clay soil was obtained from the soil stockpile to the southeast of Cell 6. Material was placed in 6-inch lifts, moisture conditioned, and compacted according to specifications.
- Raked/homogenized clay material using the CAT dozer prior to compaction.

Geo-Logic Associates (GLA):

- Performed 5 nuclear density/moisture tests on the general fill. Results met the project's specifications regarding percent compaction and moisture content.
- Collected 4 tubes of clay material (2 tubes per sampling location) for permeability tests.
- Observed and documented construction activities.

Figures 1 and 2. GLA and 4X personnel perform nuclear density/moisture tests and collect permeability samples for the clay liner

Prepared by: Emily Abbott	Reviewed by: Bryan Fritzler

Figure 3. 4X personnel continue placement of clay liner, as seen from the northwest corner of the compost pad expansion area

Geo-Logic ASSOCIATES

DAILY CONSTRUCTION FIELD REPORT

Project Name: East Regional LF Compost Pad Expansion	Project No. AU25.1108	Daily Field Report Sequence OC Number: 6	
Location of Work: Bennett, Colorado	Client or Manager: Republic Services	Date: September 9, 2025	Day of the Week: Tuesday
General Contractor: 4X Contractors	Liner Contractor: -	Project Engineer: Bryan Fritzler	
General Foreman: Jose Varela	Liner Superintendent: -	CQA Engineer: Bryan Fritzler	
Source and Description of Fill Material: On-site native clay soils	Weather: Partly cloudy, 60-84°F	CQA Technician: Emily Abbott	
Equipment On-Site: Water Truck, (2) CAT Scraper, CAT Dozer, CAT Sheepsfoot Compactor, Hamm Smooth Drum Compactor, Hitachi Excavator			

4X Contractors (4X):

- Completed placement of clay liner in the expansion area. Clay soil was obtained from the soil stockpile to the southeast of Cell 6. Material was placed in 6-inch lifts, moisture conditioned, and compacted according to specifications.
- Raked/homogenized clay material using the CAT dozer prior to compaction.

Geo-Logic Associates (GLA):

- Observed and documented construction activities.

Figure 1. 4X personnel place and prepare clay liner as seen from the northern edge of the compost pad expansion area

Prepared by: Emily Abbott	Reviewed by: Bryan Fritzler

Geo-Logic ASSOCIATES

DAILY CONSTRUCTION FIELD REPORT

Project Name: East Regional LF Compost Pad Expansion	Project No. AU25.1108	Daily Field Report Sequence OC Number: 7	
Location of Work: Bennett, Colorado	Client or Manager: Republic Services	Date: September 10, 2025	Day of the Week: Wednesday
General Contractor: 4X Contractors	Liner Contractor: -	Project Engineer: Bryan Fritzler	
General Foreman: Jose Varela	Liner Superintendent: -	CQA Engineer: Bryan Fritzler	
Source and Description of Fill Material: On-site native clay soils	Weather: Partly cloudy, 52-89°F	CQA Technician: Emily Abbott	
Equipment On-Site: Water Truck, (2) CAT Scraper, CAT Dozer, CAT Sheepsfoot Compactor, Hamm Smooth Drum Compactor, Hitachi Excavator			

4X Contractors (4X):

- Began placement of soil cover on existing compost pad.
- Observed surveyor activity.

Geo-Logic Associates (GLA):

- Observed and documented construction activities.
- Observed surveyor activity.

Figure 1. 4X personnel place soil cover on existing compost pad as seen from the northern edge of the compost pad expansion area

Prepared by: Emily Abbott	Reviewed by: Bryan Fritzler

Figure 2. Cardinal Points Surveying, Inc. personnel completes survey of clay liner as seen from the southern edge of the compost pad expansion area

Geo-Logic ASSOCIATES

DAILY CONSTRUCTION FIELD REPORT

Project Name: East Regional LF Compost Pad Expansion	Project No. AU25.1108	Daily Field Report Sequence OC Number: 8	
Location of Work: Bennett, Colorado	Client or Manager: Republic Services	Date: September 11, 2025	Day of the Week: Thursday
General Contractor: 4X Contractors	Liner Contractor: -	Project Engineer: Bryan Fritzler	
General Foreman: Jose Varela	Liner Superintendent: -	CQA Engineer: Bryan Fritzler	
Source and Description of Fill Material: On-site native clay soils	Weather: Clear, 63-85°F	CQA Technician: Emily Abbott	
Equipment On-Site: Water Truck, (2) CAT Scraper, CAT Dozer, CAT Sheepsfoot Compactor, Hamm Smooth Drum Compactor, Hitachi Excavator			

4X Contractors (4X):

- Continued placement of soil cover on existing compost pad.

Geo-Logic Associates (GLA):

- Observed and documented construction activities.

Figure 1. 4X personnel place soil cover on existing compost pad as seen from the northern edge of the existing compost pad

Prepared by: Emily Abbott	Reviewed by: Bryan Fritzler

Geo-Logic ASSOCIATES

DAILY CONSTRUCTION FIELD REPORT

Project Name: East Regional LF Compost Pad Expansion	Project No. AU25.1108	Daily Field Report Sequence OC Number: 9	
Location of Work: Bennett, Colorado	Client or Manager: Republic Services	Date: September 12, 2025	Day of the Week: Friday
General Contractor: 4X Contractors	Liner Contractor: -	Project Engineer: Bryan Fritzler	
General Foreman: Jose Varela	Liner Superintendent: -	CQA Engineer: Bryan Fritzler	
Source and Description of Fill Material: On-site native clay soils	Weather: Partly cloudy, 61-79°F	CQA Technician: Emily Abbott	
Equipment On-Site: Water Truck, (2) CAT Scraper, CAT Dozer, CAT Sheepsfoot Compactor, Hamm Smooth Drum Compactor, Hitachi Excavator			

4X Contractors (4X):

- Began placement of soil cover on compost pad expansion area's clay liner after receiving authorization from Keith Ruf.

Geo-Logic Associates (GLA):

- Observed and documented construction activities.

Figure 1. 4X personnel place soil cover on compost pad expansion area as seen from the northern edge of the compost pad expansion area

Prepared by: Emily Abbott	Reviewed by: Bryan Fritzler

Geo-Logic ASSOCIATES

DAILY CONSTRUCTION FIELD REPORT

Project Name: East Regional LF Compost Pad Expansion	Project No. AU25.1108	Daily Field Report Sequence OC Number: 10	
Location of Work: Bennett, Colorado	Client or Manager: Republic Services	Date: September 15, 2025	Day of the Week: Monday
General Contractor: 4X Construction Group, LLC	Liner Contractor: -	Project Engineer: Bryan Fritzler	
General Foreman: Jose Varela	Liner Superintendent: -	CQA Engineer: Bryan Fritzler	
Source and Description of Fill Material: On-site native clay soils	Weather: Clear, 57-82°F	CQA Technician: Emily Abbott	
Equipment On-Site: Water Truck, (2) CAT Scraper, CAT Dozer, CAT Sheepsfoot Compactor, Hamm Smooth Drum Compactor, Hitachi Excavator			

4X Construction Group (4X):

- Continued placement of soil cover on compost pad expansion area.

Geo-Logic Associates (GLA):

- Observed and documented construction activities.
- Performed moisture/density testing on placed soil cover material.

Figure 1. 4X personnel place soil cover on compost pad expansion area as seen from the northern edge of the compost pad expansion area

Prepared by: Emily Abbott	Reviewed by: Bryan Fritzler

Geo-Logic ASSOCIATES

DAILY CONSTRUCTION FIELD REPORT

Project Name: East Regional LF Compost Pad Expansion	Project No. AU25.1108	Daily Field Report Sequence OC Number: 11	
Location of Work: Bennett, Colorado	Client or Manager: Republic Services	Date: September 16, 2025	Day of the Week: Tuesday
General Contractor: 4X Construction Group, LLC	Liner Contractor: -	Project Engineer: Bryan Fritzler	
General Foreman: Jose Varela	Liner Superintendent: -	CQA Engineer: Bryan Fritzler	
Source and Description of Fill Material: On-site native clay soils	Weather: Partly cloudy w/ afternoon storms, 54-74°F	CQA Technician: Emily Abbott	
Equipment On-Site: Water Truck, (2) CAT Scraper, CAT Dozer, CAT Sheepsfoot Compactor, Hamm Smooth Drum Compactor, Hitachi Excavator			

4X Construction Group (4X):

- Completed placement and compaction of soil cover on compost pad expansion area.

Geo-Logic Associates (GLA):

- Observed and documented construction activities.

Figure 1. Compost expansion pad as seen from its northern edge.

Prepared by: Emily Abbott	Reviewed by: Bryan Fritzler

Appendix B

General Fill Material Data

Geo-Logic ASSOCIATES

Appendix B.1

Atterberg Limit Results

Geo-Logic ASSOCIATES

Geo-Logic ASSOCIATES

ATTERBERG LIMITS

Summary Report

ASTM D-4318

Client : Republic Services

Project No: AU25.1108

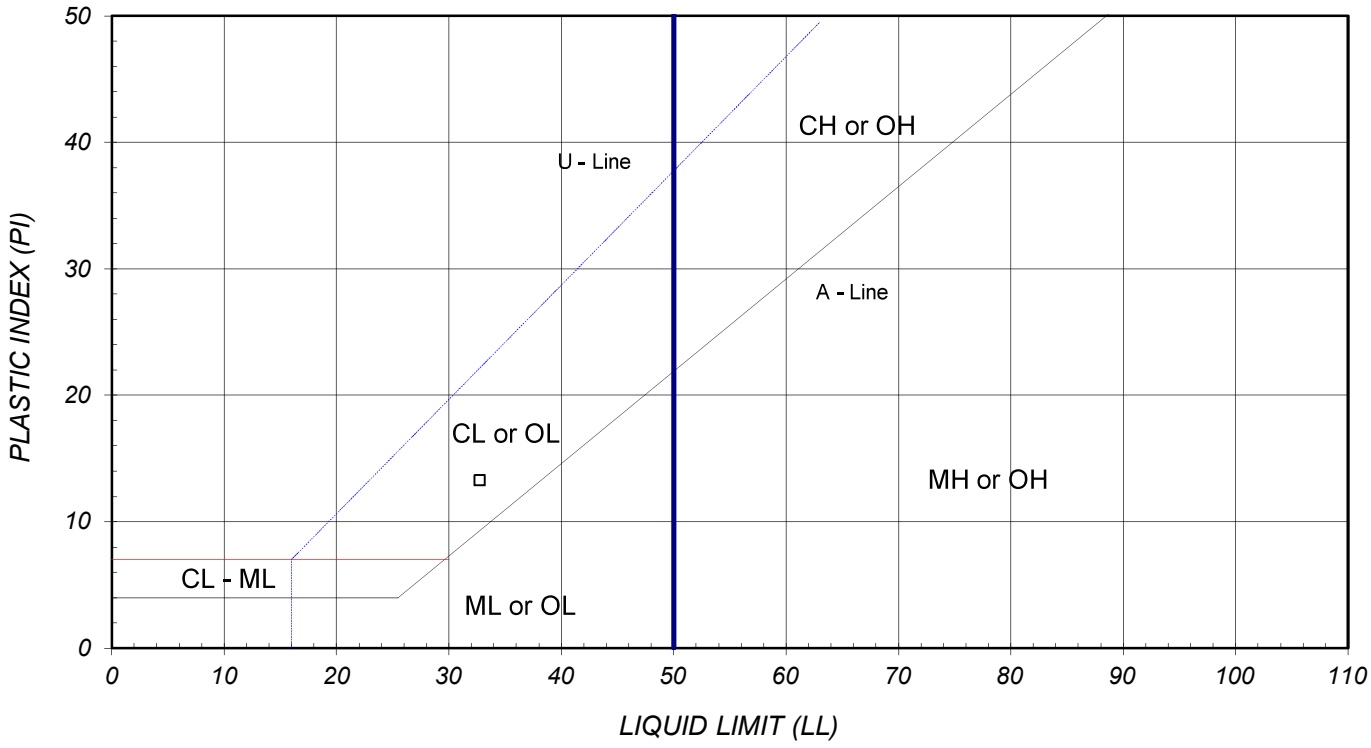
Lab Log No.:

Project Name: East Regional Compost Pad

Report Date: September 6, 2025

LSN	SYMBOL	SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	UNIFIED SYMBOL	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX
1	□	GF1	Brown Silty Clay		33	20	13

PLASTICITY CHART



These results apply only to the above listed samples. The data and information are proprietary and can not be released without authorization of Vector Engineering Inc.
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Appendix B.2

Sieve Results

Geo-Logic ASSOCIATES

Geo-Logic ASSOCIATES

PARTICLE SIZE ANALYSIS

TEST REPORT

ASTM D-6913

Client : REPUBLIC SERVICES

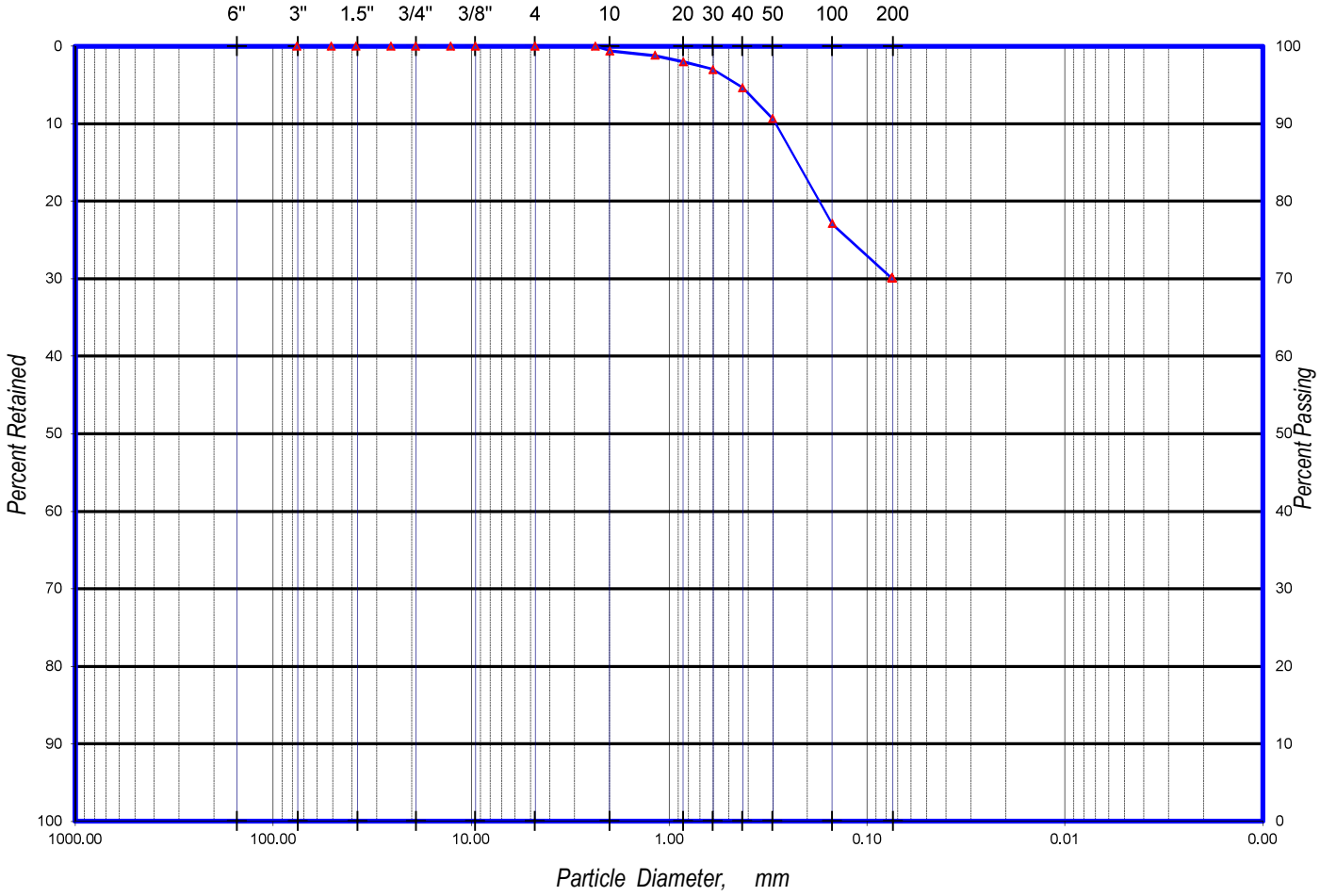
Project No: AU25.1108

Lab Sample No: **GF1**

Project Name: EAST REGIONAL LF COMPOST PAD

Report Date: September 2, 2025

BOLDERS	COBBLES	GRAVEL		SAND			SILT AND CLAY
		COARSE	FINE	COARSE	MEDIAN	FINE	
US SIEVE SIZE, INCHES				US STANDARD SIEVE SIZE No.			HYDROMETER



Symbol	Sample ID	Description	% Gravel	% Sand	% Silt - Clay
▲	GF-1	Brown silty clay	0.0	29.9	70.1

Size Passing, mm D_{60} = N/A D_{30} = N/A D_{10} = N/A

Coefficient of Curvature, C_c: N/A Coefficient of Uniformity, C_u: N/A Fineness Modulus = 0.37

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Appendix B.3

Proctor Results

Geo-Logic ASSOCIATES

Geo-Logic ASSOCIATES

MOISTURE / DENSITY RELATIONSHIPS

TEST REPORT

ASTM D - 698

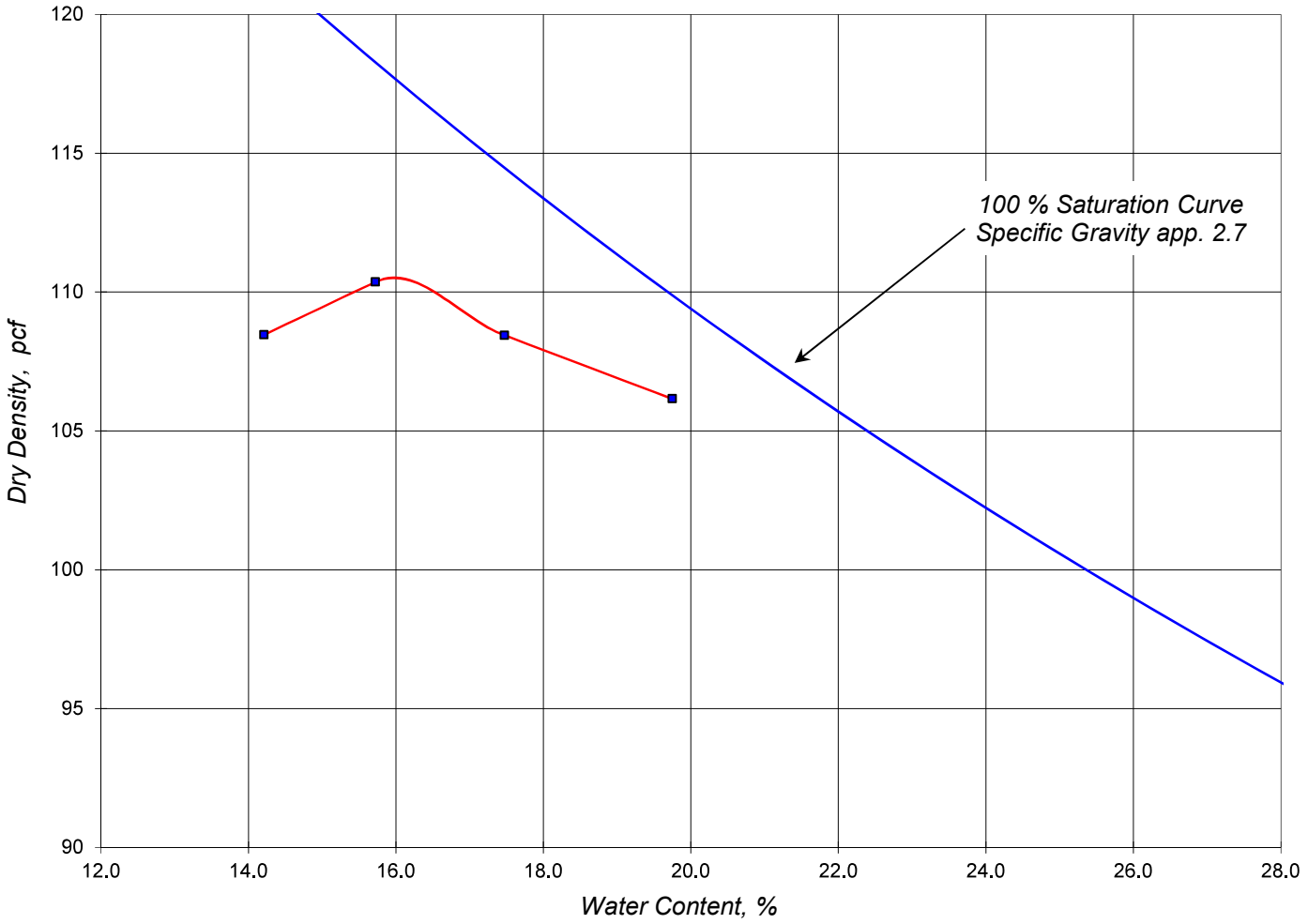
Client: Republic Services

Project No.: AU25.1108

Lab Log No.: GF1

Project Name: East Regional LF

Report Date: August 14, 2025



Symbol	Lab No.	Sample Identification	Description	Maximum Dry Density pcf	Maximum Dry Density kg / m³	Optimum Water Content %
■	GF1	GF-1	Light Brown Sily Clay	110.5	1.77	16

Corrected Values For Oversized Particles, per ASTM D-4718

■	GF1	with	0	Percent + 3/4" Gravel, the maximum Dry Density	=	110.5	16.0

Note: The test was conducted as method A with 0 percent retained on the no. 4 sieve (minus 3/4")

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Appendix B.4

Field Density/Moisture Test Summary

Geo-Logic ASSOCIATES

Geo-Logic ASSOCIATES

MOISTURE/DENSITY TESTING

General Fill

Project Name: East Regional Landfill Compost Pad Expansion

Project No: AU25.1108.00

Test No.	Date	Location	Lift #	Proctor Sample #	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Source Depth (in)	Wet Density (pcf)	Dry Density (pcf)	Moisture Content (%)	% Comp.	P/F	Notes
1	9/5/2025	Compost Pad	1	GF1	110.5	16.0	6	123.1	107.5	14.5	97.3%	P	spec 95% @ -5% to +5% omc
2	9/5/2025	Compost Pad	1	GF1	110.5	16.0	6	123.5	106.8	15.6	96.7%	P	
3	9/5/2025	Compost Pad	1	GF1	110.5	16.0	6	125.9	108.2	16.4	97.9%	P	
4	9/5/2025	Compost Pad	1	GF1	110.5	16.0	6	125.0	105.6	18.4	95.6%	P	
5	9/5/2025	Compost Pad	1	GF1	110.5	16.0	6	124.6	106.3	17.2	96.2%	P	
6	9/5/2025	Compost Pad	1	GF1	110.5	16.0	6	122.7	106.4	15.3	96.3%	P	
7	9/5/2025	Compost Pad	2	GF1	110.5	16.0	6	123.2	107.8	14.3	97.6%	P	
8	9/5/2025	Compost Pad	2	GF1	110.5	16.0	6	123.0	105.2	16.9	95.2%	P	
9	9/5/2025	Compost Pad	2	GF1	110.5	16.0	6	128.3	109.2	17.5	98.8%	P	
10	9/5/2025	Compost Pad	2	GF1	110.5	16.0	6	123.9	105.6	17.3	95.6%	P	
11	9/5/2025	Compost Pad	2	GF1	110.5	16.0	6	120.8	105.2	14.8	95.2%	P	
12	9/5/2025	Compost Pad	2	GF1	110.5	16.0	6	124.0	108.6	14.2	98.3%	P	
13	9/5/2025	Compost Pad	2	GF1	110.5	16.0	6	125.2	107.2	16.8	97.0%	P	
14	9/5/2025	Compost Pad	2	GF1	110.5	16.0	6	123.3	107.6	14.6	97.4%	P	

Appendix C

Compacted Clay Liner Material Data

Geo-Logic ASSOCIATES

Appendix C.1

Atterberg Limits Results

Geo-Logic ASSOCIATES

ADVANCED TERRA TESTING

Atterberg Limits
ASTM D 4318

CLIENT	Geo-Logic Associates	BORING NO.	--
JOB NO.	2893-023	DEPTH	--
PROJECT	East Regional LF	SAMPLE NO.	CL-1
PROJECT NO.	--	DATE SAMPLED	--
LOCATION	--	SAMPLED BY	--
DATE TESTED	09/09/25	DESCRIPTION	--
TECHNICIAN	WB		

Plastic Limits

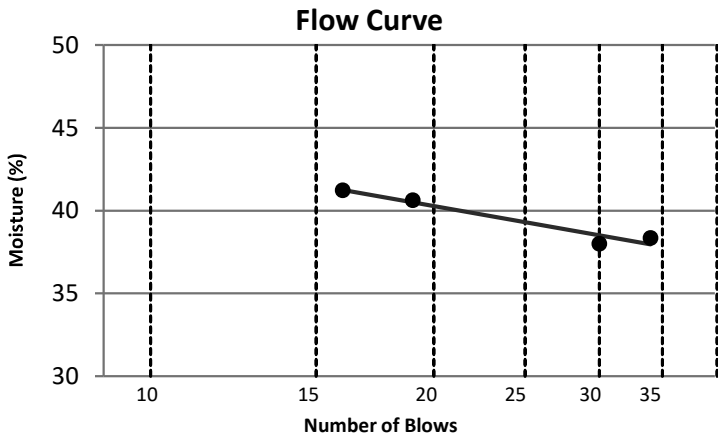
Mass of Wet Pan and Soil (g):	26.26	25.14
Mass of Dry Pan and Soil (g):	25.20	24.17
Mass of Pan (g):	18.42	17.64
Moisture (%)	**15.6**	**14.9**

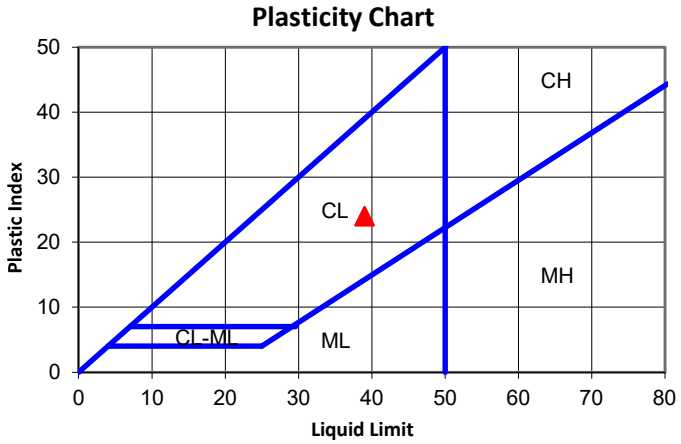
Liquid Limits

Number of Blows	16	19	34	30
Mass of Wet Pan and Soil (g):	29.20	29.51	27.89	28.08
Mass of Dry Pan and Soil (g):	26.06	26.34	25.32	25.48
Mass of Pan (g):	18.42	18.52	18.61	18.63
Moisture (%)	**41.2**	**40.6**	**38.4**	**38.0**

Plastic Index

Plastic Limit:	**15**	Atterberg Classification:	CL
Liquid Limit:	**39**	Method:	A
Plastic Index:	**24**		





NOTES

Data entry by:	WB	Date:	09/10/25
Checked by:	BDF	Date:	09/11/25
File name:	2893023__Atterberg ASTM D4318_1.xlsm		

ADVANCED TERRA TESTING

Atterberg Limits
ASTM D 4318

CLIENT	Geo-Logic Associates	BORING NO.	--
JOB NO.	2893-023	DEPTH	--
PROJECT	East Regional LF	SAMPLE NO.	CL-2
PROJECT NO.	--	DATE SAMPLED	--
LOCATION	--	SAMPLED BY	--
DATE TESTED	09/05/25	DESCRIPTION	--
TECHNICIAN	MH		

Plastic Limits

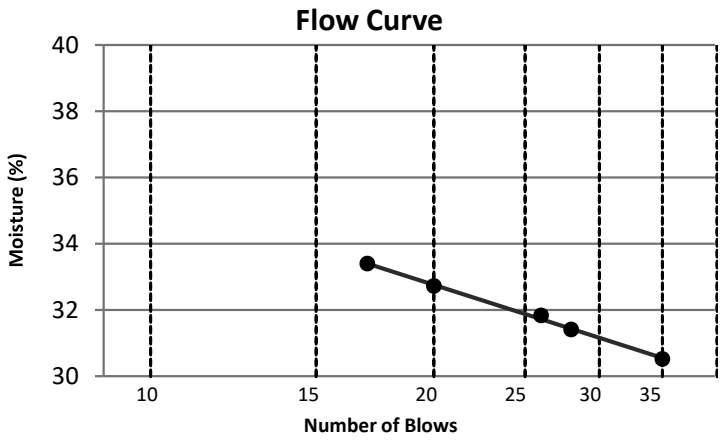
Mass of Wet Pan and Soil (g):	25.81	26.06
Mass of Dry Pan and Soil (g):	24.97	25.21
Mass of Pan (g):	18.60	18.81
Moisture (%)	**13.3**	**13.3**

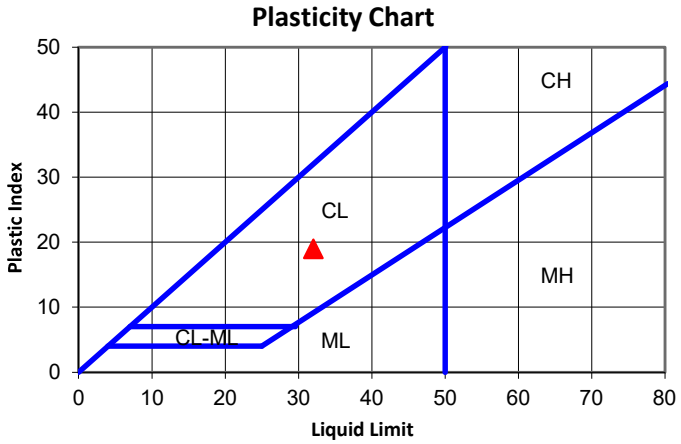
Liquid Limits

Number of Blows	17	20	26	28	35
Mass of Wet Pan and Soil (g):	25.64	24.74	23.96	25.47	26.04
Mass of Dry Pan and Soil (g):	23.88	23.01	22.43	23.82	24.23
Mass of Pan (g):	18.61	17.71	17.65	18.58	18.28
Moisture (%)	**33.4**	**32.7**	**31.8**	**31.4**	**30.5**

Plastic Index

Plastic Limit:	**13**	Atterberg Classification:	CL
Liquid Limit:	**32**	Method:	A
Plastic Index:	**19**		





NOTES

Data entry by: MH — Date: 09/08/25
Checked by: BDF — Date: 09/11/25
File name: 2893023__Atterberg ASTM D4318_0.xlsm

Geo-Logic ASSOCIATES

ATTERBERG LIMITS

Summary Report

ASTM D-4318

Client : Republic Services

Project No: AU25.1108

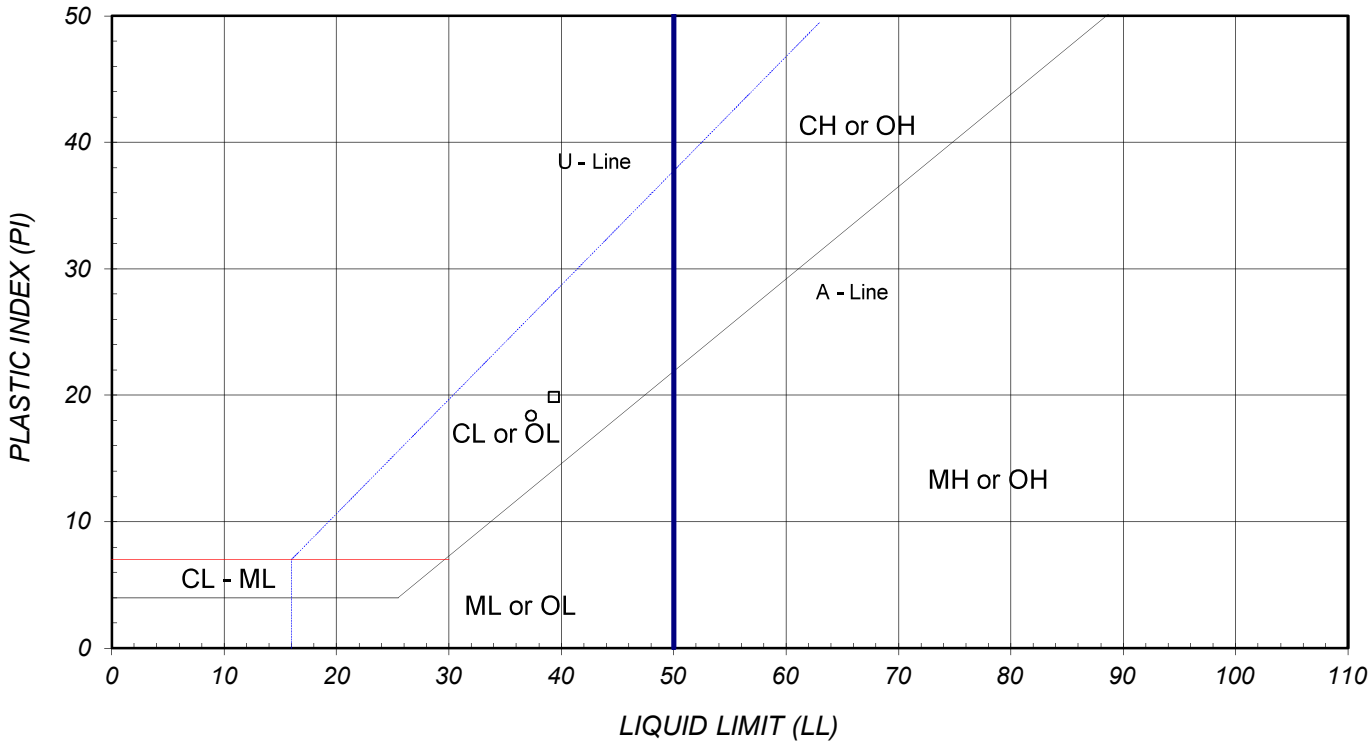
Lab Log No.:

Project Name: East Regional Compost Pad

Report Date: September 6, 2025

LSN	SYMBOL	SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	UNIFIED SYMBOL	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX
1	□	CL-3	Dark Brown Lean Clay		39	20	20
2	○	CL-4	Dark Brown Lean Clay		37	19	18

PLASTICITY CHART



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Appendix C.2

Sieve Results

Geo-Logic ASSOCIATES

ADVANCED TERRA TESTING

Grain Size Analysis
ASTM D 6913

CLIENT	Geo-Logic Associates	BORING NO.	--
JOB NO.	2893-023	DEPTH	--
PROJECT	East Regional LF	SAMPLE NO.	CL-1
PROJECT NO.	--	DATE SAMPLED	--
LOCATION	--	DESCRIPTION	--
DATE TESTED	09/10/25		
TECHNICIAN	CK		

Hygroscopic Moisture of Fines

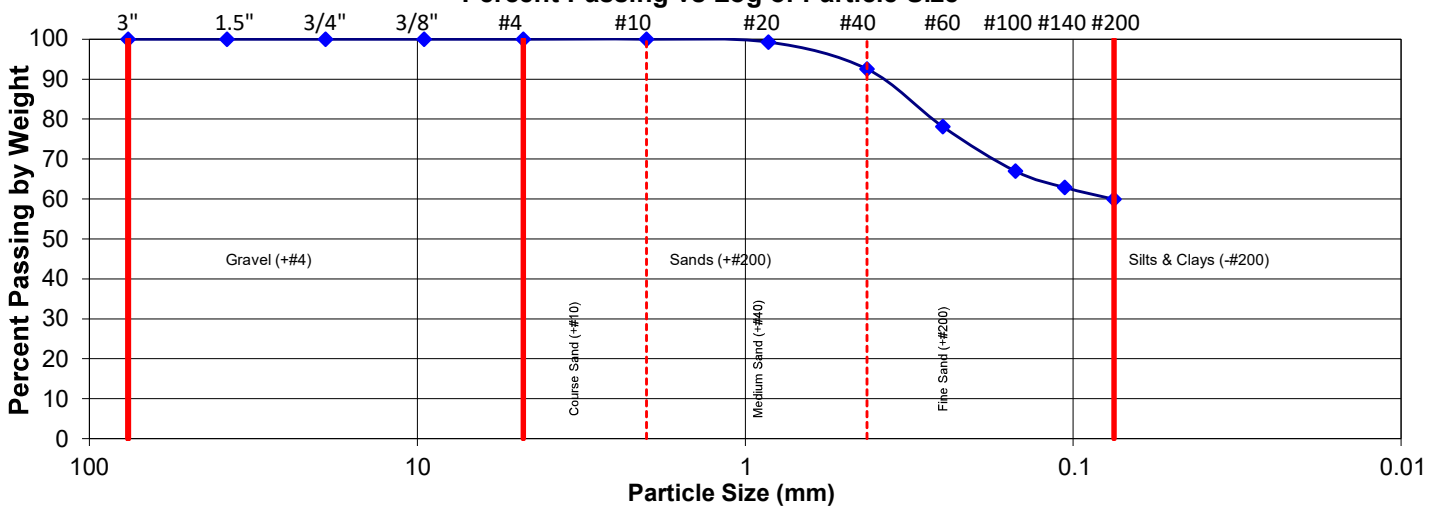
Mass Wet Pan and Soil (g): 427.93
Mass Dry Pan and Soil (g): 419.83
Mass of Pan (g): 172.36
Moisture (%): **3.3**

Sample Data

Total Wet Mass of Sample (g): 16900.0
Total Dry Mass of Sample (g): 16364.4
Split Fraction: #4
Mass of Sub-Sample Fraction (g): 255.57

Sieve Number	Sieve Size (mm)	Mass of Pan and Soil (g)	Mass of Pan (g)	Mass of Individual Retained Soil (g)	Correction Factor	Percent Passing by Weight (%)
3"	76.2	--	--	--	--	**--**
1.5"	38.1	--	--	--	--	**--**
3/4"	19.05	--	--	--	--	**--**
3/8"	9.53	--	--	--	--	**--**
#4	4.75	--	--	--	--	**--**
#10	2.00	0.0	--	0.0	1.00	**100.0**
#20	0.850	1.7	--	1.7	1.00	**99.3**
#40	0.425	16.8	--	16.8	1.00	**92.5**
#60	0.250	35.7	--	35.7	1.00	**78.1**
#100	0.150	27.6	--	27.6	1.00	**66.9**
#140	0.106	10.1	--	10.1	1.00	**62.9**
#200	0.075	7.3	--	7.3	1.00	**59.9**

Percent Passing vs Log of Particle Size



USCS Classification ASTM D 2487

Atterberg Classification: CL
Group Symbol: CL
USCS Classification: Sandy Lean Clay

Coefficient of Curvature - C_c: --
Coefficient of Uniformity - C_u: --

Data entry by: BDF — Date: 09/11/25
Checked by: CK — Date: 09/11/25
File name: 2893023__Grain Size Analysis ASTM D6913_1.xlsm

ADVANCED TERRA TESTING

Grain Size Analysis
ASTM D 6913

CLIENT	Geo-Logic Associates	BORING NO.	--
JOB NO.	2893-023	DEPTH	--
PROJECT	East Regional LF	SAMPLE NO.	CL-2
PROJECT NO.	--	DATE SAMPLED	--
LOCATION	--	DESCRIPTION	--
DATE TESTED	09/04/25		
TECHNICIAN	CK		

Hygroscopic Moisture of Fines

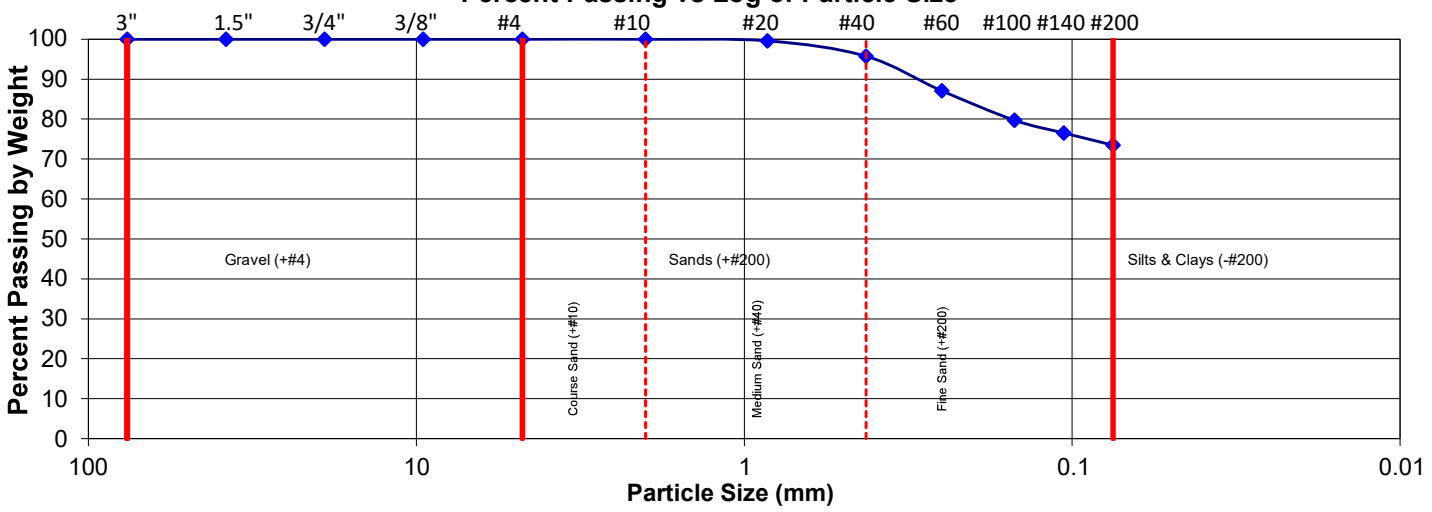
Mass Wet Pan and Soil (g):	841.64
Mass Dry Pan and Soil (g):	807.90
Mass of Pan (g):	266.07
Moisture (%):	**6.2**

Sample Data

Total Wet Mass of Sample (g):	17170.0
Total Dry Mass of Sample (g):	16163.5
Split Fraction:	3/8"
Mass of Sub-Sample Fraction (g):	575.57

Sieve Number	Sieve Size (mm)	Mass of Pan and Soil (g)	Mass of Pan (g)	Mass of Individual Retained Soil (g)	Correction Factor	Percent Passing by Weight (%)
3"	76.2	--	--	--	--	**--**
1.5"	38.1	--	--	--	--	**--**
3/4"	19.05	--	--	--	--	**--**
3/8"	9.53	--	--	--	--	**--**
#4	4.75	--	--	--	--	**--**
#10	2.00	0.0	0.0	0.0	1.00	**100.0**
#20	0.850	2.2	0.0	2.2	1.00	**99.6**
#40	0.425	21.0	0.0	21.0	1.00	**95.7**
#60	0.250	46.9	0.0	46.9	1.00	**87.1**
#100	0.150	39.8	0.0	39.8	1.00	**79.7**
#140	0.106	17.3	0.0	17.3	1.00	**76.5**
#200	0.075	16.6	0.0	16.6	1.00	**73.5**

Percent Passing vs Log of Particle Size



USCS Classification ASTM D 2487

Atterberg Classification:	CL	Coefficient of Curvature - C_c:	--
Group Symbol:	CL	Coefficient of Uniformity - C_u:	--
USCS Classification:	Lean Clay With Sand		

Data entry by:	CK	Date:	09/05/25
Checked by:	BDF	Date:	09/11/25
File name:	2893023__Grain Size Analysis ASTM D6913_0.xlsm		

Geo-Logic ASSOCIATES

PARTICLE SIZE ANALYSIS

TEST REPORT

ASTM D-6913

Client : REPUBLIC SERVICES

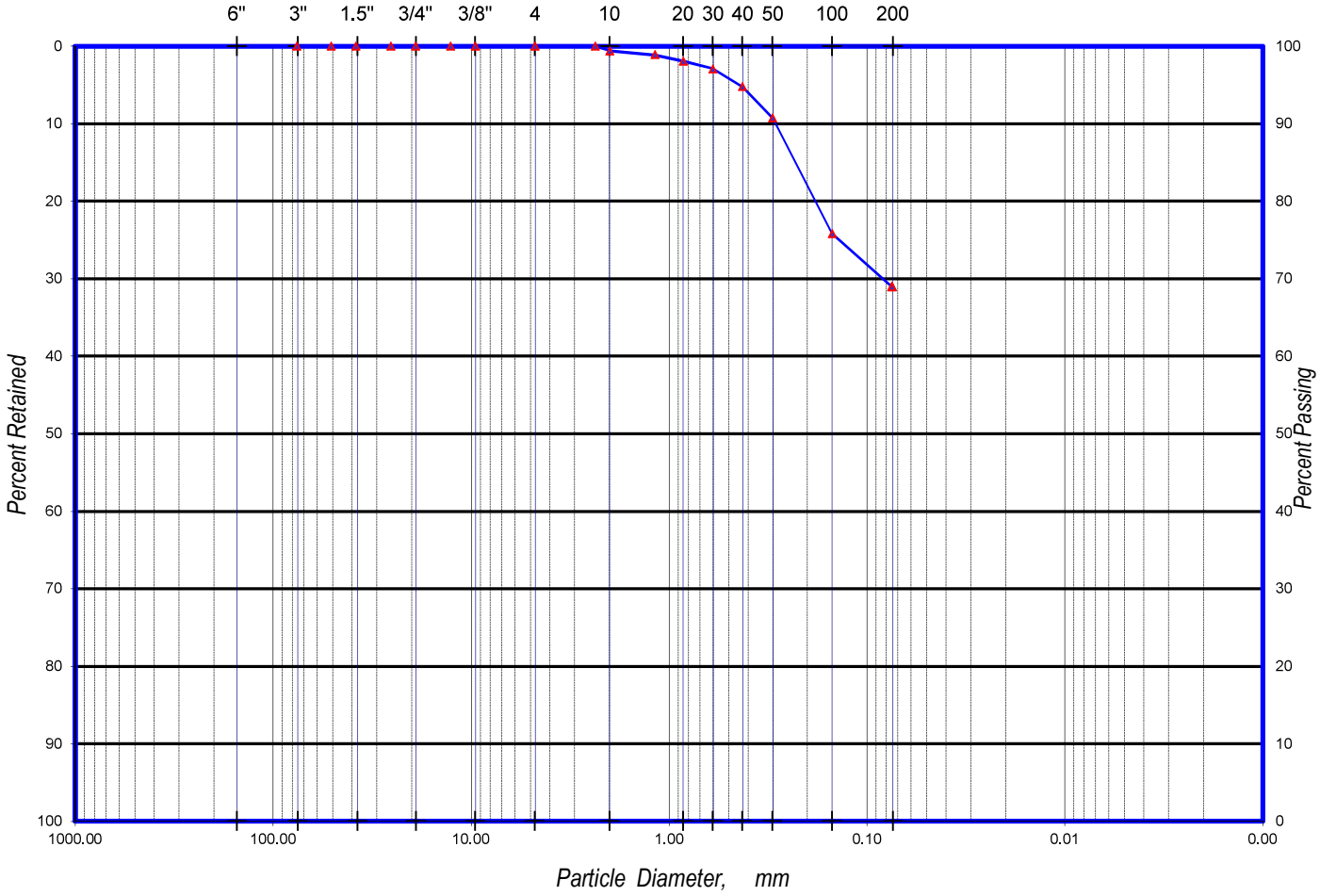
Project No: AU25.1108

Lab Sample No: CL-3

Project Name: EAST REGIONAL LF COMPOST PAD

Report Date: September 5, 2025

BOLDERS	COBBLES	GRAVEL		SAND			SILT AND CLAY
		COARSE	FINE	COARSE	MEDIAN	FINE	
US SIEVE SIZE, INCHES				US STANDARD SIEVE SIZE No.			HYDROMETER



Symbol	Sample ID	Description	% Gravel	% Sand	% Silt - Clay
▲	CL-3	Dark brown lean clay	0.0	31.1	68.9

Size Passing, mm D_{60} = N/A D_{30} = N/A D_{10} = N/A

Coefficient of Curvature, C_c: N/A Coefficient of Uniformity, C_u: N/A Fineness Modulus = 0.38

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Geo-Logic ASSOCIATES

PARTICLE SIZE ANALYSIS

TEST REPORT

ASTM D-6913

Client : REPUBLIC SERVICES

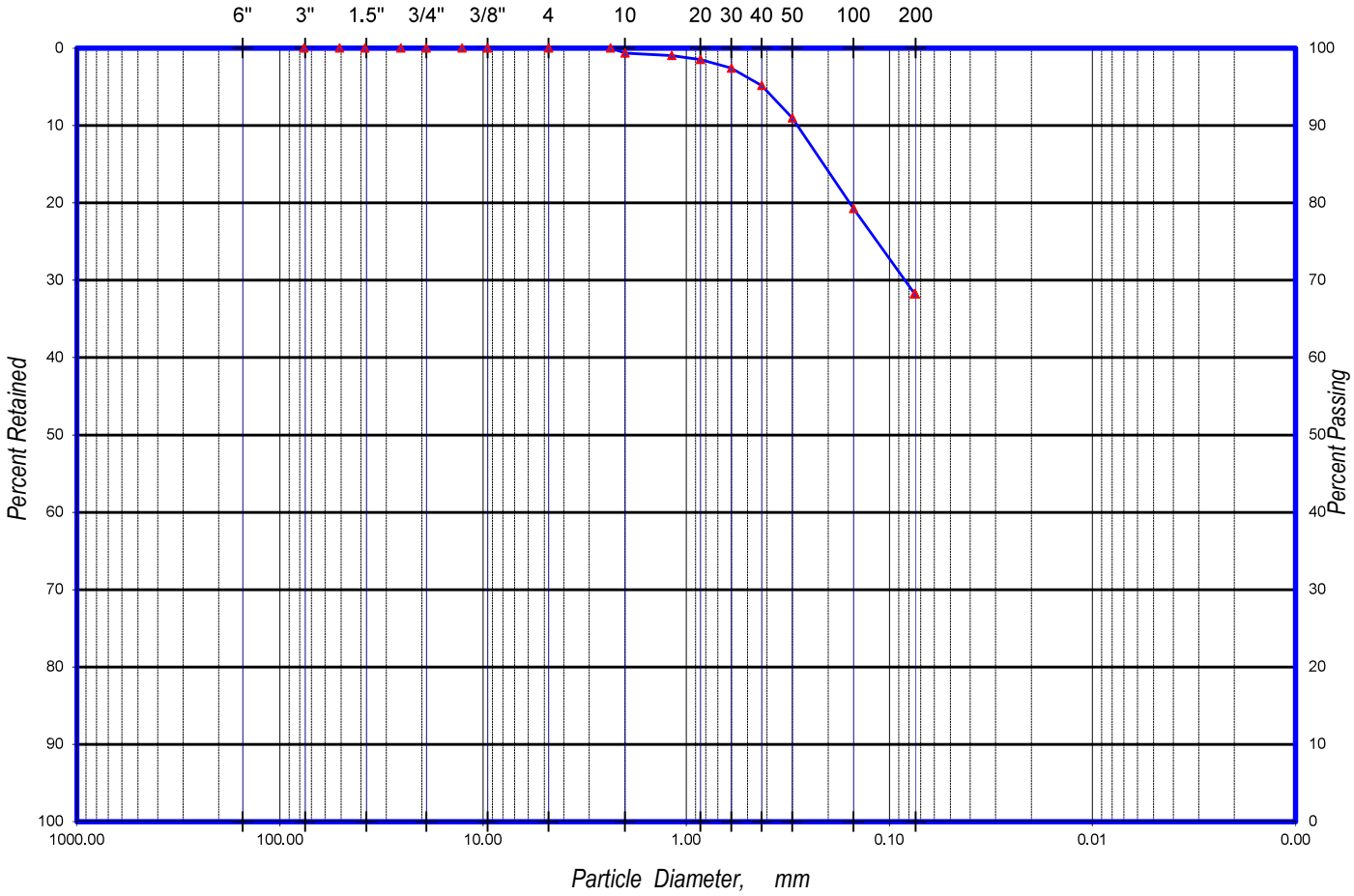
Project No: AU25.1108

Lab Sample No: CL4

Project Name: EAST REGIONAL LF COMPOST PAD

Report Date: September 6, 2025

BOLDERS	COBBLES	GRAVEL		SAND			SILT AND CLAY
		COARSE	FINE	COARSE	MEDIAN	FINE	
US SIEVE SIZE, INCHES				US STANDARD SIEVE SIZE No.			HYDROMETER



Symbol	Sample ID	Description	% Gravel	% Sand	% Silt - Clay
▲	CL-4	Dark brown lean clay	0.0	31.8	68.2

Size Passing, mm D_{60} = N/A D_{30} = N/A D_{10} = N/A

Coefficient of Curvature, C_c: N/A Coefficient of Uniformity, C_u: N/A Fineness Modulus = 0.33

These results apply only to the above listed samples. The data and information are proprietary and can not be released without authorization of Vector Engineering Inc.
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Appendix C.3

Proctor Results

Geo-Logic ASSOCIATES

ADVANCED TERRA TESTING

Laboratory Compaction Characteristics

ASTM D698

CLIENT	Geo-Logic Associates	BORING NO.	--
JOB NO.	2893-023	DEPTH	--
PROJECT	East Regional LF	SAMPLE NO.	CL-1
PROJECT NO.	--	DATE SAMPLED	--
LOCATION	--	DESCRIPTION	--
DATE TESTED	09/09/25		
TECHNICIAN	BDF		

Laboratory Compaction Characteristics

Hygroscopic Moisture

Mass of Wet Pan and Soil (g):	427.93
Mass of Dry Pan and Soil (g):	419.83
Mass of Pan (g):	172.36
Moisture (%):	3.3

Rock Correction ASTM D 4718

Method:	A
Course Fraction (%):	0.0
Rock Correction Applied:	NO
Mass of Dry Aggregate (g):	--
Mass of SSD Aggregate (g):	--
Mass of Aggregate in Water (g):	--
Rock Specific Gravity:	N/A
Zero Air Voids Specific Gravity:	2.65

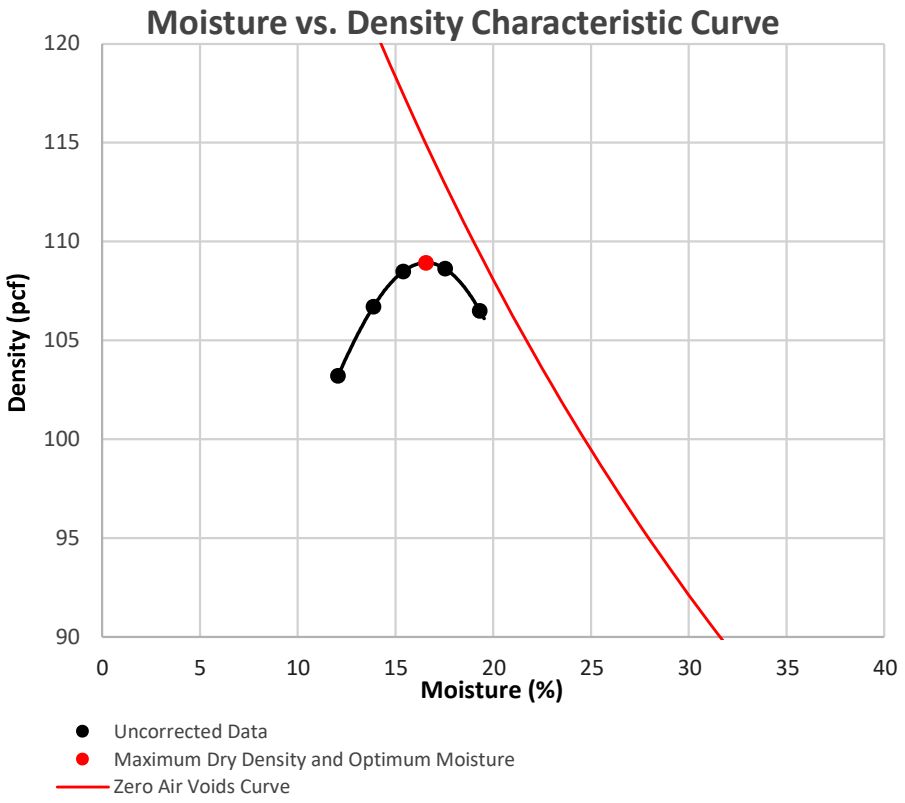
Optimum Dry Density and Moisture

Uncorrected

Dry Density (pcf):	**108.9**
Dry Density (kg/m³):	**1745**
Moisture (%):	**16.6**

Corrected

Dry Density (pcf):	**N/A**
Dry Density (kg/m³):	**N/A**
Moisture (%):	**N/A**



Sample Number:	1	2	3	4	5
Mass of Wet Pan and Soil (g):	283.14	281.55	266.68	271.78	291.56
Mass of Dry Soil and Pan (g):	246.26	240.52	224.59	239.50	260.89
Mass of Pan (g);	6.65	6.61	6.64	6.76	6.62
Moisture (%):	15.4	17.5	19.3	13.9	12.1
Mass of Wet Soil and Mold (g):	6457.6	6495.3	6486.0	6402.0	6313.6
Mass of Mold (g):	4564.9	4564.9	4564.9	4564.9	4564.9
Wet Density (pcf):	125.2	127.7	127.1	121.5	115.7
Dry Density (pcf):	108.5	108.6	106.5	106.7	103.2
Wet Density (kg/m³):	2005	2045	2035	1946	1853
Dry Density (kg/m³):	1738	1740	1706	1709	1653

Data entry by: BDF Date: 09/09/25
Checked by: JB Date: 09/10/25
File name: 2893023__compaction ASTM D698 D1557_1.xlsm

ADVANCED TERRA TESTING

Laboratory Compaction Characteristics

ASTM D698

CLIENT	Geo-Logic Associates	BORING NO.	--
JOB NO.	2893-023	DEPTH	--
PROJECT	East Regional LF	SAMPLE NO.	CL-2
PROJECT NO.	--	DATE SAMPLED	--
LOCATION	--	DESCRIPTION	--
DATE TESTED	09/08/25		
TECHNICIAN	BDF		

Laboratory Compaction Characteristics

Hygroscopic Moisture

Mass of Wet Pan and Soil (g):	841.64
Mass of Dry Pan and Soil (g):	807.90
Mass of Pan (g):	266.07
Moisture (%):	6.2

Rock Correction ASTM D 4718

Method:	B
Course Fraction (%):	0.0
Rock Correction Applied:	NO
Mass of Dry Aggregate (g):	--
Mass of SSD Aggregate (g):	--
Mass of Aggregate in Water (g):	--
Rock Specific Gravity:	N/A
Zero Air Voids Specific Gravity:	2.65

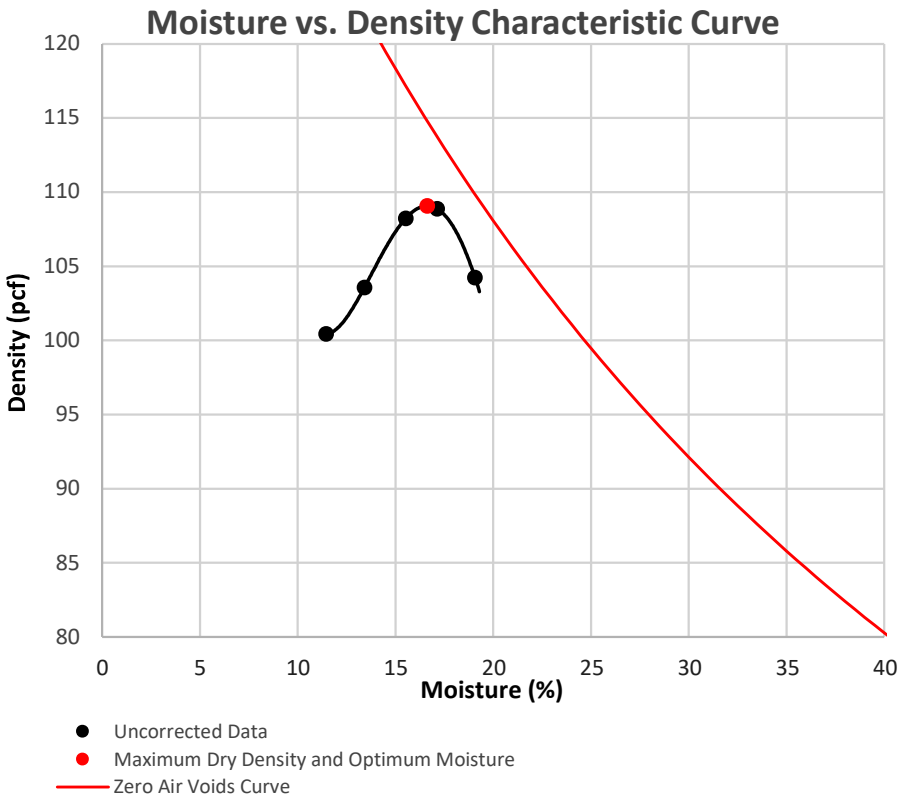
Optimum Dry Density and Moisture

Uncorrected

Dry Density (pcf):	**109.1**
Dry Density (kg/m³):	**1747**
Moisture (%):	**16.6**

Corrected

Dry Density (pcf):	**N/A**
Dry Density (kg/m³):	**N/A**
Moisture (%):	**N/A**



Sample Number:	1	2	3	4	5
Mass of Wet Pan and Soil (g):	214.01	251.85	318.26	266.94	275.09
Mass of Dry Soil and Pan (g):	186.16	215.98	268.37	236.17	247.52
Mass of Pan (g);	6.81	6.68	6.74	6.77	6.74
Moisture (%):	15.5	17.1	19.1	13.4	11.5
Mass of Wet Soil and Mold (g):	6455.5	6493.0	6441.5	6340.9	6257.4
Mass of Mold (g):	4564.9	4564.9	4564.9	4564.9	4564.9
Wet Density (pcf):	125.0	127.5	124.1	117.5	111.9
Dry Density (pcf):	108.2	108.9	104.2	103.6	100.4
Wet Density (kg/m³):	2003	2043	1988	1882	1793
Dry Density (kg/m³):	1734	1744	1670	1659	1609

Data entry by: BDF Date: 09/08/25
Checked by: JB Date: 09/10/25
File name: 2893023__compaction ASTM D698 D1557_0.xlsm

Appendix C.4

Field Density/Moisture Test Summary Results

Geo-Logic ASSOCIATES

Geo-Logic ASSOCIATES

MOISTURE/DENSITY TESTING

Clay Liner

Project Name: East Regional Landfill Compost Pad Expansion

Project No: AU25.1108.00

Test No.	Date	Location	Lift #	Proctor Sample #	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Source Depth (in)	Wet Density (pcf)	Dry Density (pcf)	Moisture Content (%)	% Comp.	P/F	Notes
1	9/6/2025	Compost Pad	1	CL-1	108.9	16.6	6	128.7	108.5	18.6	99.6%	P	spec 95% @ 0% to +4% omc
2	9/6/2025	Compost Pad	1	CL-1	108.9	16.6	6	123.8	105.1	17.8	96.5%	P	
3	9/6/2025	Compost Pad	1	CL-1	108.9	16.6	6	124.9	106.2	17.6	97.5%	P	
4	9/6/2025	Compost Pad	1	CL-1	108.9	16.6	6	125.2	105.9	18.2	97.2%	P	
5	9/6/2025	Compost Pad	1	CL-1	108.9	16.6	6	126.6	106.2	19.2	97.5%	P	
6	9/6/2025	Compost Pad	1	CL-1	108.9	16.6	6	129.0	107.6	19.9	98.8%	P	
7	9/6/2025	Compost Pad	1	CL-1	108.9	16.6	6	125.8	106.2	18.5	97.5%	P	
8	9/6/2025	Compost Pad	1	CL-1	108.9	16.6	6	124.6	106.2	17.3	97.5%	P	
9	9/6/2025	Compost Pad	2	CL-1	108.9	16.6	6	123.6	104.2	18.6	95.7%	P	
10	9/6/2025	Compost Pad	2	CL-1	108.9	16.6	6	127.3	106.2	19.9	97.5%	P	
11	9/6/2025	Compost Pad	2	CL-1	108.9	16.6	6	125.6	105.6	18.9	97.0%	P	
12	9/8/2025	Compost Pad	2	CL-1	108.9	16.6	6	123.0	104.0	18.3	95.5%	P	CP-1A perm
13	9/8/2025	Compost Pad	2	CL-1	108.9	16.6	6	124.9	104.8	19.2	96.2%	P	
14	9/8/2025	Compost Pad	2	CL-1	108.9	16.6	6	126.0	106.2	18.6	97.5%	P	
15	9/8/2025	Compost Pad	2	CL-1	108.9	16.6	6	126.2	105.9	19.2	97.2%	P	
16	9/8/2025	Compost Pad	2	CL-1	108.9	16.6	6	124.9	104.0	20.1	95.5%	P	CP-1B perm

Appendix C.5

Compacted Clay Liner Field Density Testing Locations

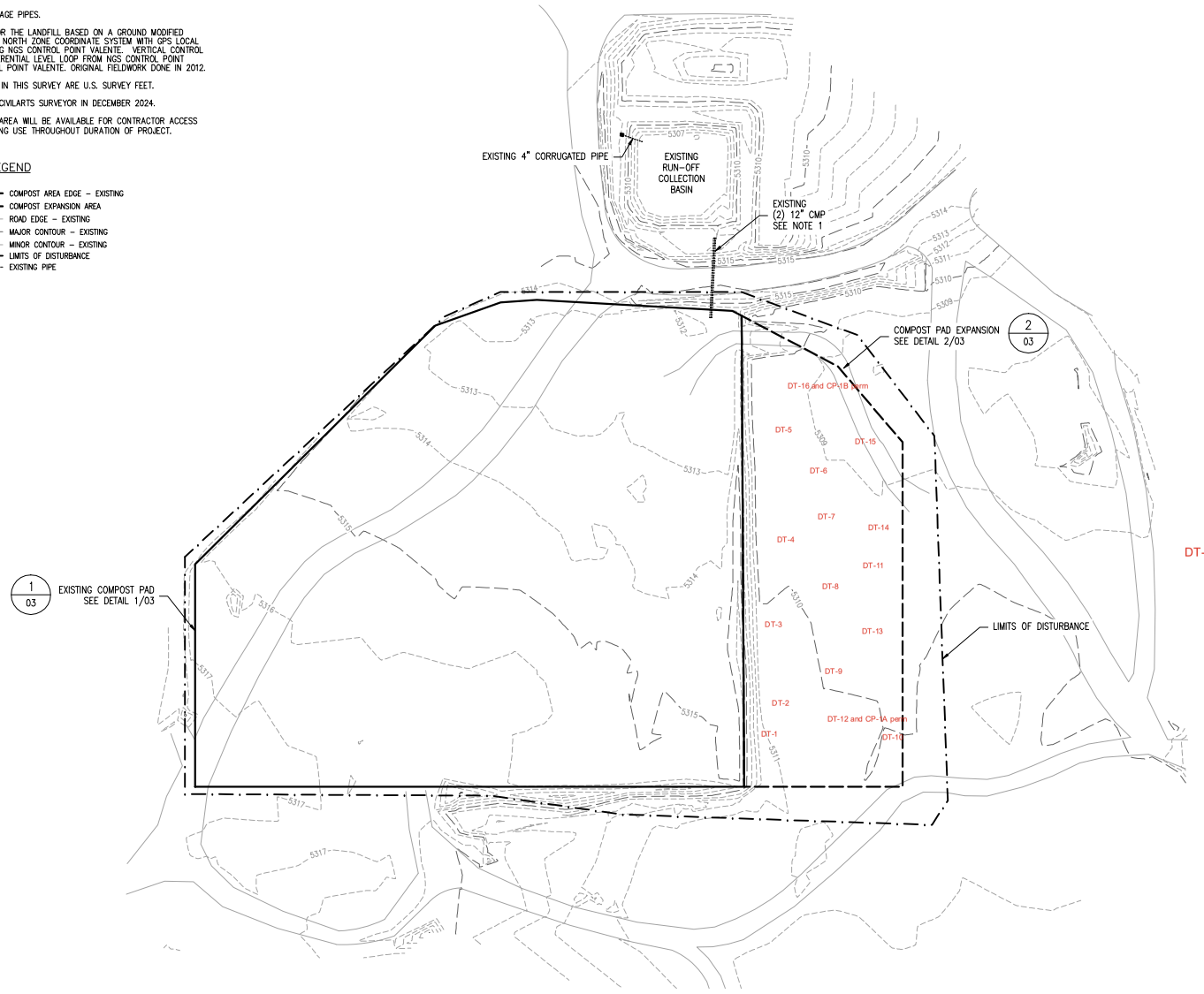
Geo-Logic ASSOCIATES

NOTES:

1. PROTECT EXISTING DRAINAGE PIPES.
2. HORIZONTAL CONTROL FOR THE LANDFILL BASED ON A GROUND MODIFIED COLORADO STATE PLANE NORTH ZONE COORDINATE SYSTEM WITH GPS LOCAL BASE STATION OCCUPYING NGS CONTROL POINT VALENTE. VERTICAL CONTROL NAVD88 BASED ON DIFFERENTIAL LEVEL LOOP FROM NGS CONTROL POINT BRYTEC TO NGS CONTROL POINT VALENTE. ORIGINAL FIELDWORK DONE IN 2012.
3. UNITS OF MEASUREMENT IN THIS SURVEY ARE U.S. SURVEY FEET.
4. SURVEY PERFORMED BY CIVILARTS SURVEYOR IN DECEMBER 2024.
5. EXISTING COMPOST PAD AREA WILL BE AVAILABLE FOR CONTRACTOR ACCESS AND STORAGE/STOCKPILING USE THROUGHOUT DURATION OF PROJECT.

LEGEND

- COMPOST AREA EDGE – EXISTING
- COMPOST EXPANSION AREA
- ROAD EDGE – EXISTING
- –100– MAJOR CONTOUR – EXISTING
- – – 99 – – – MINOR CONTOUR – EXISTING
- LIMITS OF DISTURBANCE
- EXISTING PIPE



DT-# - Moisture/Density and/or Permeability Location

0 50 100 200

SCALE: 1" = 50

ISSUE	DATE	DESCRIPTION
	5/8/2025	ISSUED FOR BID
0	1/16/2025	ISSUED FOR REVIEW

PROJECT MANAGER	SF
PROJECT ENGINEER	SF
DESIGNER	RS
PROJECT NUMBER	10279381

EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

COMPOST PAD EXPANSION

EXISTING CONDITIONS AND SITE PLAN

Test Location Map

FILENAME	00C-01	SHEET
SCALE	1" = 50'-0"	01

Appendix C.6

Permeability Test Results

Geo-Logic ASSOCIATES

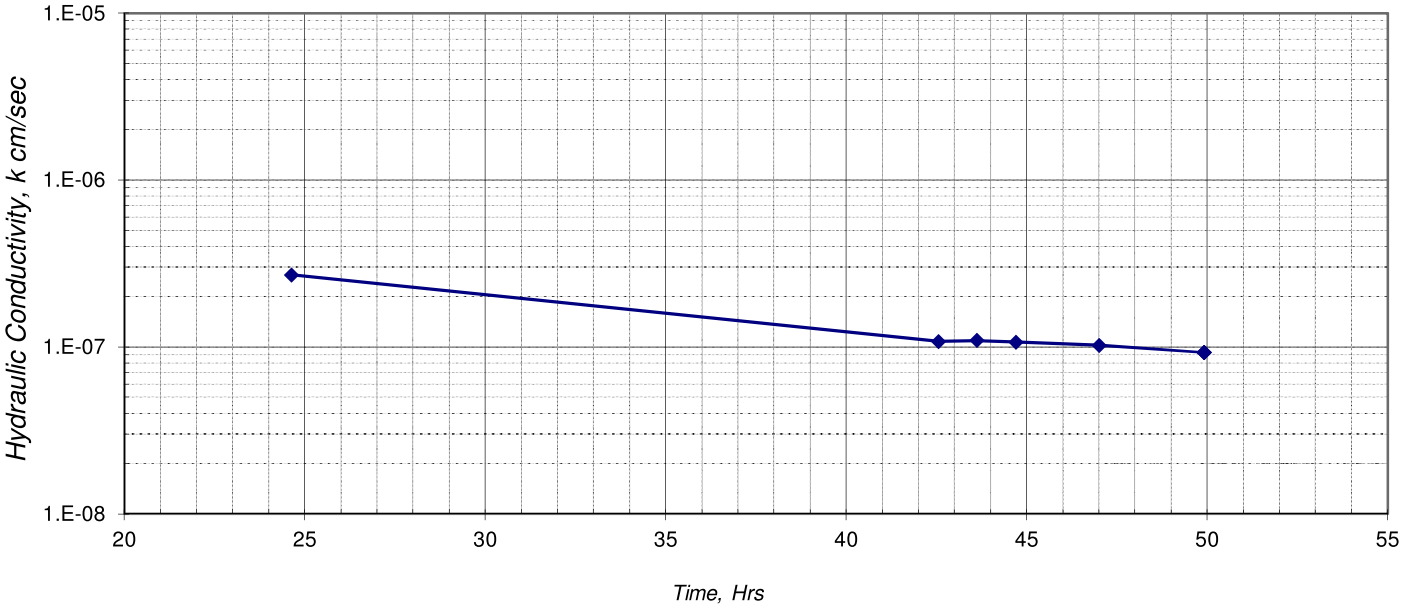
HYDRAULIC CONDUCTIVITY
REPORT

Geo-Logic ASSOCIATES

Client / Project Name:	Project No:	Lab Sample Number:
Republic Services, Inc. / East Regional LF Module 2, Cell 6	**AU25.1108.00**	**5325A**

Sample ID:	Description:	Report Date:
CP-1A	**dark brown lean clay**	**September 16, 2025**

Hydraulic Conductivity vs Time



SPECIMEN DATA

SAMPLE ID:	CP-1A	
DESCRIPTION:	dark brown lean clay	
	INITIAL	FINAL
HEIGHT, in.	3.7	3.7
DIAMETER, in.	2.4	2.4
WATER CONTENT, %	18.9	19.9
DRY DENSITY, pcf	104	108
SATURATION, %	82	95

(Specific Gravity assumed as 2.7)

COMMENTS:
Tap water used as permeant.

TEST DATA

ASTM D-5084, Method C

EFFECTIVE STRESS:	5 psi
GRADIENT RANGE:	9 - 12
IN / OUT RATIO:	1.00
"B" PARAMETER:	0.95

TRIAL nos.	TIME hrs.	HYDRAULIC CONDUCTIVITY, k^{20} cm / s
1	24.6	2.7E-07
2	42.6	1.1E-07
3	43.6	1.1E-07
4	44.7	1.1E-07
5	47.0	1.0E-07
6	49.9	9.2E-08

AVERAGE LAST 4 : **1.0E-07**

corrected to 20° C

This testing is based upon accepted industry practice as well as the test method listed. These results apply only to the samples supplied and tested for the above referenced job.

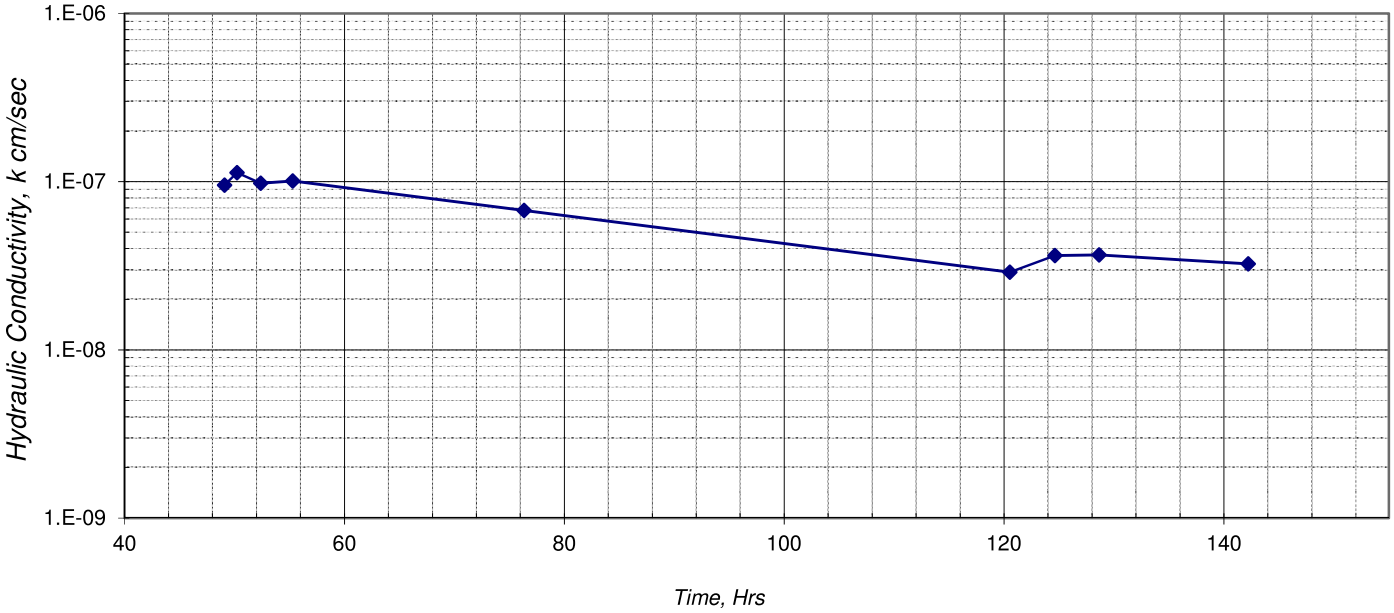
HYDRAULIC CONDUCTIVITY
REPORT

Geo-Logic ASSOCIATES

Client / Project Name:	Project No:	Lab Sample Number:
Republic Services, Inc. / East Regional LF Module 2, Cell 6	**AU25.1108.00**	**5325B**

Sample ID:	Description:	Report Date:
CP-1B	**dark brown lean clay**	**September 17, 2025**

Hydraulic Conductivity vs Time



SPECIMEN DATA

SAMPLE ID:	CP-1B	
DESCRIPTION:	dark brown lean clay	
	INITIAL	FINAL
HEIGHT, in.	3.9	3.8
DIAMETER, in.	2.4	2.4
WATER CONTENT, %	21.7	23.5
DRY DENSITY, pcf	99	101
SATURATION, %	84	95

(Specific Gravity assumed as 2.7)

COMMENTS:

Tap water used as permeant.

TEST DATA

ASTM D-5084, Method C

EFFECTIVE STRESS:	5 psi
GRADIENT RANGE:	9 - 12
IN / OUT RATIO:	0.99
"B" PARAMETER:	0.95

TRIAL nos.	TIME hrs.	HYDRAULIC CONDUCTIVITY, k^{20} cm / s
3	52.4	9.8E-08
4	55.3	1.0E-07
5	76.3	6.8E-08
6	120.5	2.9E-08
7	124.6	3.6E-08
8	128.7	3.7E-08
9	142.2	3.3E-08

AVERAGE LAST 4 : **3.4E-08**

corrected to 20° C

This testing is based upon accepted industry practice as well as the test method listed. These results apply only to the samples supplied and tested for the above referenced job.

Appendix D

Protective Cover Layer Data

Geo-Logic ASSOCIATES

Appendix D.1

Atterberg Limit Results

Geo-Logic ASSOCIATES

Geo-Logic ASSOCIATES

ATTERBERG LIMITS

Summary Report

ASTM D-4318

Client : Republic Services

Project No: AU25.1108

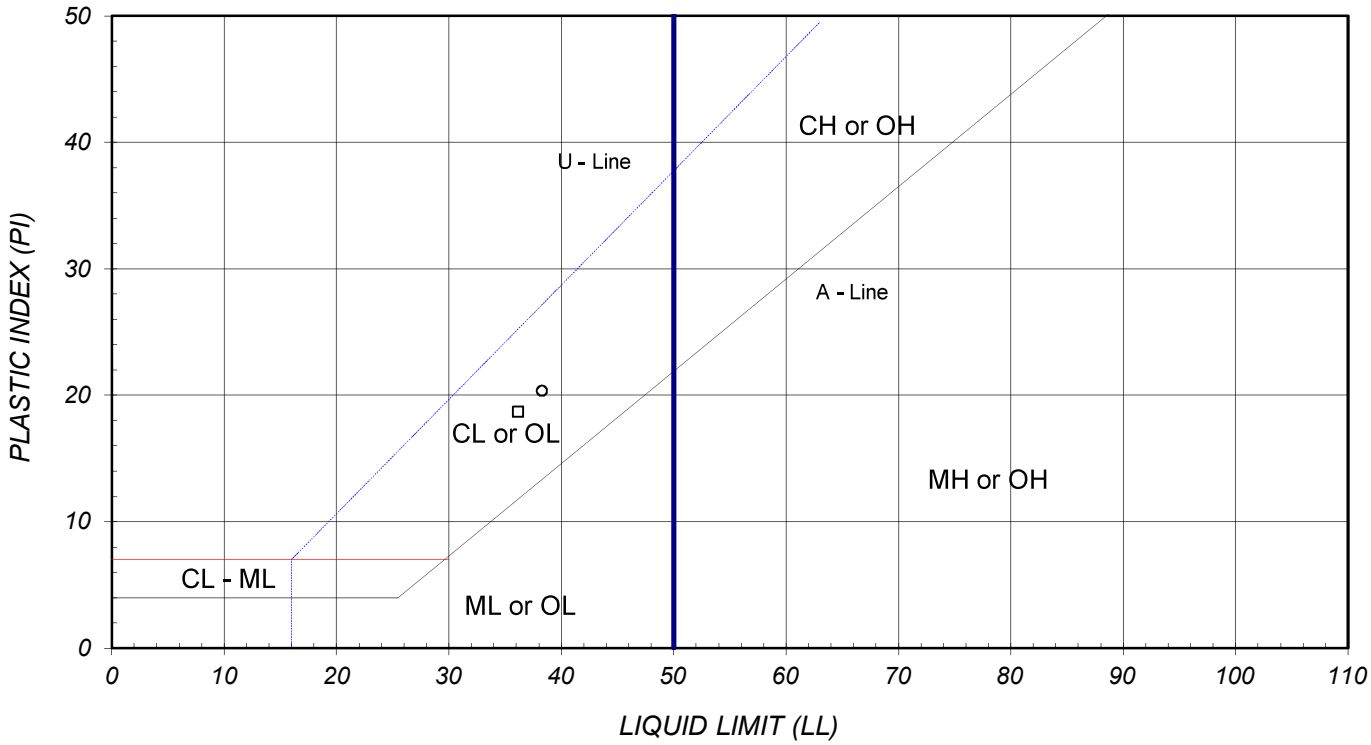
Lab Log No.:

Project Name: East Regional Compost Pad

Report Date: September 10, 2025

LSN	SYMBOL	SAMPLE IDENTIFICATION	SAMPLE DESCRIPTION	UNIFIED SYMBOL	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX
1	□	PC1	Brown sitly clay		36	18	19
2	○	PC2	Brown silty clay		38	18	20

PLASTICITY CHART



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Appendix D.2

Sieve Results

Geo-Logic ASSOCIATES

Geo-Logic ASSOCIATES

PARTICLE SIZE ANALYSIS

TEST REPORT

ASTM D-6913

Client : REPUBLIC SERVICES

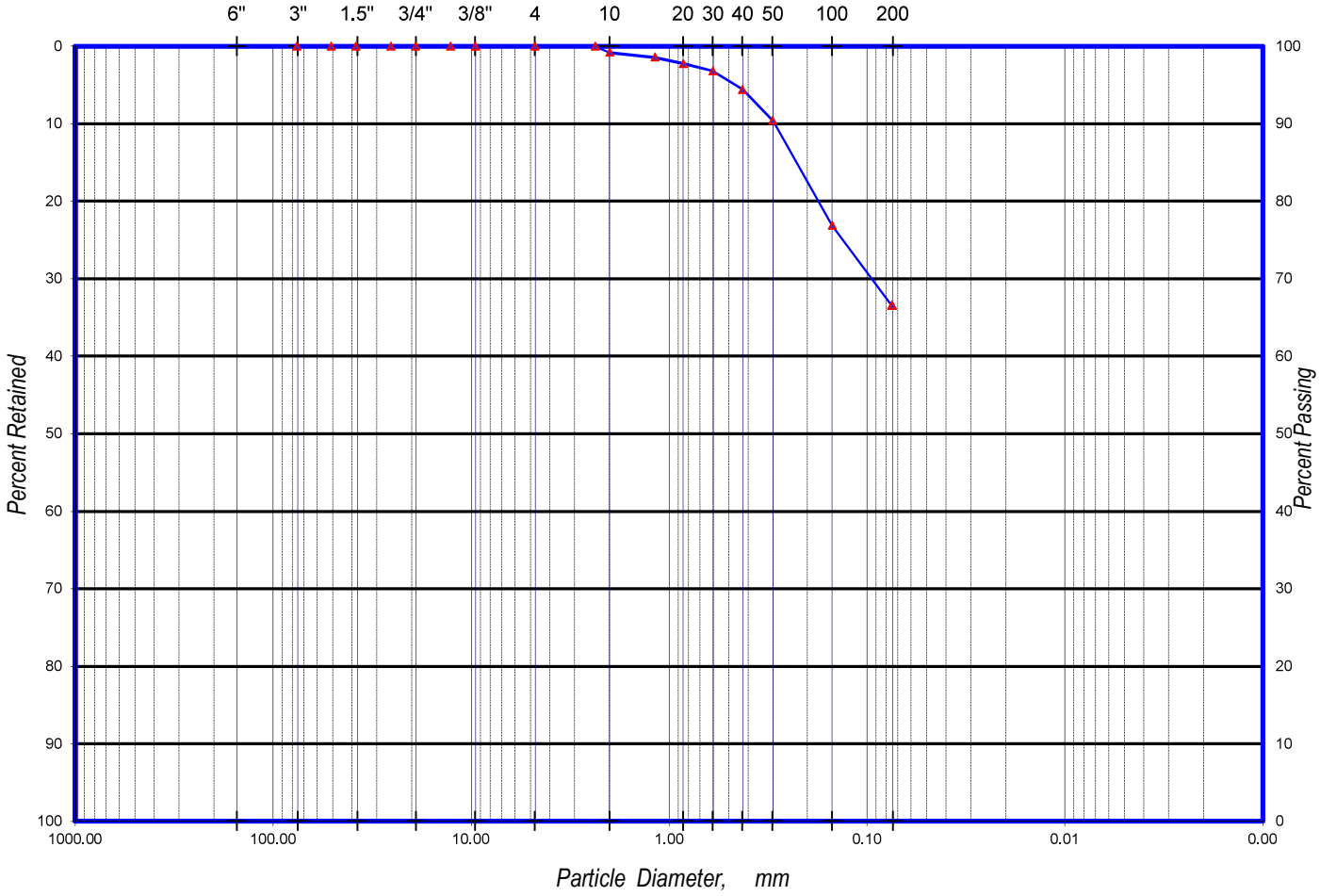
Project No: AU25.1108

Lab Sample No: PC1

Project Name: EAST REGIONAL LF COMPOST PAD

Report Date: September 10, 2025

BOLDERS	COBBLES	GRAVEL		SAND			SILT AND CLAY
		COARSE	FINE	COARSE	MEDIAN	FINE	
US SIEVE SIZE, INCHES				US STANDARD SIEVE SIZE No.			HYDROMETER



Symbol	Sample ID	Description	% Gravel	% Sand	% Silt - Clay
▲	PC1	Brown silty clay	0.0	33.5	66.5

Size Passing, mm D_{60} = N/A D_{30} = N/A D_{10} = N/A

Coefficient of Curvature, C_c: N/A Coefficient of Uniformity, C_u: N/A Fineness Modulus = 0.37

These results apply only to the above listed samples. The data and information are proprietary and can not be released without authorization of Vector Engineering Inc.
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Geo-Logic ASSOCIATES

PARTICLE SIZE ANALYSIS

TEST REPORT

ASTM D-6913

Client : REPUBLIC SERVICES

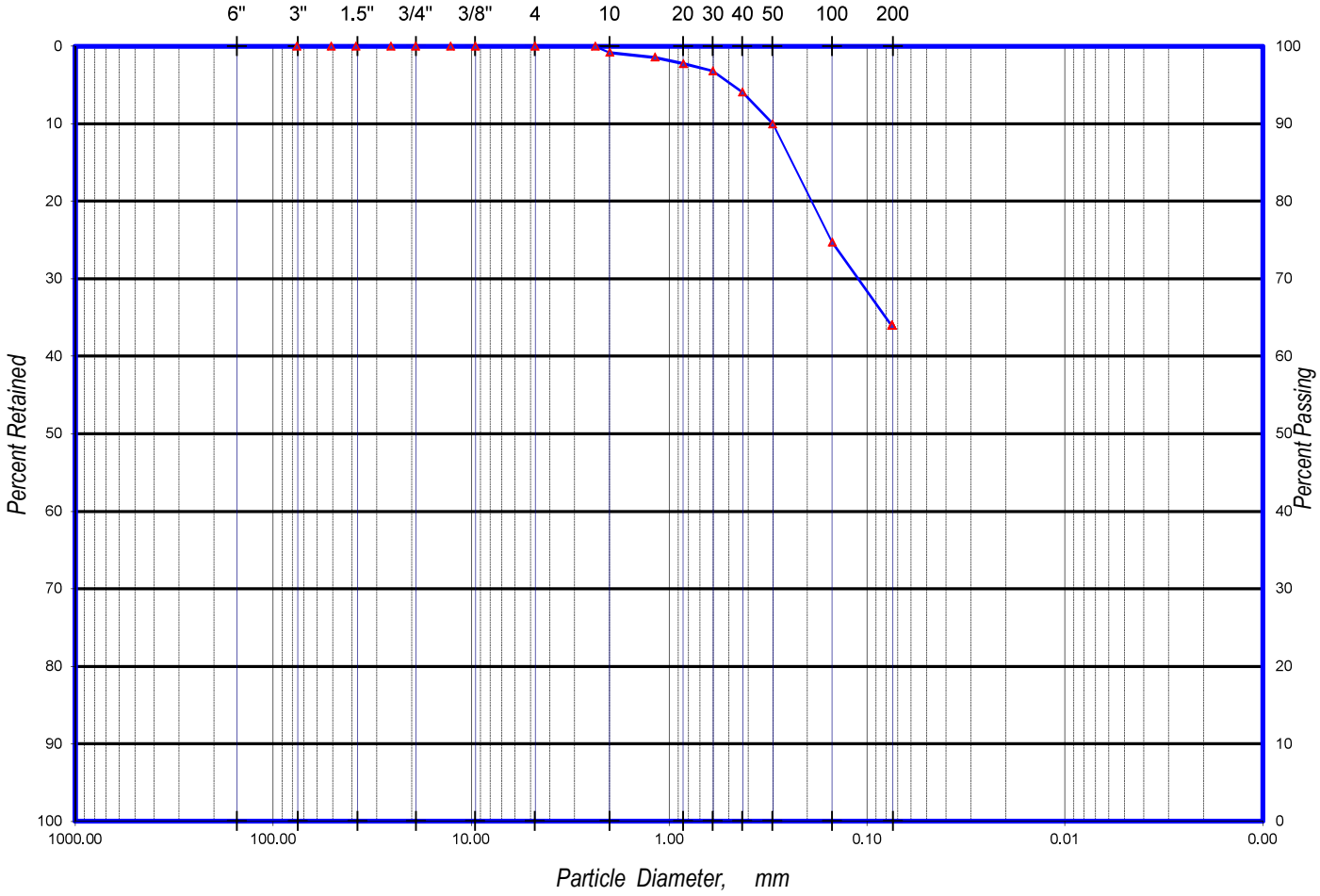
Project No: AU25.1108

Lab Sample No: PC2

Project Name: EAST REGIONAL LF COMPOST PAD

Report Date: September 10, 2025

BOLDERS	COBBLES	GRAVEL		SAND			SILT AND CLAY
		COARSE	FINE	COARSE	MEDIAN	FINE	
US SIEVE SIZE, INCHES				US STANDARD SIEVE SIZE No.			HYDROMETER



Symbol	Sample ID	Description	% Gravel	% Sand	% Silt - Clay
▲	PC2	Brown silty clay	0.0	36.1	63.9

Size Passing, mm D_{60} = N/A D_{30} = N/A D_{10} = N/A

Coefficient of Curvature, C_c: N/A Coefficient of Uniformity, C_u: N/A Fineness Modulus = 0.40

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Appendix D.3

Proctor Results

Geo-Logic ASSOCIATES

Geo-Logic ASSOCIATES

MOISTURE / DENSITY RELATIONSHIPS

TEST REPORT

ASTM D - 698

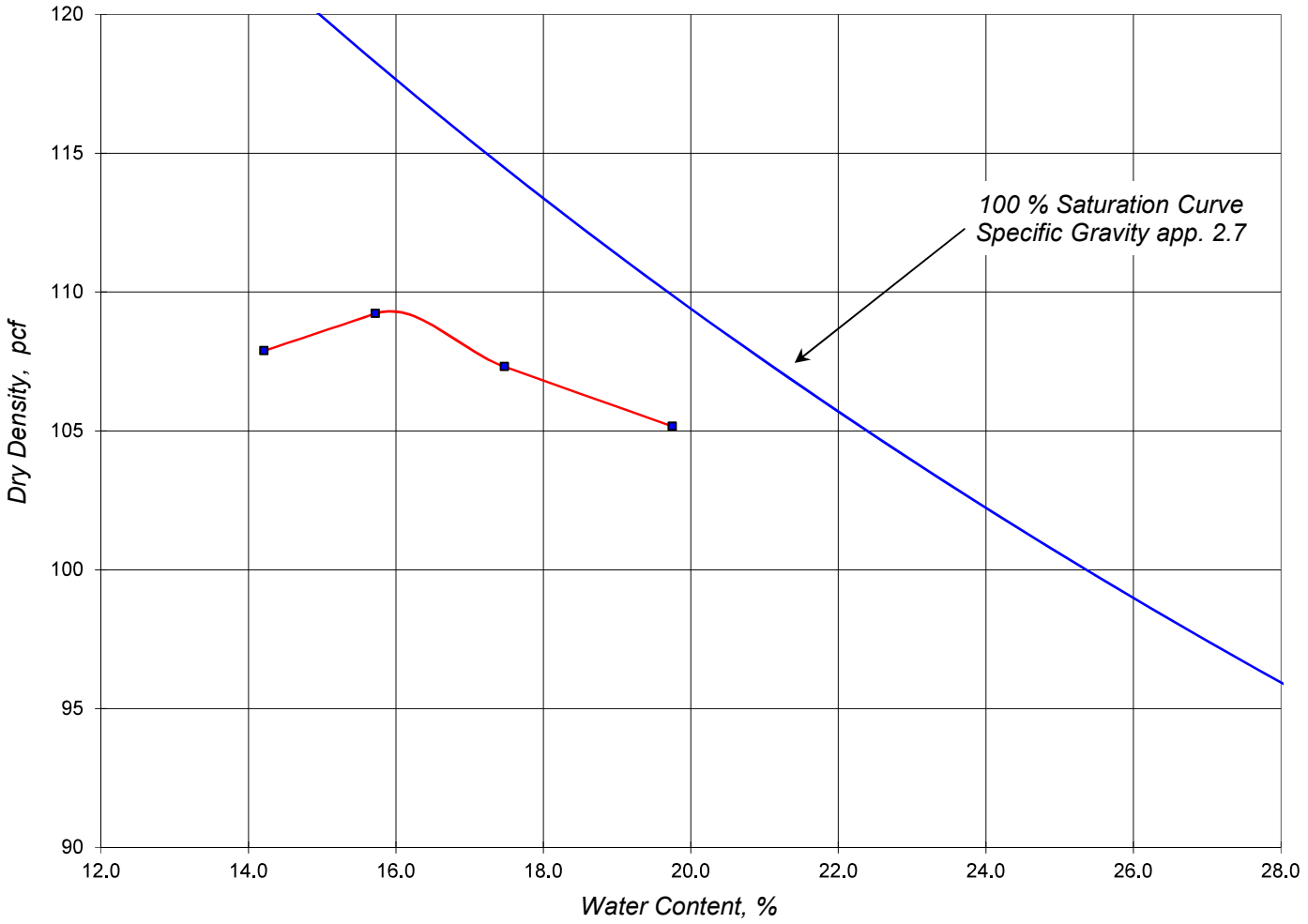
Client: Republic Services

Project No.: AU25.1108

Lab Log No.: PC-1

Project Name: East Regional LF

Report Date: September 10, 2025



Symbol	Lab No.	Sample Identification	Description	Maximum Dry Density pcf	Maximum Dry Density kg / m³	Optimum Water Content %
■	PC-1	PC 1	Light Brown Sily Clay	109.3	1.75	15.9

Corrected Values For Oversized Particles, per ASTM D-4718

■	PC-1	with	0	Percent + 3/4" Gravel, the maximum Dry Density	=	109.3	15.9

Note: The test was conducted as method A with 0 percent retained on the no. 4 sieve (minus 3/4")

These results apply only to the above listed samples. The data and information are proprietary and can not be released without authorization of Vector Engineering Inc.
By accepting the data and results represented on this page, client agrees to limit the liability of Vector Engineering, Inc. from Client and all other parties claims arising out of the use of this data to the cost for the respective test(s) represented here, and Client agrees to indemnify and hold harmless Vector from and against all liability in excess of the aforementioned limit.

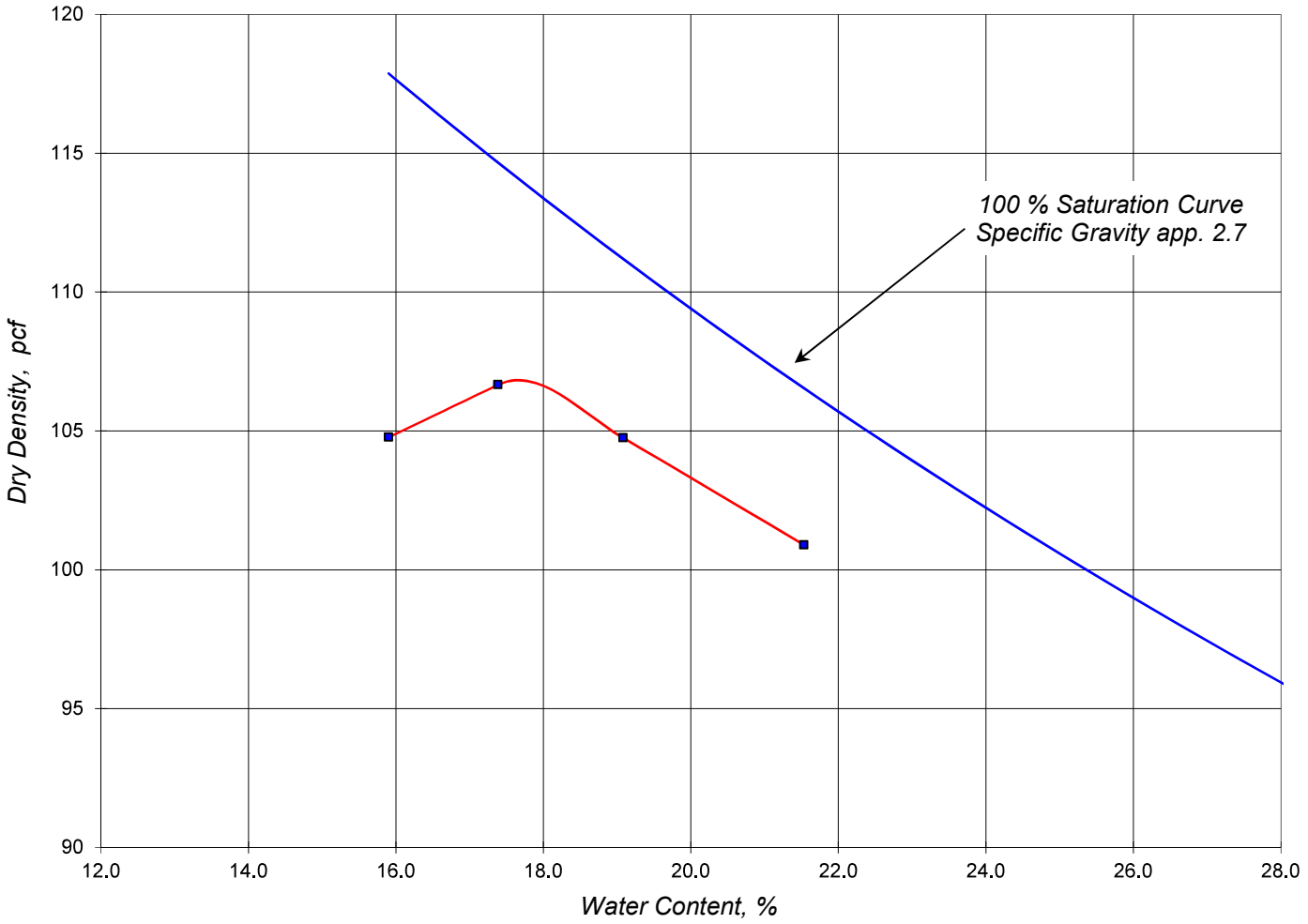
Geo-Logic ASSOCIATES

MOISTURE / DENSITY RELATIONSHIPS

TEST REPORT

ASTM D - 698

Client:	Project No.:	Lab Log No.:
Republic Services	AU25.1108	PC-2
Project Name:		**Report Date:**
East Regional LF		September 10, 2025



Symbol	Lab No.	Sample Identification	Description	Maximum Dry Density pcf	Maximum Dry Density kg / m³	Optimum Water Content %
■	PC-2	PC 2	Light Brown Sily Clay	106.8	1.71	17.7

Corrected Values For Oversized Particles, per ASTM D-4718

■	PC-2	with	0	Percent + 3/4" Gravel, the maximum Dry Density	=	106.8	17.7

Note: The test was conducted as method A with 0 percent retained on the no. 4 sieve (minus 3/4")

These results apply only to the above listed samples. The data and information are proprietary and can not be released without authorization of Vector Engineering Inc.
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Appendix D.4

Field Density/Moisture Test Summary Results

Geo-Logic ASSOCIATES

Geo-Logic ASSOCIATES

MOISTURE/DENSITY TESTING

Protective Cover

Project Name: East Regional Landfill Compost Pad Expansion

Project No: AU25.1108.00

Test No.	Date	Location	Lift #	Proctor Sample #	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Source Depth (in)	Wet Density (pcf)	Dry Density (pcf)	Moisture Content (%)	% Comp.	P/F	Notes
1	9/15/2025	Compost Pad	1	PC1	109.3	15.9	6	117.4	101.3	15.9	92.7%	P	spec 90% @ -5% to +5% omc
2	9/15/2025	Compost Pad	1	PC1	109.3	15.9	6	119.1	102.5	16.2	93.8%	P	
3	9/15/2025	Compost Pad	1	PC1	109.3	15.9	6	119.7	102.9	16.3	94.1%	P	
4	9/15/2025	Compost Pad	1	PC1	109.3	15.9	6	117.6	101.9	15.4	93.2%	P	
5	9/15/2025	Compost Pad	1	PC1	109.3	15.9	6	119.5	104.6	14.2	95.7%	P	
6	9/15/2025	Compost Pad	1	PC1	109.3	15.9	6	118.9	103.5	14.9	94.7%	P	
7	9/15/2025	Compost Pad	1	PC1	109.3	15.9	6	118.7	104.2	13.9	95.3%	P	

Appendix E

As-Built Surveys

Geo-Logic ASSOCIATES

Appendix E.1

Prepared Subgrade

Geo-Logic ASSOCIATES

Republic Services Landfill Subgrade Certification
Subgrade Exist to Subgrade Design (COMPOST)
Republic Services
Bennett, Colorado

9/6/2025

Matthew A Cordova
Professional Land Surveyor No. 33194
Cardinal Points Surveying, Inc

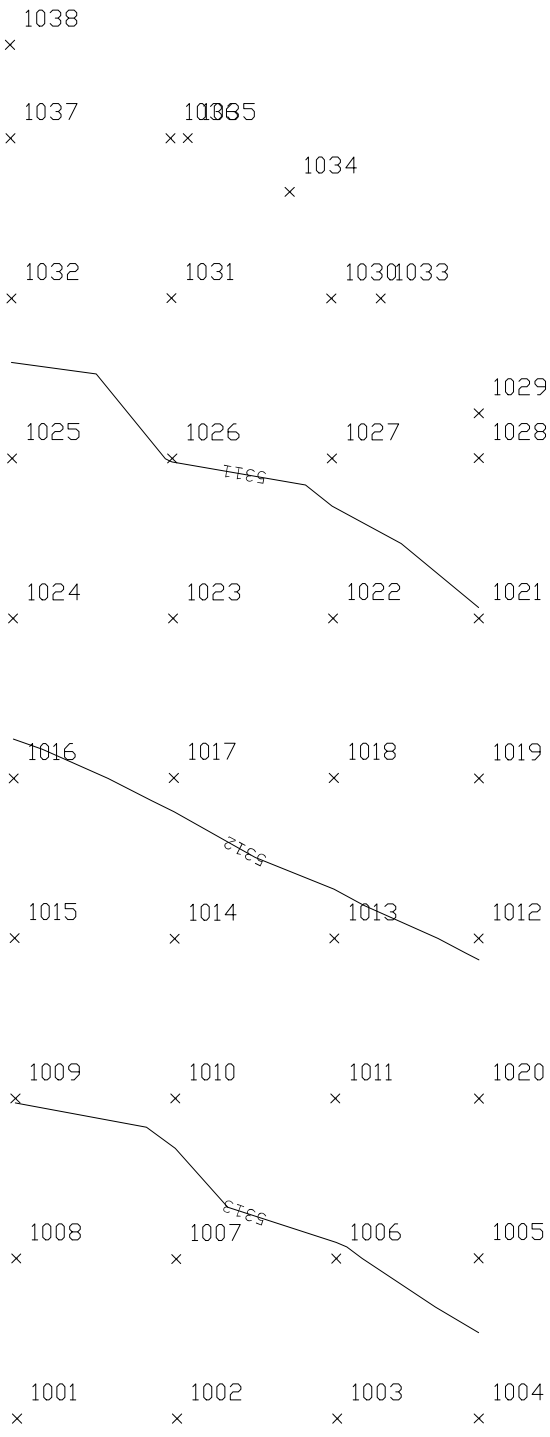
As Staked	Point No.	SUBGRADE DESIGN			ACTUAL SUBGRADE			Vertical		Horizontal		COMMENTS
		Northing	Easting	Subgrade	Northing	Easting	Elev	Vertical Accuracy	Within Tolerance?	Distance from Design	Within Tolerance?	
1001_ST	1001	1186549.53	3282511.59	5313.95	1186549.50	3282511.62	5313.90	0.05	OK	0.04	OK	EOL
1002_ST	1002	1186549.53	3282561.59	5313.73	1186549.45	3282561.56	5313.67	0.06	OK	0.09	OK	EOL
1003_ST	1003	1186549.53	3282611.64	5313.51	1186549.51	3282611.53	5313.51	-0.01	OK	0.10	OK	EOL
1004_ST	1004	1186549.57	3282655.89	5313.31	1186549.56	3282655.92	5313.26	0.05	OK	0.03	OK	EOL
1005_ST	1005	1186599.62	3282655.85	5312.86	1186599.59	3282655.78	5312.78	0.09	OK	0.08	OK	EOL
1006_ST	1006	1186599.54	3282611.32	5313.06	1186599.52	3282611.37	5313.05	0.01	OK	0.05	OK	Grid
1007_ST	1007	1186599.36	3282561.35	5313.28	1186599.35	3282561.35	5313.21	0.07	OK	0.01	OK	Grid
1008_ST	1008	1186599.55	3282511.34	5313.5	1186599.48	3282511.32	5313.43	0.07	OK	0.07	OK	Grid
1009_ST	1009	1186649.54	3282511.1	5313.05	1186649.49	3282511.09	5312.99	0.06	OK	0.05	OK	Grid
1010_ST	1010	1186649.54	3282561.01	5312.83	1186649.54	3282560.97	5312.91	-0.07	OK	0.04	OK	Grid
1011_ST	1011	1186649.54	3282611.06	5312.61	1186649.53	3282611.08	5312.55	0.06	OK	0.02	OK	Grid
1012_ST	1012	1186699.53	3282655.83	5311.97	1186699.53	3282655.89	5311.95	0.02	OK	0.06	OK	EOL
1013_ST	1013	1186699.54	3282610.74	5312.17	1186699.61	3282610.69	5312.14	0.02	OK	0.10	OK	Grid
1014_ST	1014	1186699.46	3282560.84	5312.39	1186699.46	3282560.82	5312.33	0.06	OK	0.03	OK	Grid
1015_ST	1015	1186699.65	3282510.83	5312.6	1186699.59	3282510.75	5312.53	0.07	OK	0.10	OK	Grid
1016_ST	1016	1186749.57	3282510.58	5312.16	1186749.55	3282510.54	5312.12	0.03	OK	0.04	OK	Grid
1017_ST	1017	1186749.7	3282560.59	5311.94	1186749.64	3282560.56	5311.91	0.02	OK	0.07	OK	Grid
1018_ST	1018	1186749.7	3282610.59	5311.72	1186749.71	3282610.58	5311.68	0.03	OK	0.02	OK	Grid

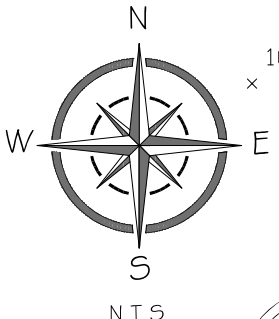
As Staked	Point No.	SUBGRADE DESIGN			ACTUAL SUBGRADE			Vertical		Horizontal		COMMENTS
		Northing	Easting	Subgrade	Northing	Easting	Elev	Vertical Accuracy	Within Tolerance?	Distance from Design	Within Tolerance?	
1019_ST	1019	1186749.53	3282655.91	5311.52	1186749.56	3282655.86	5311.46	0.06	OK	0.05	OK	EOL
1020_ST	1020	1186649.53	3282655.9	5312.42	1186649.41	3282655.91	5312.36	0.05	OK	0.12	OK	EOL
1021_ST	1021	1186799.57	3282655.89	5311.07	1186799.52	3282655.81	5311.02	0.05	OK	0.09	OK	EOL
1022_ST	1022	1186799.58	3282610.34	5311.27	1186799.53	3282610.31	5311.21	0.06	OK	0.05	OK	Grid
1023_ST	1023	1186799.51	3282560.34	5311.49	1186799.48	3282560.34	5311.44	0.05	OK	0.03	OK	Grid
1024_ST	1024	1186799.51	3282510.33	5311.71	1186799.46	3282510.29	5311.62	0.09	OK	0.06	OK	Grid
1025_ST	1025	1186849.56	3282510.08	5311.26	1186849.43	3282510.02	5311.21	0.05	OK	0.15	OK	Grid
1026_ST	1026	1186849.5	3282560.08	5311.05	1186849.47	3282560.06	5310.99	0.06	OK	0.04	OK	Grid
1027_ST	1027	1186849.54	3282609.99	5310.92	1186849.48	3282609.97	5310.91	0.01	OK	0.06	OK	Grid
1028_ST	1028	1186849.62	3282655.88	5310.82	1186849.58	3282655.92	5310.76	0.05	OK	0.06	OK	EOL
1029_ST	1029	1186863.63	3282655.89	5310.75	1186863.67	3282655.94	5310.72	0.03	OK	0.07	OK	EOL
1030_ST	1030	1186899.54	3282609.8	5310.68	1186899.43	3282609.84	5310.67	0.02	OK	0.11	OK	Grid
1031_ST	1031	1186899.61	3282559.83	5310.81	1186899.53	3282559.82	5310.82	-0.01	OK	0.08	OK	Grid
1032_ST	1032	1186899.55	3282509.82	5310.93	1186899.56	3282509.79	5310.86	0.07	OK	0.03	OK	Grid
1033_ST	1033	1186899.54	3282625.22	5310.83	1186899.61	3282625.21	5310.82	0.00	OK	0.08	OK	EOL
1034_ST	1034	1186932.85	3282596.8	5310.9	1186932.92	3282596.79	5310.82	0.08	OK	0.06	OK	EOL
1035_ST	1035	1186949.61	3282564.91	5310.89	1186949.59	3282564.93	5310.87	0.03	OK	0.02	OK	EOL
1036_ST	1036	1186949.56	3282559.56	5310.86	1186949.55	3282559.55	5310.84	0.01	OK	0.02	OK	Grid
1037_ST	1037	1186949.56	3282509.57	5310.68	1186949.51	3282509.54	5310.68	0.00	OK	0.05	OK	Grid
1038_ST	1038	1186978.77	3282509.42	5310.97	1186978.80	3282509.40	5310.96	0.01	OK	0.03	OK	EOL

SUBGRADE TOPOGRAPHY

East Regional Landfill, Compost Area

Bennett Colorado





N T S

PROJECT: 2025-229 WASTE CONNECTIONS DESCRIPTION: COMPOST AREA CERTIFICATION	
SHEET: 1 OF 1	JOB NUMBER: 2025-229 4X
DATE: 10/17/2025	FILE NAME:
SCALE: NTS	REF. JOB NO. 2025-229 4X

Cardinal Points
Surveying Inc.
(719) 253-0874 - (719) 253-0878 fax
4601 Eagleridge Place, Suite 110
Pueblo, Colorado 81008

Appendix E.2

Compacted Clay Layer

Geo-Logic ASSOCIATES

Republic Services Landfill Top of Clay Certification
Top of Clay Exist to Subgrade Exist (COMPOST)
Republic Services
Bennett, Colorado

9/12/2025

Matthew A Cordova
Professional Land Surveyor No. 33194
Cardinal Points Surveying, Inc

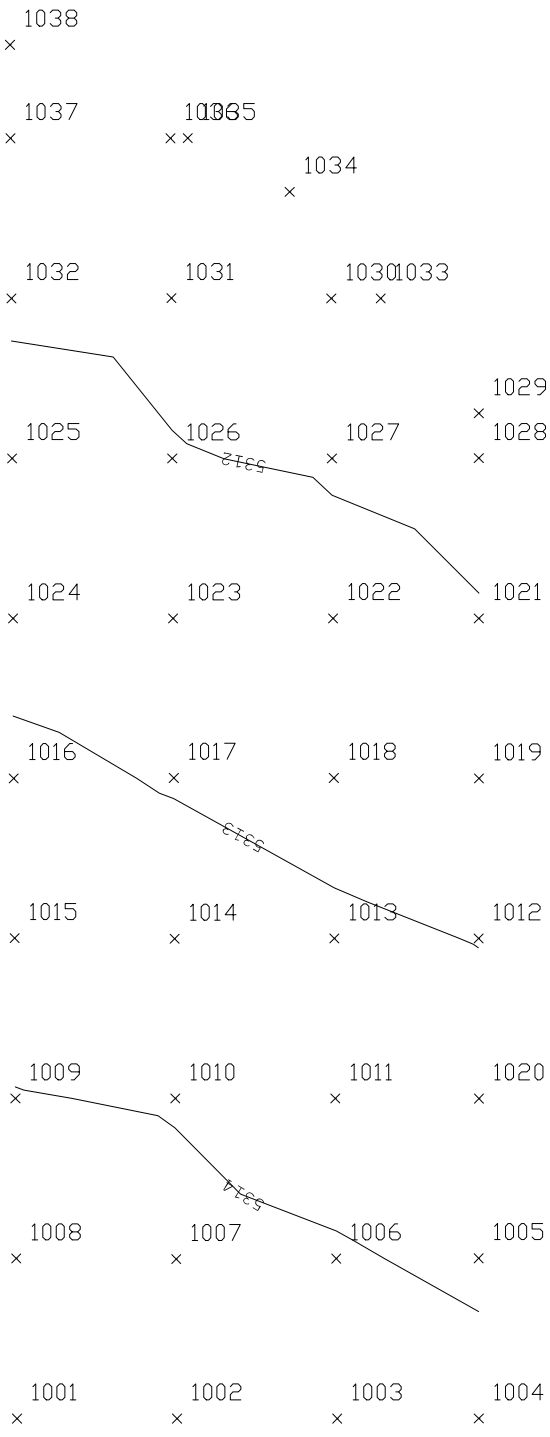
As Staked	Point No.	SUBGRADE EXISTING			TOP OF CLAY EXISTING			Vertical		Horizontal		COMMENTS
		Northing	Easting	Subgrade	Northing	Easting	Elev	Vertical Accuracy	Within Tolerance?	Distance from Design	Within Tolerance?	
1001_TC	1001	1186549.53	3282511.59	5313.9	1186549.55	3282511.61	5314.93	-1.03	OK	0.03	OK	EOL
1002_TC	1002	1186549.53	3282561.59	5313.67	1186549.41	3282561.54	5314.71	-1.04	OK	0.13	OK	EOL
1003_TC	1003	1186549.53	3282611.64	5313.51	1186549.42	3282611.55	5314.53	-1.01	OK	0.14	OK	EOL
1004_TC	1004	1186549.57	3282655.89	5313.26	1186549.56	3282655.88	5314.33	-1.07	OK	0.01	OK	EOL
1005_TC	1005	1186599.62	3282655.85	5312.78	1186599.67	3282655.77	5313.84	-1.06	OK	0.09	OK	EOL
1006_TC	1006	1186599.54	3282611.32	5313.05	1186599.47	3282611.34	5314.08	-1.03	OK	0.07	OK	Grid
1007_TC	1007	1186599.36	3282561.35	5313.21	1186599.33	3282561.31	5314.27	-1.06	OK	0.05	OK	Grid
1008_TC	1008	1186599.55	3282511.34	5313.43	1186599.45	3282511.32	5314.50	-1.06	OK	0.11	OK	Grid
1009_TC	1009	1186649.54	3282511.1	5312.99	1186649.55	3282511.12	5314.03	-1.05	OK	0.03	OK	Grid
1010_TC	1010	1186649.54	3282561.01	5312.91	1186649.47	3282560.86	5313.94	-1.04	OK	0.17	OK	Grid
1011_TC	1011	1186649.54	3282611.06	5312.55	1186649.56	3282611.10	5313.60	-1.05	OK	0.04	OK	Grid
1012_TC	1012	1186699.53	3282655.83	5311.95	1186699.54	3282655.71	5312.98	-1.03	OK	0.12	OK	EOL
1013_TC	1013	1186699.54	3282610.74	5312.14	1186699.59	3282610.77	5313.15	-1.01	OK	0.06	OK	Grid
1014_TC	1014	1186699.46	3282560.84	5312.33	1186699.54	3282560.84	5313.41	-1.08	OK	0.08	OK	Grid
1015_TC	1015	1186699.65	3282510.83	5312.53	1186699.57	3282510.78	5313.58	-1.05	OK	0.10	OK	Grid
1016_TC	1016	1186749.57	3282510.58	5312.12	1186749.60	3282510.48	5313.20	-1.07	OK	0.10	OK	Grid
1017_TC	1017	1186749.7	3282560.59	5311.91	1186749.55	3282560.55	5312.94	-1.03	OK	0.16	OK	Grid
1018_TC	1018	1186749.7	3282610.59	5311.68	1186749.79	3282610.58	5312.68	-1.00	OK	0.09	OK	Grid

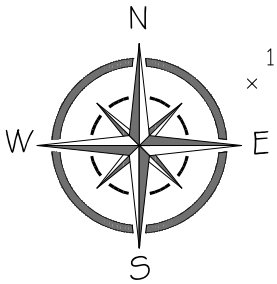
As Staked	Point No.	SUBGRADE EXISTING			TOP OF CLAY EXISTING			Vertical		Horizontal		COMMENTS
		Northing	Easting	Subgrade	Northing	Easting	Elev	Vertical Accuracy	Within Tolerance?	Distance from Design	Within Tolerance?	
1019_TC	1019	1186749.53	3282655.91	5311.46	1186749.63	3282655.83	5312.51	-1.05	OK	0.12	OK	EOL
1020_TC	1020	1186649.53	3282655.9	5312.36	1186649.54	3282655.77	5313.37	-1.01	OK	0.12	OK	EOL
1021_TC	1021	1186799.57	3282655.89	5311.02	1186799.62	3282655.89	5312.03	-1.02	OK	0.06	OK	EOL
1022_TC	1022	1186799.58	3282610.34	5311.21	1186799.52	3282610.18	5312.23	-1.02	OK	0.17	OK	Grid
1023_TC	1023	1186799.51	3282560.34	5311.44	1186799.53	3282560.30	5312.51	-1.07	OK	0.04	OK	Grid
1024_TC	1024	1186799.51	3282510.33	5311.62	1186799.42	3282510.26	5312.70	-1.07	OK	0.12	OK	Grid
1025_TC	1025	1186849.56	3282510.08	5311.21	1186849.56	3282510.03	5312.27	-1.06	OK	0.06	OK	Grid
1026_TC	1026	1186849.5	3282560.08	5310.99	1186849.46	3282560.04	5312.03	-1.04	OK	0.06	OK	Grid
1027_TC	1027	1186849.54	3282609.99	5310.91	1186849.49	3282609.93	5311.93	-1.02	OK	0.07	OK	Grid
1028_TC	1028	1186849.62	3282655.88	5310.76	1186849.46	3282655.90	5311.82	-1.06	OK	0.16	OK	EOL
1029_TC	1029	1186863.63	3282655.89	5310.72	1186863.72	3282655.88	5311.76	-1.05	OK	0.09	OK	EOL
1030_TC	1030	1186899.54	3282609.8	5310.67	1186899.49	3282609.84	5311.68	-1.01	OK	0.06	OK	Grid
1031_TC	1031	1186899.61	3282559.83	5310.82	1186899.50	3282559.92	5311.85	-1.03	OK	0.14	OK	Grid
1032_TC	1032	1186899.55	3282509.82	5310.86	1186899.58	3282509.74	5311.90	-1.04	OK	0.09	OK	Grid
1033_TC	1033	1186899.54	3282625.22	5310.82	1186899.65	3282625.26	5311.87	-1.05	OK	0.12	OK	EOL
1034_TC	1034	1186932.85	3282596.8	5310.82	1186932.97	3282596.71	5311.89	-1.07	OK	0.14	OK	EOL
1035_TC	1035	1186949.61	3282564.91	5310.87	1186949.62	3282564.98	5311.92	-1.05	OK	0.07	OK	EOL
1036_TC	1036	1186949.56	3282559.56	5310.84	1186949.55	3282559.51	5311.91	-1.06	OK	0.06	OK	Grid
1037_TC	1037	1186949.56	3282509.57	5310.68	1186949.44	3282509.52	5311.70	-1.02	OK	0.13	OK	Grid
1038_TC	1038	1186978.77	3282509.42	5310.96	1186978.69	3282509.28	5311.99	-1.03	OK	0.16	OK	EOL

TOP OF CLAY TOPOGRAPHY

East Regional Landfill, Compost Area

Bennett Colorado





1" = 60'

PROJECT: 2025-229 WASTE CONNECTIONS DESCRIPTION: COMPOST AREA CERTIFICATION	
SHEET: 1 OF 1	JOB NUMBER: 2025-229 4X
DATE: 10/17/2025	FILE NAME:
SCALE: NTS	REF. JOB NO. 2025-229 4X

Cardinal Points
Surveying Inc.
(719) 253-0874 - (719) 253-0878 fax
4601 Eaglerdge Place, Suite 110
Pueblo, Colorado 81008

Appendix E.3

Protective Cover Layer

Geo-Logic ASSOCIATES

Republic Services Landfill Top of Clay Certification

Top of Ops Final to Top of Clay (COMPOST)

Republic Services

Bennett, Colorado

10/16/2025

Matthew A Cordova
Professional Land Surveyor No. 33194
Cardinal Points Surveying, Inc

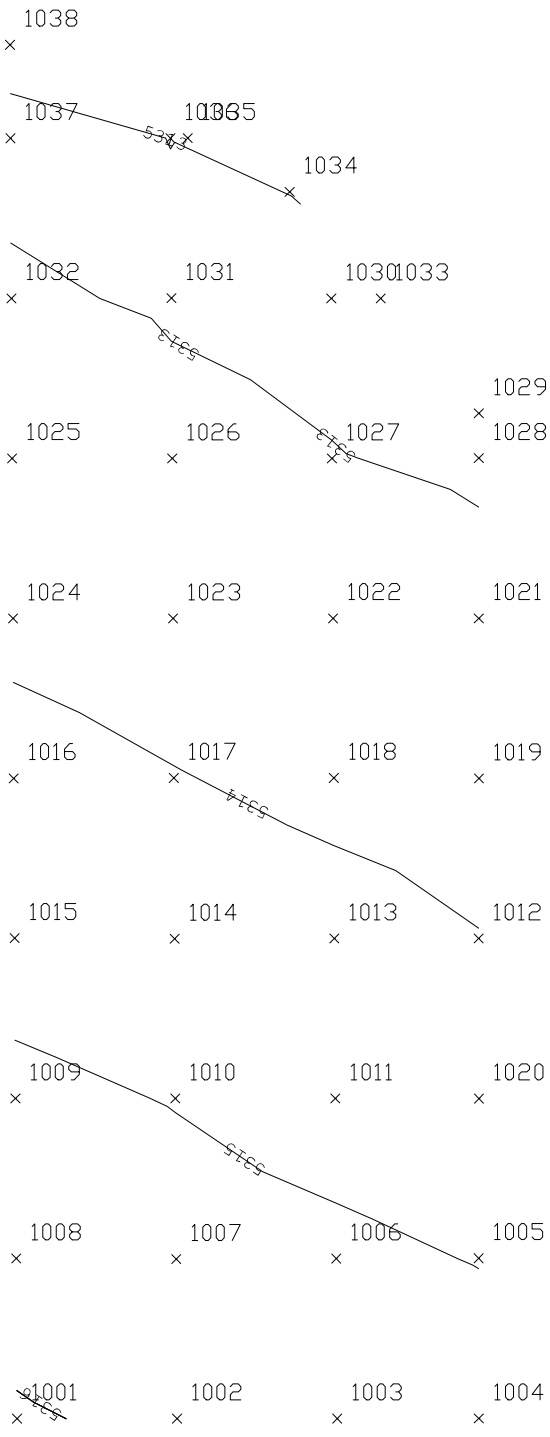
As Staked	Point No.	TOP OF CLAY EXISTING			TOP OF OPS FINAL			Vertical		Horizontal		COMMENTS
		Northing	Easting	Subgrade	Northing	Easting	Elev	Vertical Accuracy	Within Tolerance?	Distance from Design	Within Tolerance?	
2001_ops	1001	1186549.53	3282511.59	5314.93	1186549.52	3282511.60	5316.08	-1.15	OK	0.02	OK	EOL
2002_ops	1002	1186549.53	3282561.59	5314.71	1186549.52	3282561.62	5315.83	-1.12	OK	0.03	OK	EOL
2003_ops	1003	1186549.53	3282611.64	5314.53	1186549.55	3282611.60	5315.63	-1.10	OK	0.04	OK	EOL
2004_ops	1004	1186549.57	3282655.89	5314.33	1186549.54	3282655.86	5315.40	-1.08	OK	0.05	OK	EOL
2005_ops	1005	1186599.62	3282655.85	5313.84	1186599.63	3282655.86	5314.97	-1.13	OK	0.01	OK	EOL
2006_ops	1006	1186599.54	3282611.32	5314.08	1186599.54	3282611.35	5315.16	-1.07	OK	0.03	OK	Grid
2007_ops	1007	1186599.36	3282561.35	5314.27	1186599.36	3282561.33	5315.35	-1.08	OK	0.03	OK	Grid
2008_ops	1008	1186599.55	3282511.34	5314.5	1186599.55	3282511.37	5315.64	-1.15	OK	0.03	OK	Grid
2009_ops	1009	1186649.54	3282511.1	5314.03	1186649.52	3282511.13	5315.18	-1.15	OK	0.04	OK	Grid
2010_ops	1010	1186649.54	3282561.01	5313.94	1186649.56	3282561.03	5314.97	-1.03	OK	0.03	OK	Grid
2011_ops	1011	1186649.54	3282611.06	5313.6	1186649.51	3282611.04	5314.71	-1.10	OK	0.03	OK	Grid
2012_ops	1012	1186699.53	3282655.83	5312.98	1186699.53	3282655.82	5314.03	-1.05	OK	0.01	OK	EOL
2013_ops	1013	1186699.54	3282610.74	5313.15	1186699.53	3282610.68	5314.28	-1.13	OK	0.06	OK	Grid
2014_ops	1014	1186699.46	3282560.84	5313.41	1186699.44	3282560.76	5314.48	-1.08	OK	0.09	OK	Grid
2015_ops	1015	1186699.65	3282510.83	5313.58	1186699.59	3282510.79	5314.69	-1.11	OK	0.07	OK	Grid
2016_ops	1016	1186749.57	3282510.58	5313.2	1186749.64	3282510.62	5314.28	-1.08	OK	0.08	OK	Grid
2017_ops	1017	1186749.7	3282560.59	5312.94	1186749.73	3282560.55	5314.03	-1.09	OK	0.05	OK	Grid
2018_ops	1018	1186749.7	3282610.59	5312.68	1186749.71	3282610.60	5313.80	-1.12	OK	0.01	OK	Grid

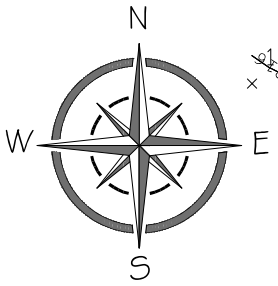
As Staked	Point No.	TOP OF CLAY EXISTING			TOP OF OPS FINAL			Vertical		Horizontal		COMMENTS
		Northing	Easting	Subgrade	Northing	Easting	Elev	Vertical Accuracy	Within Tolerance?	Distance from Design	Within Tolerance?	
2019_ops	1019	1186749.53	3282655.91	5312.51	1186749.48	3282655.90	5313.63	-1.12	OK	0.05	OK	EOL
2020_ops	1020	1186649.53	3282655.9	5313.37	1186649.54	3282655.95	5314.53	-1.16	OK	0.06	OK	EOL
2021_ops	1021	1186799.57	3282655.89	5312.03	1186799.57	3282655.86	5313.20	-1.17	OK	0.03	OK	EOL
2022_ops	1022	1186799.58	3282610.34	5312.23	1186799.49	3282610.33	5313.37	-1.14	OK	0.08	OK	Grid
2023_ops	1023	1186799.51	3282560.34	5312.51	1186799.50	3282560.39	5313.60	-1.09	OK	0.06	OK	Grid
2024_ops	1024	1186799.51	3282510.33	5312.7	1186799.52	3282510.27	5313.81	-1.12	OK	0.06	OK	Grid
2025_ops	1025	1186849.56	3282510.08	5312.27	1186849.54	3282510.03	5313.37	-1.10	OK	0.05	OK	Grid
2026_ops	1026	1186849.5	3282560.08	5312.03	1186849.46	3282560.01	5313.15	-1.11	OK	0.09	OK	Grid
2027_ops	1027	1186849.54	3282609.99	5311.93	1186849.62	3282609.98	5313.02	-1.09	OK	0.08	OK	Grid
2028_ops	1028	1186849.62	3282655.88	5311.82	1186849.52	3282655.83	5312.91	-1.09	OK	0.11	OK	EOL
2029_ops	1029	1186863.63	3282655.89	5311.76	1186863.73	3282655.94	5312.83	-1.06	OK	0.11	OK	EOL
2030_ops	1030	1186899.54	3282609.8	5311.68	1186899.50	3282609.78	5312.85	-1.17	OK	0.04	OK	Grid
2031_ops	1031	1186899.61	3282559.83	5311.85	1186899.58	3282559.80	5312.95	-1.10	OK	0.04	OK	Grid
2032_ops	1032	1186899.55	3282509.82	5311.9	1186899.46	3282509.76	5313.07	-1.16	OK	0.11	OK	Grid
2033_ops	1033	1186899.54	3282625.22	5311.87	1186899.60	3282625.22	5312.95	-1.08	OK	0.07	OK	EOL
2034_ops	1034	1186932.85	3282596.8	5311.89	1186932.88	3282596.82	5313.01	-1.12	OK	0.04	OK	EOL
2035_ops	1035	1186949.61	3282564.91	5311.92	1186949.53	3282564.89	5313.02	-1.10	OK	0.08	OK	EOL
2036_ops	1036	1186949.56	3282559.56	5311.91	1186949.58	3282559.56	5313.00	-1.10	OK	0.02	OK	Grid
2037_ops	1037	1186949.56	3282509.57	5311.7	1186949.54	3282509.59	5312.88	-1.18	OK	0.03	OK	Grid
2038_ops	1038	1186978.77	3282509.42	5311.99	1186978.72	3282509.48	5313.14	-1.15	OK	0.08	OK	EOL

TOP OF OPS TOPOGRAPHY

East Regional Landfill, Compost Area

Bennett Colorado

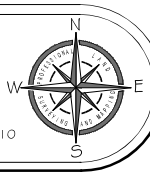




1" = 60'

PROJECT: 2025-229 WASTE CONNECTIONS DESCRIPTION: COMPOST AREA CERTIFICATION	
SHEET: 1 OF 1	JOB NUMBER: 2025-229 4X
DATE: 10/17/2025	FILE NAME:
SCALE: NTS	REF. JOB NO. 2025-229 4X

Cardinal Points
Surveying Inc.
(719) 253-0874 - (719) 253-0878 fax
4601 Eaglerdge Place, Suite 110
Pueblo, Colorado 81008



Appendix F

Construction Drawings

Geo-Logic ASSOCIATES

HDR ENGINEERING, INC.
1670 BROADWAY, SUITE 3400
DENVER, COLORADO 80202
919-376-7777

REPUBLIC SERVICES

VICINITY MAP

1000 0 1000 2000
SCALE IN FEET

N

Conformed Drawings For:

East Regional Landfill

Compost Pad Expansion

Project No.
10418951

Adams County, Colorado
May 2025
Issued for Bid

INDEX OF DRAWINGS

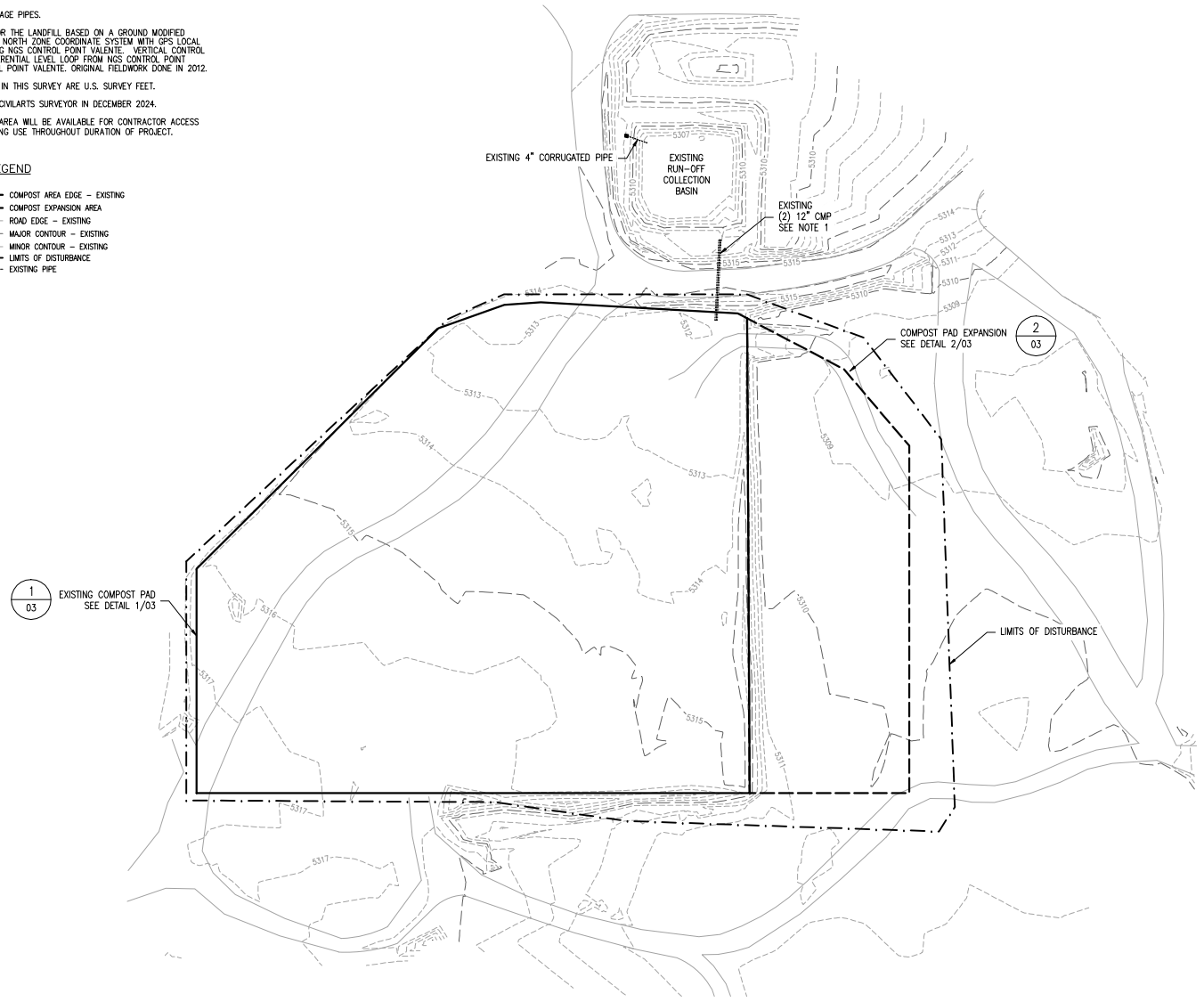
00C-00 COVER SHEET AND DRAWING INDEX
00C-01 EXISTING CONDITIONS AND SITE PLAN
00C-02 COMPOST AREA EXPANSION GRADING PLAN
00C-03 COMPOST AREA EXPANSION SECTIONS AND DETAILS

NOTES:

1. PROTECT EXISTING DRAINAGE PIPES.
2. HORIZONTAL CONTROL FOR THE LANDFILL BASED ON A GROUND MODIFIED COLORADO STATE PLANE NORTH ZONE COORDINATE SYSTEM WITH GPS LOCAL BASE STATION OCCUPYING NGS CONTROL POINT VALENTE. VERTICAL CONTROL NAVD88 BASED ON DIFFERENTIAL LEVEL LOOP FROM NGS CONTROL POINT BRYTEC TO NGS CONTROL POINT VALENTE. ORIGINAL FIELDWORK DONE IN 2012.
3. UNITS OF MEASUREMENT IN THIS SURVEY ARE U.S. SURVEY FEET.
4. SURVEY PERFORMED BY CIVILARTS SURVEYOR IN DECEMBER 2024.
5. EXISTING COMPOST PAD AREA WILL BE AVAILABLE FOR CONTRACTOR ACCESS AND STORAGE/STOCKPILING USE THROUGHOUT DURATION OF PROJECT.

LEGEND

- COMPOST AREA EDGE – EXISTING
- COMPOST EXPANSION AREA
- ROAD EDGE – EXISTING
- –100– MAJOR CONTOUR – EXISTING
- – – 99 – – – MINOR CONTOUR – EXISTING
- LIMITS OF DISTURBANCE
- EXISTING PIPE



ISSUE	DATE	DESCRIPTION
	5/8/2025	ISSUED FOR BID
0	1/16/2025	ISSUED FOR REVIEW

PROJECT MANAGER	SF
PROJECT ENGINEER	SF
DESIGNER	RS
PROJECT NUMBER	10279381

EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

COMPOST PAD EXPANSION

EXISTING CONDITIONS AND SITE PLAN

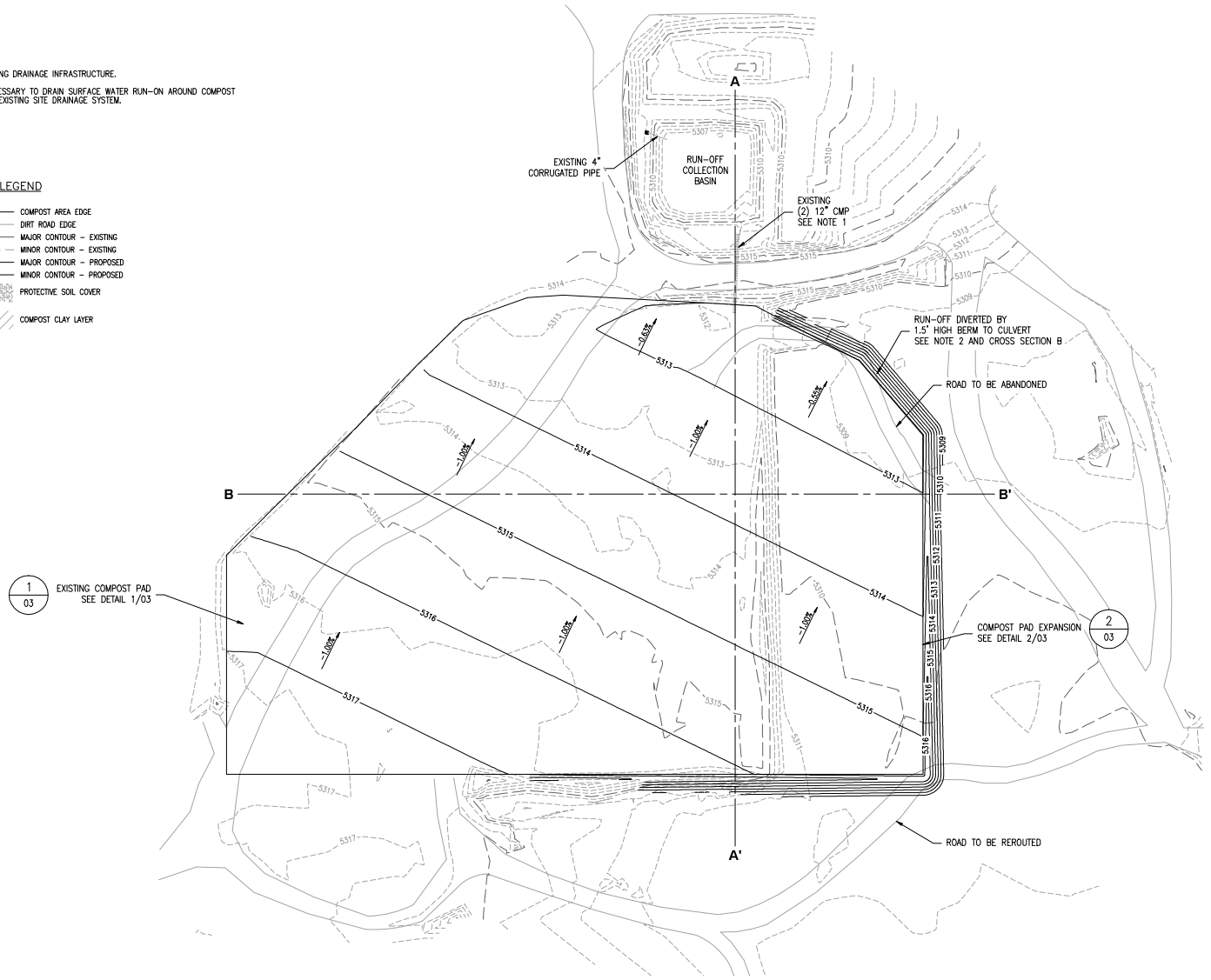
FILENAME	00C-01
SCALE	1" = 50'-0"
SHEET	01

NOTES:

1. PROTECT EXISTING DRAINAGE INFRASTRUCTURE.
2. GRADE AS NECESSARY TO DRAIN SURFACE WATER RUN-ON AROUND COMPOST AREA TO PRE-EXISTING SITE DRAINAGE SYSTEM.

LEGEND

- COMPOST AREA EDGE
- DIRT ROAD EDGE
- MAJOR CONTOUR - EXISTING
- MINOR CONTOUR - EXISTING
- MAJOR CONTOUR - PROPOSED
- MINOR CONTOUR - PROPOSED
- PROTECTIVE SOIL COVER
- COMPOST CLAY LAYER



EARTHWORK ESTIMATES (IN PLACE)	
Subgrade Fill [CY]	4215
Subgrade Cut [CY]	497
Clay Liner [CY] (FILL)	2200
Protective Soil [CY] (FILL)	10700

0 50 100 200

SCALE: 1" = 50

ISSUE	DATE	DESCRIPTION
	5/8/2025	ISSUED FOR BID
0	1/16/2025	ISSUED FOR REVIEW

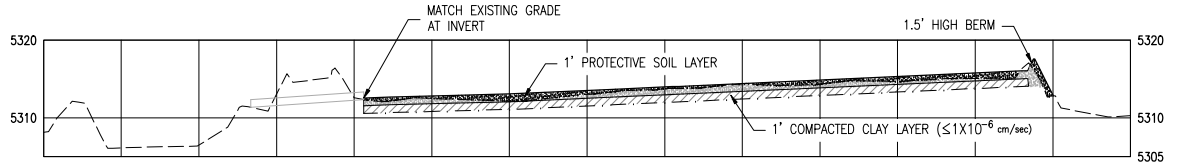
PROJECT MANAGER	SF
PROJECT ENGINEER	SF
DESIGNER	RS
PROJECT NUMBER	10279381

EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

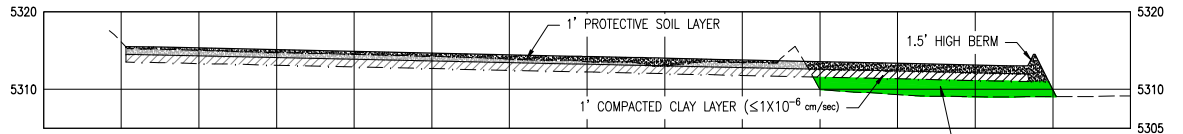
COMPOST PAD EXPANSION

COMPOST PAD EXPANSION
GRADING PLAN

FILENAME	00C-02	SHEET
SCALE	1" = 50'-0"	02



CROSS SECTION A–A'
Horizontal Scale: 1" = 40'
Vertical Scale: 1" = 8'



CROSS SECTION B–B'
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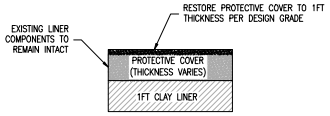
Vertical Scale: 1" = 4'



1/02 EXISTING COMPOST PAD PROTECTIVE COVER RESTORATION DETAIL

2/02 COMPOST PAD LINER EXPANSION DETAIL

NOTES:
1. AT THE TIE-IN SURFACE TO EXISTING PAD, SCARIFY AT ANGLE AND REWORK.

0 50 100 200
SCALE: 1" = 50

ISSUE	DATE	DESCRIPTION
	5/8/2025	ISSUED FOR BID
0	1/16/2025	ISSUED FOR REVIEW

PROJECT MANAGER	SF
PROJECT ENGINEER	SF
DESIGNER	RS
PROJECT NUMBER	10279381

EAST REGIONAL LANDFILL
ADAMS COUNTY, COLORADO

COMPOST PAD EXPANSION

COMPOST PAD EXPANSION
SECTIONS AND DETAILS

FILENAME	00C-03	SHEET
SCALE	AS NOTED	03

APPENDIX F

EMPLOYEE TRAINING FORM

East Regional Landfill
Composting Engineering Design and Operations Plan (EDOP)
Employee Training Record Form

This record should be retained with the EDOP document for a period of at least three (3) years.

Annual Training and Plan Review		
Date of Training:		Person Conducting Training:
Employees or Contractors Receiving Training		
Name		**Signature**

ATTACHMENT G

3D Renderings

500' 0' 250' 500' 1000'

NOTES

1. REFERENCE AERIAL TOPOGRAPHY BASED ON OCTOBER 10, 2023 AND JANUARY 16, 2024 AERIAL SURVEY PERFORMED BY FIRMATEK.

This drawing has not been published but rather has been prepared by Geo-Logic Associates, Inc. for use by the client named in the title block, solely in respect of the construction operation, and maintenance of the facility named in the title block. Geo-Logic Associates, Inc. shall not be liable for the use of this drawing on any other facility or for any other purpose.

REV. NO.	DATE	DESCRIPTION	APPROVED BY

DATE OF ISSUE: 5-18-2026
DESIGNED BY:
DRAWN BY: RDD
CHECKED BY:
APPROVED BY:

Geo-Logic ASSOCIATES
143E Spring Hill Drive, Grass Valley, CA 95945
geo-logic.com | 530.272.2448

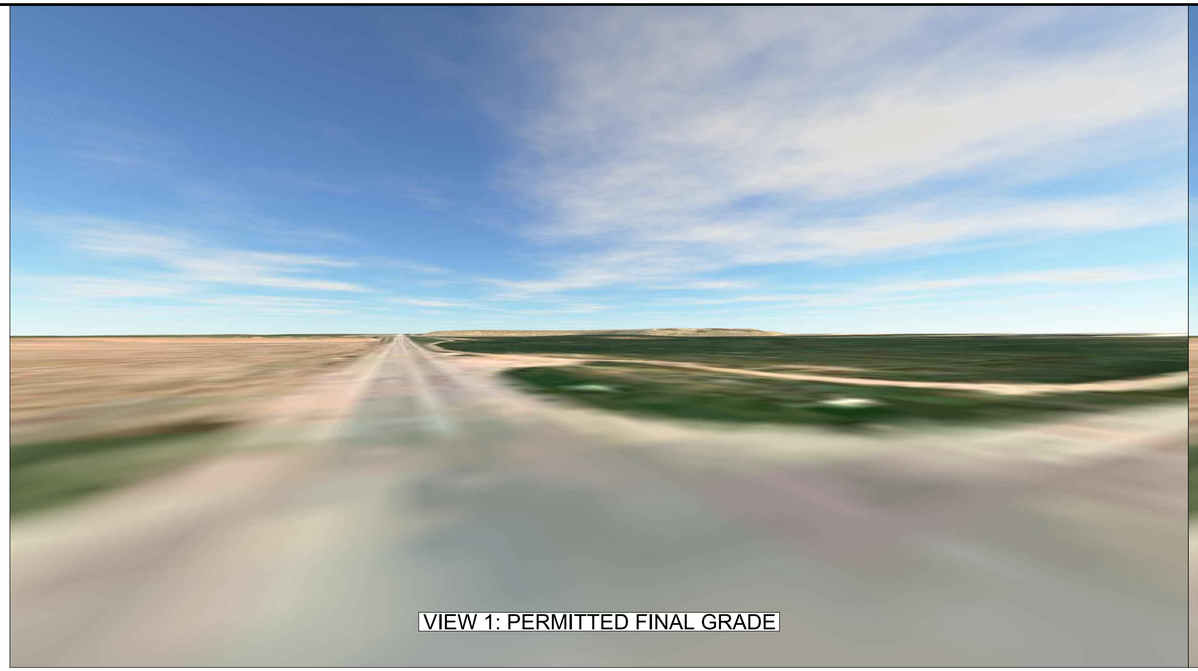
EAST REGIONAL LANDFILL
VISUAL RENDERINGS FOR MAJOR MODIFICATION
ADAMS COUNTY, COLORADO

VIEWPOINTS

DRAWING NO. 1

PROJECT NO. 2326.1029.00

N:\EAST REGIONAL\AU\26.1060 2026 GENERAL ENGINEERING\4_CAD\EXHIBITS\2026-05-07 3D RENDERS\VIEW LOCATIONS.DWG May 18, 2026 - 5:24 PM BY: GLA-USER



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REV. NO.	DATE	DESCRIPTION	APPROVED BY

DATE OF ISSUE: 5-14-2026
DESIGNED BY:
DRAWN BY: RDD
CHECKED BY:
APPROVED BY:

Geo-Logic ASSOCIATES
143E Spring Hill Drive, Grass Valley, CA 95945
geo-logic.com | 530.272.2448

EAST REGIONAL LANDFILL
VISUAL RENDERINGS FOR MAJOR MODIFICATION
ADAMS COUNTY, COLORADO

SIDE BY SIDE VIEWS

DRAWING NO. 2

PROJECT NO. 2326.1029.00

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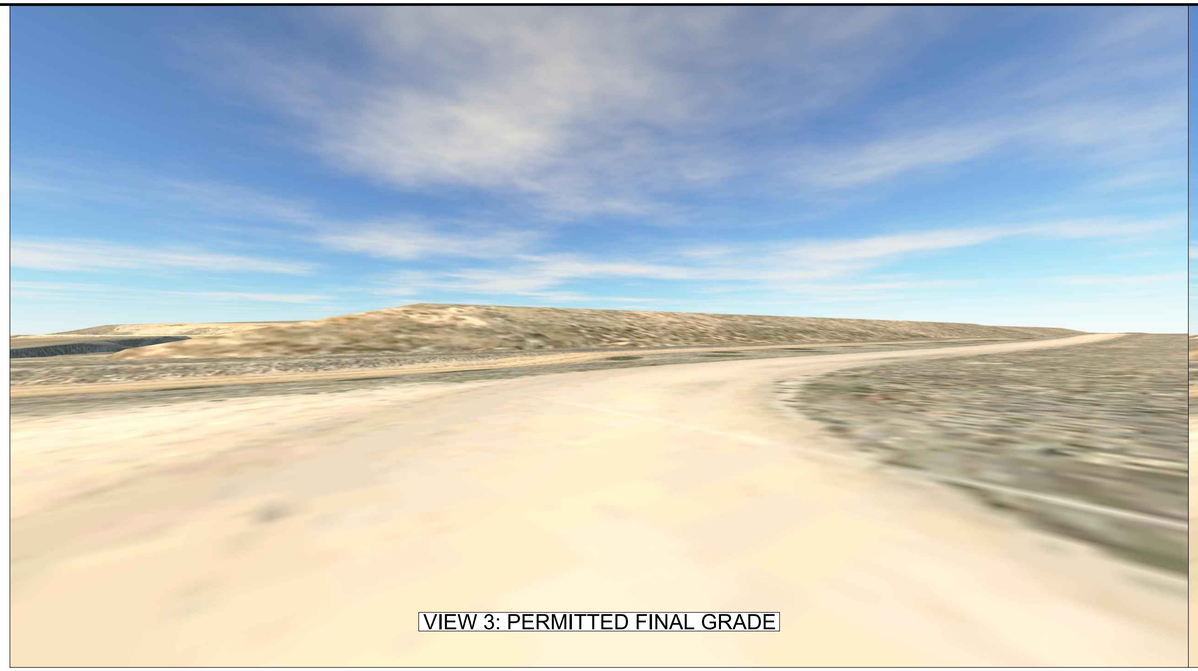
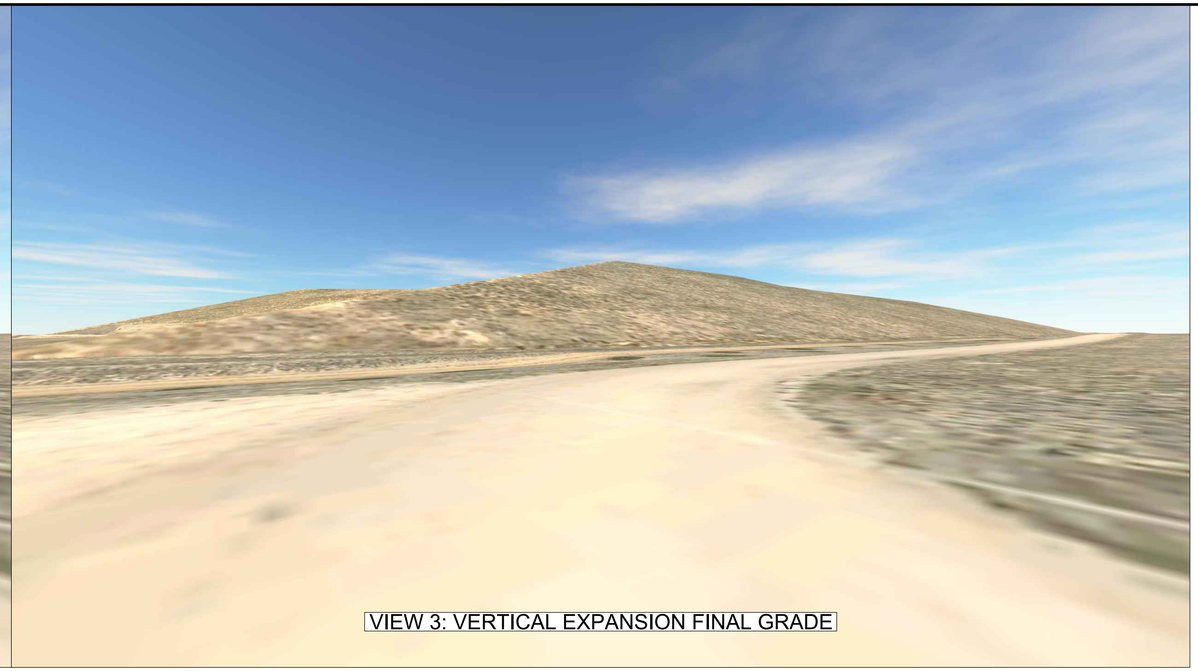
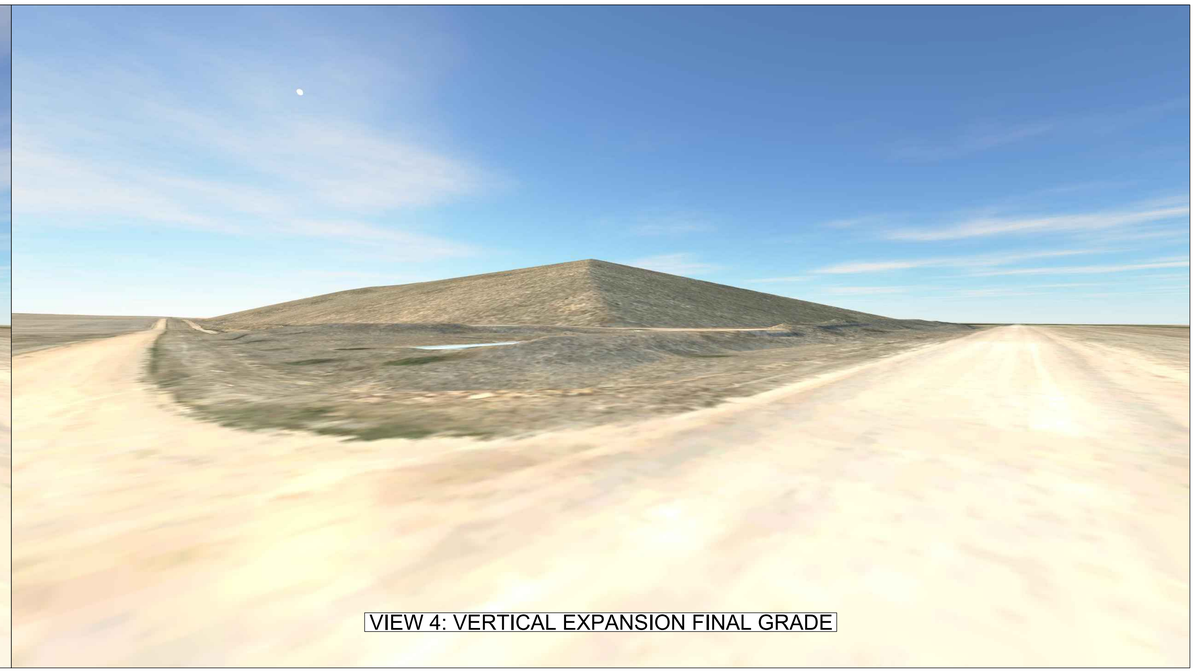


VIEW 3: PERMITTED FINAL GRADE



VIEW 3: VERTICAL EXPANSION FINAL GRADE

VIEW 4: PERMITTED FINAL GRADE



VIEW 4: VERTICAL EXPANSION FINAL GRADE

This drawing has not been published but rather has been prepared by Geo-Logic Associates, Inc. for use by the client named in the title block, solely in respect of the construction operation, and maintenance of the facility named in the title block. Geo-Logic Associates, Inc. shall not be liable for the use of this drawing on any other facility or for any other purpose.

REV. NO.	DATE	DESCRIPTION	APPROVED BY

DATE OF ISSUE: 5-14-2026
DESIGNED BY:
DRAWN BY: RDD
CHECKED BY:
APPROVED BY:

Geo-Logic ASSOCIATES
143E Spring Hill Drive, Grass Valley, CA 95945
geo-logic.com | 530.272.2448

EAST REGIONAL LANDFILL

VISUAL RENDERINGS FOR MAJOR MODIFICATION

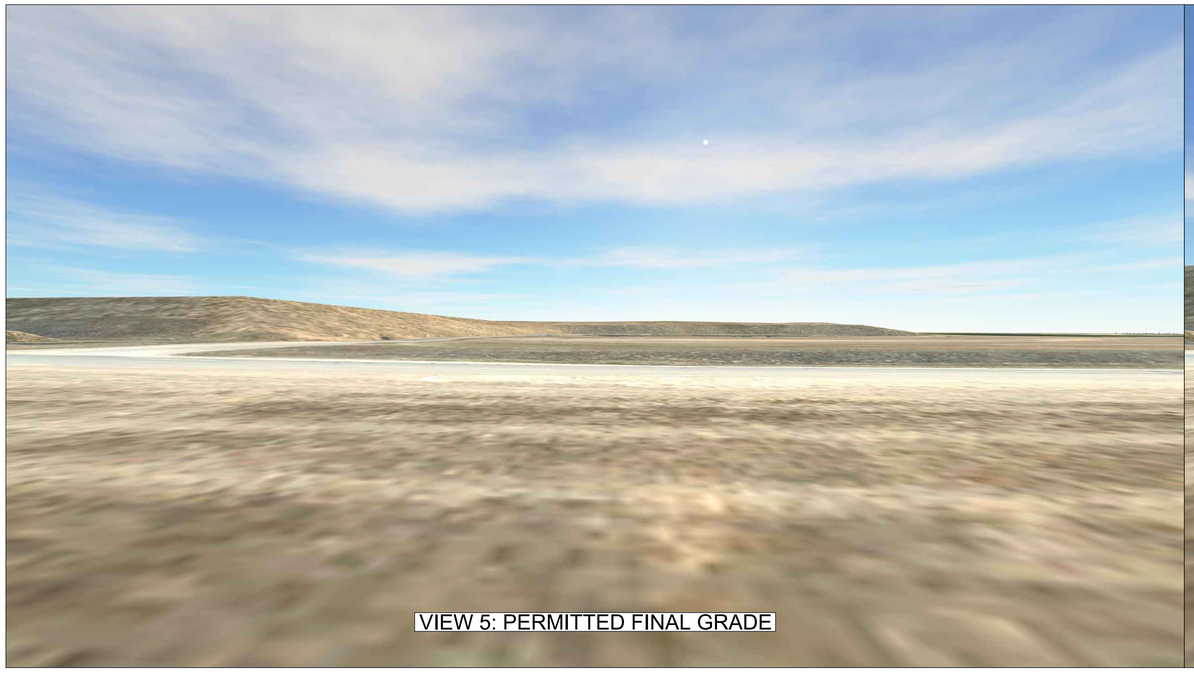
ADAMS COUNTY, COLORADO

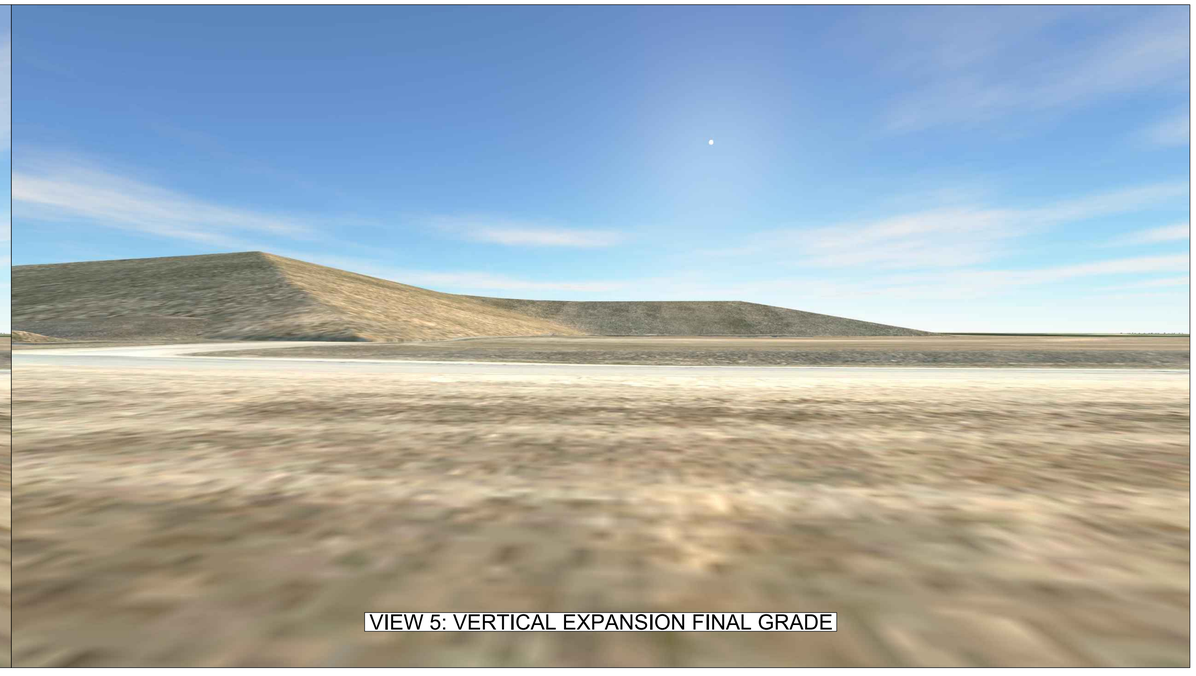
SIDE BY SIDE VIEWS

DRAWING NO. 3

PROJECT NO. 2326.1029.00

Z:\1XNC\PROJECTS\EAST REGIONAL\AU\26.1060 2026 GENERAL ENGINEERING\4_CAD\EXHIBITS\2026-05-07 3D RENDERS\VIEWS.DWG May 18, 2026 - 5:47 PM BY: GLA-USER





This drawing has not been published but rather has been prepared by Geo-Logic Associates, Inc. for use by the client named in the title block, solely in respect of the construction operation, and maintenance of the facility named in the title block. Geo-Logic Associates, Inc. shall not be liable for the use of this drawing on any other facility or for any other purpose.

REV. NO.	DATE	DESCRIPTION	APPROVED BY

DATE OF ISSUE: 5-14-2026
DESIGNED BY:
DRAWN BY: RDD
CHECKED BY:
APPROVED BY:

Geo-Logic ASSOCIATES
143E Spring Hill Drive, Grass Valley, CA 95945
geo-logic.com | 530.272.2448

EAST REGIONAL LANDFILL
VISUAL RENDERINGS FOR MAJOR MODIFICATION
ADAMS COUNTY, COLORADO

SIDE BY SIDE VIEWS

DRAWING NO. 4

PROJECT NO. 2326.1029.00

Z:\1XINC\PROJECTS\EAST REGIONAL\AU26.1060 2026 GENERAL ENGINEERING\4_CAD\EXHIBITS\2026-05-07 3D RENDERS\VIEWS.DWG May 18, 2026 - 5:47 PM BY: GLA-USER

ATTACHMENT H

Title Commitment

Fidelity National Title
Insurance Company

TITLE REPORT

SCHEDULE A

Title Report No.: 170-F00202-26

1. **Effective Date:** February 17, 2026 at 12:00 AM
2. The estate or interest in the land described or referred to in this Title Report is:

   Fee Simple
3. Title to the estate or interest in the land is at the Effective Date vested in:

   Five Part Development, LLC, a Colorado limited liability company
4. The land referred to in this Title Report is described as follows:

   SEE EXHIBIT "A" ATTACHED HERETO AND MADE A PART HEREOF

   (for informational purposes only) 8201 Schumaker Rd, CO
   Schumaker Rd, CO
   Schumaker Rd, CO
   Schumaker Rd, CO

EXHIBIT "A"
Legal Description

Legal Description: Parcel A (as taken from QuitClaim Deed recorded February 28, 2002 at Reception No. C0933029)

That part of the South One-Half of Section 25, Township 2 South, Range 64 West of the 6th Principal Meridian, County of Adams, State of Colorado, described as:

Commencing at the Southeast corner of said Section 25; thence N88°37'05"W along the South line of the Southeast One-Quarter of said Section 25, a distance of 30.01 feet to the West right-of-way line of Schumaker Mile Road, being the point of beginning; thence continuing N88°37'05"W along said South line, a distance of 2627.55 feet to the Southeast corner of the Southwest One-Quarter of said Section 25; thence N88°29'52"W along the South line of said Southwest One-Quarter, a distance of 644.01 feet; thence N10°50'39"E, a distance of 452.12 feet; thence N89°27'01"E, a distance of 1889.61 feet to the West line of the Southeast One-Quarter of the Southeast One-Quarter of said Section 25; thence N00°16'08"E along said West line, a distance of 120.00 feet; thence S88°35'00"E, a distance of 1298.00 feet to the West right-of-way line of said Schumaker Mile Road; thence S00°11'50"W along said West right-of-way line, a distance of 630.34 feet to the Point of Beginning.

Basis for Bearings:

The East line of the Southeast One-Quarter of Section 25, Township 2 South, Range 64 West of the 6th Principal Meridian is assumed to bear S00°11'50"W.

Legal Description: Parcel B (as taken from QuitClaim Deed recorded February 28, 2002 at Reception No. C0933030)

That part of the South One-Half of Section 25, Township 2 South, Range 64 West of the 6th Principal Meridian, County of Adams, State of Colorado, described as:

Commencing at the Southeast Corner of said Section 25; thence N88°37'05"W along the South line of the Southeast One-Quarter of said Section 25, a distance of 30.01 feet to the West right-of-way line of Schumaker Mile Road; thence N00°11'50"E along said West right-of-way line, a distance of 630.34 feet to the point of beginning; thence N88°35'00"W, a distance of 1298.00 feet to the West line of the Southeast One-Quarter of the Southeast One-Quarter of said Section 25; thence S00°16'08"W along said West line, a distance of 120.00 feet; thence S89°27'01"W, a distance of 1889.61 feet; thence N10°50'39"E, a distance of 571.30 feet; thence N54°08'55"W, a distance of 593.30 feet; thence N09°37'19"W, a distance of 783.00 feet; thence S57°43'21"E, a distance of 2832.16 feet to the West line of said Southeast One-Quarter of the Southeast One-Quarter of Section 25; thence S88°35'00"E, a distance of 1297.96 feet to the West right-of-way line of said Schumaker Mile Road; thence S00°11'50"W along said West right-of-way line, a distance of 30.01 feet to the Point of Beginning.

Subject to and restricted by joint use of the below Common Access Easement with Parcel C:

Legal description: Common Access Easement

That part of the South One-Half of Section 25, Township 2 South, Range 64 West of the 6th Principal Meridian, County of Adams, State of Colorado, described as:

Commencing at the Southeast Corner of said Section 25; thence N88°37'05"W along the South line of the Southeast One-Quarter of said Section 25, a distance of 30.01 feet to the West right-of-way line of Schumaker Mile Road; thence N00°11'50"E along said West right-of-way line, a distance of 630.34 feet to the point of beginning; thence N88°35'00"W, a distance of 1358.00 feet, being 60.00 feet West of the West line of the Southeast One-Quarter of the Southeast One-Quarter of said Section 25; thence N00°16'08"E, parallel with said line, a distance of 60.02 feet; thence S88°35'00"E, a distance of 1357.92 feet to the West right-of-way line of said Schumaker Mile Road; thence S00°11'50"W along said West right-of-way line, a distance of 60.02 feet to the Point of Beginning.

EXHIBIT "A"
Legal Description

Basis for Bearings:

The East line of the Southeast One-Quarter of Section 25, Township 2 South, Range 64 West of the 6th Principal Meridian is assumed to Bear S00°11'50"W.

Legal Description: Parcel C (as taken from QuitClaim Deed recorded February 28, 2002 at Reception No. C0933031)

That part of the South One-Half of Section 25, Township 2 South, Range 64 West of the 6th Principal Meridian, County of Adams, State of Colorado, described as:

Commencing at the Southeast corner of said Section 25; thence N88°37'05"W along the South line of the Southeast One-Quarter of said Section 25, a distance of 30.01 feet to the West right-of-way line of Schumaker Mile Road; thence N00°11'50"E along said West right-of-way line, a distance of 660.35 feet to the point of beginning; thence N88°35'00"W, a distance of 1297.96 feet to the West line of the Southeast One-Quarter of the Southeast One-Quarter of said Section 25; thence N57°43'21"W, a distance of 2832.16 feet; thence N09°37'19"W, a distance of 544.80 feet to the North line of the Southwest One-Quarter of said Section 25; thence S88°28'44"E along said North line, a distance of 1170.21 feet to the Northwest Corner of the Southeast One-Quarter of said Section 25; thence S35°10'02"E, a distance of 2285.69 feet to the West line of said Southeast One-Quarter of the Southeast One-Quarter of Section 25; thence S00°16'08"W along said West line, a distance of 120.00 feet; thence S88°35'00"E, a distance of 1297.92 feet to the West right-of-way line of Schumaker Mile Road; thence S00°11'50"W along said West right-of-way line, a distance of 30.01 feet to the Point of Beginning.

Subject to and restricted by joint use of the below Common Access Easement with Parcel B:

Legal description: Common Access Easement

That part of the South One-Half of Section 25, Township 2 South, Range 64 West of the 6th Principal Meridian, County of Adams, State of Colorado, described as:

Commencing at the Southeast Corner of said Section 25; thence N88°37'05"W along the South line of the Southeast One-Quarter of said Section 25, a distance of 30.01 feet to the West right-of-way line of Schumaker Mile Road; thence N00°11'50"E along said West right-of-way line, a distance of 630.34 feet to the point of beginning; thence N88°35'00"W, a distance of 1358.00 feet, being 60.00 feet West of the West line of the Southeast One-Quarter of the Southeast One-Quarter of said Section 25; thence N00°16'08"E, parallel with said line, a distance of 60.02 feet; thence S88°35'00"E, a distance of 1357.92 feet to the West right-of-way line of said Schumaker Mile Road; thence S00°11'50"W along said West right-of-way line, a distance of 60.02 feet to the Point of Beginning.

Basis for Bearings:

The East line of the Southeast One-Quarter of Section 25, Township 2 South, Range 64 West of the 6th Principal Meridian is assumed to bear S00°11'50"W.

Legal Description: Parcel D (as taken from QuitClaim Deed recorded February 28, 2002 at Reception No. C0933032)

That part of the South One-Half of Section 25, Township 2 South, Range 64 West of the 6th Principal Meridian, County of Adams, State of Colorado, described as:

Commencing at the Southeast Corner of said Section 25; thence N88°37'05"W along the South line of the Southeast One-Quarter of said Section 25, a distance of 30.01 feet to the West right-of-way line of Schumaker

EXHIBIT "A"

Legal Description

Mile Road; thence N00°11'50"E along said West right-of-way line, a distance of 690.36 feet to the point of beginning; thence N88°35'00"W, a distance of 1297.92 feet to the West line of the Southeast One-Quarter of the Southeast One-Quarter of said Section 25; thence N00°16'08"E along said West line, a distance of 120.00 feet; thence N35°10'02"W, a distance of 2285.69 feet to the Northwest Corner of the Southeast One-Quarter of said Section 25; thence S88°28'44"E along the North line of the Northwest One-Quarter of said Southeast One-Quarter, a distance of 1155.48 feet, being 170.06 feet West of, as measured along said North line, from the Northeast Corner of said Northwest One-Quarter of the Southeast One-Quarter; thence S00°16'07"W parallel with the East line of said Northwest One-Quarter of the Southeast One-Quarter, a distance of 1322.44 feet to the South line of said Northwest One-Quarter of the Southeast One-Quarter; thence S88°32'55"E along said South line, a distance of 170.05 feet to the Northwest Corner of said Southeast One-Quarter of the Southeast One-Quarter of Section 25; thence continuing S88°32'55"E along the North line of said Southeast One-Quarter of the Southeast One-Quarter, a distance of 1297.15 feet to the West right-of-way line of said Schumaker Mile Road; thence S00°11'50"W along said West right-of-way line, a distance of 630.33 feet to the point of beginning.

Basis for Bearings:

The East line of the Southeast One-Quarter of Section 25, Township 2 South, Range 64 West of the 6th Principal Meridian is assumed to bear S00°11'50"W.

LESS AND EXCEPT that portion conveyed to The County of Adams, State of Colorado in Warranty Deed recorded October 2, 2009 at Reception No. 73226 of Adams County Records.

SCHEDULE B
Exceptions

1. Any facts, rights, interests, or claims that are not shown by the Public Records but that could be ascertained by an inspection of the Land or that may be asserted by persons in possession of the Land.

2. Easements, liens or encumbrances, or claims thereof, not shown by the Public Records.

3. Any encroachment, encumbrance, violation, variation or adverse circumstance affecting the Title that would be disclosed by an accurate and complete land survey of the land and not shown by the Public Records.

4. Any lien or right to a lien for services, labor or material not shown by the Public Records.

5. Defects, liens, encumbrances, adverse claims or other matters, if any, created, first appearing in the public records or attaching subsequent to the Effective Date but prior to the date the Proposed Insured acquires for value of record the estate or interest or mortgage thereon covered by this Commitment.

6. Water rights, claims or title to water, whether or not disclosed by the Public Records.

7. Taxes and assessments for the current year, including all taxes now or heretofore assessed, due or payable.

8. Reservations by the Union Pacific Land Company of (1) oil, coal and other minerals underlying the Land, (2) the exclusive right to prospect for, mine and remove oil, coal and other minerals, and (3) the right of ingress and egress and regress to prospect for, mine and remove oil, coal and other minerals, all as contained in Deed as set forth below, and any and all assignments thereof or interests therein:

   Recording Date: October 22, 1910
   Recording No: Book 25 at Page 253

9. Easement(s) for the purpose(s) shown below and rights incidental thereto, as granted in a document:

   Granted to: Colorado Interstate Gas Company, a Delaware Corporation
   Purpose: pipeline purposes
   Recording Date: December 27, 1966
   Recording No: Book 1337 at Page 320
   Affects: more particularly described therein

   Agreement and Partial Release recorded January 14, 1994 at Reception No. 1211716

   Agreement and Partial Release recorded December 6, 2001 at Reception No. C0896827

10. Terms, conditions, provisions, agreements and obligations contained in the Surface Owner's Agreement as set forth below:

    Recording Date: January 28, 1984
    Recording No: Book 2833 at Page 775

11. Easement(s) for the purpose(s) shown below and rights incidental thereto, as granted in a document:

    Granted to: Colorado Interstate Gas Company, a Delaware corporation
    Purpose: pipeline purposes
    Recording Date: July 31, 1991
    Recording No: Book 3801 at Page 884

Affects: more particularly described therein

12. Terms, conditions, provisions, agreements and obligations contained in the Memorandum of Agreement as set forth below:

Recording Date: December 23, 1992
Recording No: Reception No. 1112113, rerecorded January 11, 1993 at Reception No. 1115643

13. Terms, conditions, provisions, agreements and obligations contained in the Approval of Certificate of Designation as set forth below:

Recording Date: November 17, 1993
Recording No: Reception No. 1194127

Approval of Revised Submittal Packet and Issuance of Certificate of Designation (new legal description and incorporation of conditions) recorded at Reception No. 1210621

14. Easement(s) whether in fee or easement only, for the purpose(s) shown below and rights incidental thereto, as granted in a document:

Granted to:	Public Service Company of Colorado
Purpose:	utility purposes (easement area)
Recording Date:	January 14, 1994
Recording No:	Book 4239 at Page 599
Affects:	more particularly described therein

Covenant and Release Agreement given in connection therewith recorded May 24, 2007 at Reception No. 51203

15. Terms, conditions, provisions, agreements and obligations contained in the Receipt and Option as set forth below:

Recording Date: January 14, 1994
Recording No: Reception No. 1211718

16. Terms, conditions, provisions, agreements and obligations contained in the Request for Notification of Surface Development as set forth below:

Recording Date: May 20, 2002
Recording No: Reception No. C0971548

17. Terms, conditions, provisions, agreements and obligations contained in the Letter regarding Prairie Falcon Parkway Express Company as set forth below:

Recording Date: January 8, 2007
Recording No: Reception No. 3078

18. Easement(s) for the purpose(s) shown below and rights incidental thereto, as granted in a document:

Granted to:	Colorado Interstate Gas Company, a Delaware corporation
Purpose:	pipeline purposes
Recording Date:	August 3, 2007

Recording No: Reception No. 74628
Affects: more particularly described therein

19. Terms, conditions, provisions, agreements and obligations contained in the Zoning Hearing Decision re Alpine Waster & Recycling as set forth below:

Recording Date: July 22, 2009
Recording No: Reception No. 53948

Resolution Approving the First Amendment to the Development Agreement recorded March 12, 2012 at Reception No. 18446

20. Terms, conditions, provisions, agreements and obligations contained in the Resolution Authorizing the Issuance of a Certificate of Designation to Five Part Development as set forth below:

Recording Date: December 8, 2010
Recording No: Reception No. 85376

21. Terms, conditions, provisions, agreements and obligations contained in the Resolution Authorizing the Issuance of an Amended Certificate of Designation re Alpine Disposal Company, LLC as set forth below:

Recording Date: October 4, 2011
Recording No: Reception No. 64633

Zoning Hearing Decision recorded October 4, 2011 at Reception No. 64637

22. Terms, conditions, provisions, agreements and obligations contained in the Findings and Order (Colorado Ground Water Commission) as set forth below:

Recording Date: February 25, 2008
Recording No: Reception No. 15980, 15981, 15982, and 15983

NOTE: This Exception is for informational purposes only.

END OF EXCEPTIONS

THIS IS A TITLE REPORT ONLY. **This is not a commitment to insure.**

The information set forth herein is based on information supplied to Fidelity National Title Company by sources believed to be reliable and is provided for accommodation purposes only. Fidelity National Title Company assumes no liability hereunder unless a policy or policies of title insurance are issued by Fidelity National Title Company and fully paid for and the insured under said policy or policies and party to whom this report was issued have no knowledge of any defect in title not disclosed. Reliance on the information set forth herein is subject to the issuance of a mortgage and/or owner's policy of title insurance by Fidelity National Title Company within six (6) months from the effective date hereof. If a title insurance policy is not issued insuring the property within such time, this title report shall be null and void as of its effective date and shall be deemed to have been furnished for informational purposes only.

EXHIBIT "B"

LIMITATION LANGUAGE FOR LIMITATION TO AMOUNT OF FEE PAID FOR SEARCH

YOU EXPRESSLY AGREE AND ACKNOWLEDGE THAT IT IS EXTREMELY DIFFICULT, IF NOT IMPOSSIBLE, TO DETERMINE THE EXTENT OF LOSS WHICH COULD ARISE FROM ERRORS OR OMISSIONS IN, OR THE COMPANY'S NEGLIGENCE IN PRODUCING, THE REPORT. YOU RECOGNIZE THAT THE FEE CHARGED IS NOMINAL IN RELATION TO THE POTENTIAL LIABILITY WHICH COULD ARISE FROM SUCH ERRORS OR OMISSIONS OR NEGLIGENCE. THEREFORE, YOU UNDERSTAND THAT THE COMPANY WAS NOT WILLING TO PROCEED IN THE PREPARATION AND ISSUANCE OF THE REQUESTED REPORT BUT FOR YOUR AGREEMENT THAT THE COMPANY'S LIABILITY IS STRICTLY LIMITED.

YOU AGREE THAT MATTERS AFFECTING TITLE BUT WHICH DO NOT APPEAR AS A LIEN OR ENCUMBRANCE AS DEFINED IN THE CUSTOMER AGREEMENT OR APPLICATION ARE OUTSIDE THE SCOPE OF THE REPORT.

YOU AGREE, AS PART OF THE CONSIDERATION FOR THE ISSUANCE OF THIS REPORT AND TO THE FULLEST EXTENT PERMITTED BY LAW, TO LIMIT THE LIABILITY OF THE COMPANY, ITS LICENSORS, AGENTS, SUPPLIERS, RESELLERS, SERVICE PROVIDERS, CONTENT PROVIDERS, OR ANY OTHER SUBSCRIBERS OR SUPPLIERS, SUBSIDIARIES, AFFILIATES, EMPLOYEES, AND SUBCONTRACTORS FOR ANY AND ALL CLAIMS, LIABILITIES, CAUSES OF ACTION, LOSSES, COSTS, DAMAGES AND EXPENSES OF ANY NATURE WHATSOEVER, INCLUDING ATTORNEY'S FEES, HOWEVER ALLEGED OR ARISING INCLUDING BUT NOT LIMITED TO THOSE ARISING FROM BREACH OF CONTRACT, NEGLIGENCE, THE COMPANY'S OWN FAULT AND/OR NEGLIGENCE, ERRORS, OMISSIONS, STRICT LIABILITY, BREACH OF WARRANTY, EQUITY, THE COMMON LAW, STATUTE, OR ANY OTHER THEORY OF RECOVERY OR FROM ANY PERSON'S USE, MISUSE, OR INABILITY TO USE THE REPORT, SO THAT **THE TOTAL AGGREGATE LIABILITY OF THE COMPANY, ITS EMPLOYEES, AGENTS AND SUBCONTRACTORS SHALL NOT EXCEED THE COMPANY'S TOTAL FEE FOR THIS REPORT.**

YOU AGREE THAT THE FOREGOING LIMITATION ON LIABILITY IS A TERM MATERIAL TO THE PRICE YOU ARE PAYING WHICH PRICE IS LOWER THAN WOULD OTHERWISE BE OFFERED TO YOU WITHOUT SAID TERM. YOU RECOGNIZE THAT THE COMPANY WOULD NOT ISSUE THIS REPORT, BUT FOR YOUR AGREEMENT, AS PART OF THE CONSIDERATION GIVEN FOR THIS REPORT, TO THE FOREGOING LIMITATION OF LIABILITY AND THAT ANY SUCH LIABILITY IS CONDITIONED AND PREDICATED UPON THE FULL AND TIMELY PAYMENT OF THE COMPANY'S INVOICE FOR THIS REPORT.

THIS REPORT IS LIMITED IN SCOPE AND IS NOT AN ABSTRACT OF TITLE, TITLE OPINION, PRELIMINARY TITLE REPORT, TITLE REPORT, COMMITMENT TO ISSUE TITLE INSURANCE, OR A TITLE POLICY, AND SHOULD NOT BE RELIED UPON AS SUCH. IN PROVIDING THIS REPORT, THE COMPANY IS NOT ACTING AS AN ABSTRACTOR OF TITLE. THIS REPORT DOES NOT PROVIDE OR OFFER ANY TITLE INSURANCE, LIABILITY COVERAGE OR ERRORS AND OMISSIONS COVERAGE. THIS REPORT IS NOT TO BE RELIED UPON AS A REPRESENTATION OF THE STATUS OF TITLE TO THE PROPERTY. THE COMPANY MAKES NO REPRESENTATIONS AS TO THE REPORT'S ACCURACY, DISCLAIMS ANY WARRANTIES AS TO THE REPORT, ASSUMES NO DUTIES TO YOU, DOES NOT INTEND FOR YOU TO RELY ON THE REPORT, AND ASSUMES NO LIABILITY FOR ANY LOSS OCCURRING BY REASON OF RELIANCE ON THIS REPORT OR OTHERWISE.

IF YOU DO NOT WISH TO LIMIT LIABILITY AS STATED HEREIN AND YOU DESIRE THAT ADDITIONAL LIABILITY BE ASSUMED BY THE COMPANY, YOU MAY REQUEST AND PURCHASE A POLICY OF TITLE INSURANCE, A BINDER, OR A COMMITMENT TO ISSUE A POLICY OF TITLE INSURANCE. NO ASSURANCE IS GIVEN AS TO THE INSURABILITY OF THE TITLE OR STATUS OF TITLE. YOU EXPRESSLY AGREE AND ACKNOWLEDGE THAT YOU HAVE AN INDEPENDENT DUTY TO ENSURE AND/OR RESEARCH THE ACCURACY OF ANY INFORMATION OBTAINED FROM THE COMPANY OR ANY PRODUCTS OR SERVICES PURCHASED.

NO THIRD PARTY IS PERMITTED TO USE OR RELY UPON THE INFORMATION SET FORTH IN THIS REPORT, AND NO LIABILITY TO ANY THIRD PARTY IS UNDERTAKEN BY THE COMPANY.

YOU AGREE THAT, TO THE FULLEST EXTENT PERMITTED BY LAW, IN NO EVENT WILL THE COMPANY, ITS LICENSORS, AGENTS, SUPPLIERS, RESELLERS, SERVICE PROVIDERS, CONTENT PROVIDERS, OR

ANY OTHER SUBSCRIBERS OR SUPPLIERS, SUBSIDIARIES, AFFILIATES, EMPLOYEES, AND SUBCONTRACTORS BE LIABLE FOR CONSEQUENTIAL, INCIDENTAL, INDIRECT, PUNITIVE, EXEMPLARY, OR SPECIAL DAMAGES, OR LOSS OF PROFITS, REVENUE, INCOME, SAVINGS, DATA, BUSINESS, OPPORTUNITY, OR GOODWILL, PAIN AND SUFFERING, EMOTIONAL DISTRESS, NON-OPERATION OR INCREASED EXPENSE OF OPERATION, BUSINESS INTERRUPTION OR DELAY, COST OF CAPITAL, OR COST OF REPLACEMENT PRODUCTS OR SERVICES, REGARDLESS OF WHETHER SUCH LIABILITY IS BASED ON BREACH OF CONTRACT, TORT, NEGLIGENCE, THE COMPANY'S OWN FAULT AND/OR NEGLIGENCE, STRICT LIABILITY, BREACH OF WARRANTIES, FAILURE OF ESSENTIAL PURPOSE, OR OTHERWISE AND WHETHER CAUSED BY NEGLIGENCE, ERRORS, OMISSIONS, STRICT LIABILITY, BREACH OF CONTRACT, BREACH OF WARRANTY, THE COMPANY'S OWN FAULT AND/OR NEGLIGENCE OR ANY OTHER CAUSES WHATSOEVER, AND EVEN IF THE COMPANY HAS BEEN ADVISED OF THE LIKELIHOOD OF SUCH DAMAGES OR KNEW OR SHOULD HAVE KNOWN OF THE POSSIBILITY FOR SUCH DAMAGES.

THESE LIMITATIONS WILL SURVIVE THE CONTRACT.

LIMITATIONS OF LIABILITY

APPLICANT EXPRESSLY AGREES AND ACKNOWLEDGES THAT IT IS EXTREMELY DIFFICULT, IF NOT IMPOSSIBLE, TO DETERMINE THE EXTENT OF LOSS WHICH COULD ARISE FROM ERRORS OR OMISSIONS IN, OR THE COMPANY'S NEGLIGENCE IN PRODUCING, THE REPORT. APPLICANT RECOGNIZES THAT THE FEE CHARGED IS NOMINAL IN RELATION TO THE POTENTIAL LIABILITY WHICH COULD ARISE FROM SUCH ERRORS OR OMISSIONS OR NEGLIGENCE. THEREFORE, APPLICANT UNDERSTANDS THAT THE COMPANY IS NOT WILLING TO PROCEED IN THE PREPARATION AND ISSUANCE OF THE REQUESTED REPORT UNLESS THE COMPANY'S LIABILITY IS STRICTLY LIMITED. APPLICANT AGREES WITH THE PROPRIETY OF SUCH LIMITATION AND AGREES TO BE BOUND BY ITS TERMS.

THE LIMITATIONS ARE AS FOLLOWS AND THE LIMITATIONS WILL SURVIVE THE CONTRACT:

MATTERS AFFECTING TITLE BUT WHICH DO NOT APPEAR AS A LIEN OR ENCUMBRANCE, AS DEFINED ABOVE, AMONG THE TITLE INSTRUMENTS ARE OUTSIDE THE SCOPE OF THE REPORT.

APPLICANT AGREES, AS PART OF THE CONSIDERATION FOR THE ISSUANCE OF THE REPORT AND TO THE FULLEST EXTENT PERMITTED BY LAW, TO LIMIT THE LIABILITY OF THE COMPANY, ITS LICENSORS, AGENTS, SUPPLIERS, RESELLERS, SERVICE PROVIDERS, CONTENT PROVIDERS, OR ANY OTHER SUBSCRIBERS OR SUPPLIERS, SUBSIDIARIES, AFFILIATES, EMPLOYEES, AND SUBCONTRACTORS FOR ANY AND ALL CLAIMS, LIABILITIES, CAUSES OF ACTION, LOSSES, COSTS, DAMAGES AND EXPENSES OF ANY NATURE WHATSOEVER, INCLUDING ATTORNEY'S FEES, HOWEVER ALLEGED OR ARISING INCLUDING BUT NOT LIMITED TO THOSE ARISING FROM BREACH OF CONTRACT, NEGLIGENCE, THE COMPANY'S OWN FAULT AND/OR NEGLIGENCE, ERRORS, OMISSIONS, STRICT LIABILITY, BREACH OF WARRANTY, EQUITY, THE COMMON LAW, STATUTE, OR ANY OTHER THEORY OF RECOVERY, OR FROM ANY PERSON'S USE, MISUSE, OR INABILITY TO USE THE REPORT OR ANY OF THE MATERIALS CONTAINED THEREIN OR PRODUCED, **SO THAT THE TOTAL AGGREGATE LIABILITY OF THE COMPANY AND ITS, AGENTS, SUBSIDIARIES, AFFILIATES, EMPLOYEES, AND SUBCONTRACTORS SHALL NOT IN ANY EVENT EXCEED THE COMPANY'S TOTAL FEE FOR THE REPORT.**

APPLICANT AGREES THAT THE FOREGOING LIMITATION ON LIABILITY IS A TERM MATERIAL TO THE PRICE THE APPLICANT IS PAYING WHICH PRICE IS LOWER THAN WOULD OTHERWISE BE OFFERED TO THE APPLICANT WITHOUT SAID TERM. APPLICANT RECOGNIZES THAT THE COMPANY WOULD NOT ISSUE THE REPORT, BUT FOR THIS CUSTOMER AGREEMENT, AS PART OF THE CONSIDERATION GIVEN FOR THE REPORT, TO THE FOREGOING LIMITATION OF LIABILITY AND THAT ANY SUCH LIABILITY IS CONDITIONED AND PREDICATED UPON THE FULL AND TIMELY PAYMENT OF THE COMPANY'S INVOICE FOR THE REPORT.

THE REPORT IS LIMITED IN SCOPE AND IS NOT AN ABSTRACT OF TITLE, TITLE OPINION, PRELIMINARY TITLE REPORT, TITLE REPORT, COMMITMENT TO ISSUE TITLE INSURANCE, OR A TITLE POLICY, AND SHOULD NOT BE RELIED UPON AS SUCH. THE REPORT DOES NOT PROVIDE OR OFFER ANY TITLE INSURANCE, LIABILITY COVERAGE OR ERRORS AND OMISSIONS COVERAGE. THE REPORT IS NOT TO BE RELIED UPON AS A REPRESENTATION OF THE STATUS OF TITLE TO THE PROPERTY. THE COMPANY MAKES NO REPRESENTATIONS AS TO THE REPORT'S ACCURACY, DISCLAIMS ANY WARRANTIES AS TO THE REPORT, ASSUMES NO DUTIES TO APPLICANT, DOES NOT INTEND FOR APPLICANT TO RELY ON THE REPORT, AND ASSUMES NO LIABILITY FOR ANY LOSS OCCURRING BY REASON OF RELIANCE ON THE REPORT OR OTHERWISE.

IF APPLICANT DOES NOT WISH TO LIMIT LIABILITY AS STATED HEREIN AND APPLICANT DESIRES THAT ADDITIONAL LIABILITY BE ASSUMED BY THE COMPANY, APPLICANT MAY REQUEST AND PURCHASE A POLICY OF TITLE INSURANCE, A BINDER, OR A COMMITMENT TO ISSUE A POLICY OF TITLE INSURANCE. NO ASSURANCE IS GIVEN AS TO THE INSURABILITY OF THE TITLE OR STATUS OF TITLE. APPLICANT EXPRESSLY AGREES AND ACKNOWLEDGES IT HAS AN INDEPENDENT DUTY TO ENSURE AND/OR RESEARCH THE ACCURACY OF ANY INFORMATION OBTAINED FROM THE COMPANY OR ANY PRODUCTS OR SERVICES PURCHASED.

LIMITATIONS OF LIABILITY
(continued)

NO THIRD PARTY IS PERMITTED TO USE OR RELY UPON THE INFORMATION SET FORTH IN THE REPORT, AND NO LIABILITY TO ANY THIRD PARTY IS UNDERTAKEN BY THE COMPANY.

APPLICANT AGREES THAT, TO THE FULLEST EXTENT PERMITTED BY LAW, IN NO EVENT WILL THE COMPANY, ITS LICENSORS, AGENTS, SUPPLIERS, RESELLERS, SERVICE PROVIDERS, CONTENT PROVIDERS, OR ANY OTHER SUBSCRIBERS OR SUPPLIERS, SUBSIDIARIES, AFFILIATES, EMPLOYEES, AND SUBCONTRACTORS BE LIABLE FOR CONSEQUENTIAL, INCIDENTAL, INDIRECT, PUNITIVE, EXEMPLARY, OR SPECIAL DAMAGES, OR LOSS OF PROFITS, REVENUE, INCOME, SAVINGS, DATA, BUSINESS, OPPORTUNITY, OR GOODWILL, PAIN AND SUFFERING, EMOTIONAL DISTRESS, NON-OPERATION OR INCREASED EXPENSE OF OPERATION, BUSINESS INTERRUPTION OR DELAY, COST OF CAPITAL, OR COST OF REPLACEMENT PRODUCTS OR SERVICES, REGARDLESS OF WHETHER SUCH LIABILITY IS BASED ON BREACH OF CONTRACT, TORT, NEGLIGENCE, THE COMPANY'S OWN FAULT AND/OR NEGLIGENCE, STRICT LIABILITY, BREACH OF WARRANTIES, FAILURE OF ESSENTIAL PURPOSE, OR OTHERWISE AND WHETHER CAUSED BY NEGLIGENCE, ERRORS, OMISSIONS, STRICT LIABILITY, BREACH OF CONTRACT, BREACH OF WARRANTY, THE COMPANY'S OWN FAULT AND/OR NEGLIGENCE OR ANY OTHER CAUSES WHATSOEVER, AND EVEN IF THE COMPANY HAS BEEN ADVISED OF THE LIKELIHOOD OF SUCH DAMAGES OR KNEW OR SHOULD HAVE KNOWN OF THE POSSIBILITY FOR SUCH DAMAGES.