Appendix K

Geomembrane Third Party Conformance Results

Appendix K.1 - 80-mil LLDPE DSMS Geomembrane Conformance Results

Appendix K.2 - 40-mil LLDPE Smooth Geomembrane Conformance Results

Appendix K.3 - 80-mil LLDPE DSMS Exposed Geomembrane Conformance Results

Appendix K.1

80-mil LLDPE DSMS Geomembrane Conformance Results

GAI-LAP

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/4/2014**
Date Reported: **6/11/2014**
Client Sample ID: **R#F14A231002 L#CEE810230**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140484**
TRI Control No.: **98083**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		84	84	83	84	84	84	84	83	83	83	84	0	83	84	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9311	0.9314	0.9312								0.9312	0.0002	0.9311	0.9314	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	258	275	288	269	266						271	11	258	288	169 min.
	TD	245	272	258	239	237						250	15	237	272	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	449	549	588	541	543						534	51	449	588	300 min.
	TD	566	598	594	550	538						569	26	538	598	
ASTM D1603	Carbon Black Content (percent, %)															
		2.24	2.22									2.23	0.01	2.22	2.24	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/5/2014**
Date Reported: **6/11/2014**
Client Sample ID: **R#F14A232018 L#CEE810230**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140489**
TRI Control No.: **98091**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz)															
	Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		82	82	83	82	82	81	82	81	82	82	82	0	81	83	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9319	0.9312	0.9308								0.9313	0.0005	0.9308	0.9319	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	242	266	267	256	253						257	10	242	267	169 min.
	TD	251	259	258	229	262						252	13	229	262	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	485	538	536	509	510						516	22	485	538	300 min.
	TD	566	569	590	549	626						580	30	549	626	
ASTM D1603	Carbon Black Content (percent, %)															
		2.12	2.17									2.15	0.03	2.12	2.17	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/6/2014**
Date Reported: **6/17/2014**
Client Sample ID: **R#F14A233035 L#CEE810230**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140495**
TRI Control No.: **98106**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		83	84	83	83	83	84	84	83	84	83	83	1	83	84	80 MARV
ASTM D1505	Density (grams/ $cm.^3$)															
		0.9342	0.9332	0.9340								0.9338	0.0005	0.9332	0.9342	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	284	279	270	308	256						279	19	256	308	169 min.
	TD	254	275	276	269	256						266	10	254	276	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	561	563	548	591	515						556	28	515	591	300 min.
	TD	570	606	621	611	581						598	21	570	621	
ASTM D1603	Carbon Black Content (percent, %)															
		2.33	2.32									2.33	0.01	2.32	2.33	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/10/2014**
Date Reported: **6/19/2014**
Client Sample ID: **R#F14A234052 L#CEE810100**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140508**
TRI Control No.: **98138**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz)															
	Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		82	81	82	82	81	84	82	82	83	81	82	1	81	84	80 MARV
ASTM D1505	Density (grams/ $cm.^3$)															
		0.9362	0.9333	0.9345								0.9347	0.0015	0.9333	0.9362	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	242	269	266	262	259						260	11	242	269	169 min.
	TD	212	246	233	223	226						228	13	212	246	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	491	555	533	531	539						530	24	491	555	300 min.
	TD	519	583	556	536	539						547	24	519	583	
ASTM D1603	Carbon Black Content (percent, %)															
		2.05	2.36									2.21	0.22	2.05	2.36	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/11/2014**
Date Reported: **6/19/2014**
Client Sample ID: **R#F14A235070 L#CEE810100**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140516**
TRI Control No.: **98156**

		SPECIMENS														
		1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
METHOD	**DESCRIPTION**															
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz)															
	Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		82	80	81	82	82	82	81	83	82	81	82	1	80	83	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9327	0.9324	0.9334								0.9328	0.0005	0.9324	0.9334	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	248	236	242	239	228						239	7	228	248	169 min.
	TD	239	230	215	243	228						231	11	215	243	
	Elongation at Break (percent, %)					*Gauge Length = 2.0 in.*										
	MD	511	489	508	510	476						499	16	476	511	300 min.
	TD	573	559	548	585	560						565	14	548	585	
ASTM D1603	Carbon Black Content (percent, %)															
		2.31	2.31									2.31	0.00	2.31	2.31	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 2.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/11/2014**
Date Reported: **6/19/2014**
Client Sample ID: **R#F14A236087 L#CEE810100**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140516**
TRI Control No.: **98157**

		SPECIMENS														
		1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
METHOD	**DESCRIPTION**															
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz)															
	Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		81	82	81	82	83	82	82	84	81	80	82	1	80	84	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9325	0.9333	0.9336								0.9331	0.0006	0.9325	0.9336	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	266	262	258	262	241						258	10	241	266	169 min.
	TD	227	246	261	236	197						233	24	197	261	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	536	513	534	531	495						522	18	495	536	300 min.
	TD	523	571	609	550	433						537	66	433	609	
ASTM D1603	Carbon Black Content (percent, %)															
		2.09	2.22									2.16	0.09	2.09	2.22	2 - 3

(End of Table 2)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

TABLE 3.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/11/2014**
Date Reported: **6/19/2014**
Client Sample ID: **R#F14A241003 L#CEE810120**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140516**
TRI Control No.: **98158**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		82	81	81	82	81	81	82	82	80	81	81	1	80	82	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9350	0.9360	0.9336								0.9348	0.0012	0.9336	0.9360	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	266	269	230	243	206						243	26	206	269	169 min.
	TD	209	239	239	220	212						224	14	209	239	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	506	511	444	473	393						465	49	393	511	300 min.
	TD	426	523	534	479	469						486	43	426	534	
ASTM D1603	Carbon Black Content (percent, %)															
		2.31	2.26									2.28	0.04	2.26	2.31	2 - 3

(End of Table 3)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/13/2014**
Date Reported: **6/27/2014**
Client Sample ID: **R#F14A242020 L#CEE810120**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140528**
TRI Control No.: **98198**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		82	82	81	80	84	83	84	82	83	82	82	1	80	84	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9309	0.9313	0.9308								0.9310	0.0003	0.9308	0.9313	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	272	259	242	262	281						263	15	242	281	169 min.
	TD	245	253	239	259	231						245	11	231	259	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	538	505	499	506	538						517	19	499	538	300 min.
	TD	554	570	553	584	546						561	15	546	584	
ASTM D1603	Carbon Black Content (percent, %)															
		2.38	2.30									2.34	0.06	2.30	2.38	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/17/2014**
Date Reported: **6/27/2014**
Client Sample ID: **R#F14A243037 L#CEE810120**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140552**
TRI Control No.: **98300**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz)															
	Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		81	81	81	82	82	81	81	82	83	81	81	1	81	83	80 MARV
ASTM D1505	Density (grams/ $cm.^3$)															
		0.9321	0.9316	0.9317								0.9318	0.0003	0.9316	0.9321	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	248	243	233	243	241						242	5	233	248	169 min.
	TD	227	226	215	190	212						214	15	190	227	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	485	474	461	475	481						475	9	461	485	300 min.
	TD	548	543	503	451	511						511	39	451	548	
ASTM D1603	Carbon Black Content (percent, %)															
		2.14	2.21									2.18	0.05	2.14	2.21	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 2.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/17/2014**
Date Reported: **6/27/2014**
Client Sample ID: **R#F14A244054 L#CEE810120**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140552**
TRI Control No.: **98301**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz)															
	Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		82	84	82	81	81	83	82	81	83	83	82	1	81	84	80 MARV
ASTM D1505	Density (grams/ $cm.^3$)															
		0.9314	0.9319	0.9316								0.9316	0.0002	0.9314	0.9319	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	224	230	246	233	247						236	10	224	247	169 min.
	TD	221	256	239	243	244						241	13	221	256	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	476	479	506	486	524						494	20	476	524	300 min.
	TD	511	574	558	570	580						559	28	511	580	
ASTM D1603	Carbon Black Content (percent, %)															
		2.31	2.24									2.28	0.05	2.24	2.31	2 - 3

(End of Table 2)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/18/2014**
Date Reported: **6/27/2014**
Client Sample ID: **R#F14A245071 L#CEE810120**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140554**
TRI Control No.: **98303**

		SPECIMENS														
		1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
METHOD	**DESCRIPTION**															
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"														72 min.
		84	85	84	84	84	84	83	84	85	83	84	1	83	85	80 MARV
ASTM D1505	Density (grams/ $cm.^3$)															
		0.9324	0.9319	0.9316								0.9319	0.0004	0.9316	0.9324	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	269	256	276	256	256						263	9	256	276	169 min.
	TD	263	298	255	226	269						262	26	226	298	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	538	505	564	528	531						533	21	505	564	300 min.
	TD	585	626	565	489	570						567	50	489	626	
ASTM D1603	Carbon Black Content (percent, %)															
		2.42	2.40									2.41	0.01	2.40	2.42	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 2.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/18/2014**
Date Reported: **6/27/2014**
Client Sample ID: **R#F14A247088 L#CEE810110**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140554**
TRI Control No.: **98304**

		SPECIMENS														
		1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
METHOD	**DESCRIPTION**															
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz)															
	Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		82	81	81	83	83	83	82	83	83	83	82	1	81	83	80 MARV
ASTM D1505	Density (grams/ $cm.^3$)															
		0.9314	0.9327	0.9324								0.9322	0.0007	0.9314	0.9327	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	276	285	264	267	287						276	10	264	287	169 min.
	TD	236	259	264	275	234						254	18	234	275	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	551	546	529	520	518						533	15	518	551	300 min.
	TD	535	568	583	583	500						554	36	500	583	
ASTM D1603	Carbon Black Content (percent, %)															
		2.65	2.60									2.63	0.04	2.60	2.65	2 - 3

(End of Table 2)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 3.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/18/2014**
Date Reported: **6/27/2014**
Client Sample ID: **R#F14A251004 L#CEE810110**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140554**
TRI Control No.: **98305**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		81	82	81	81	82	81	82	84	82	81	82	1	81	84	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9322	0.9317	0.9321								0.9320	0.0002	0.9317	0.9322	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	278	246	252	301	269						269	22	246	301	169 min.
	TD	254	282	279	256	259						266	13	254	282	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	558	485	508	586	546						537	40	485	586	300 min.
	TD	578	625	623	563	588						595	28	563	625	
ASTM D1603	Carbon Black Content (percent, %)															
		2.25	2.74									2.49	0.34	2.25	2.74	2 - 3

(End of Table 3)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/20/2014**
Date Reported: **6/28/2014**
Client Sample ID: **R#F14A252023 L#CEE810110**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140568**
TRI Control No.: **98336**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz)															
	Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		85	86	85	85	84	84	85	84	84	85	85	1	84	86	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9327	0.9330	0.9325								0.9328	0.0002	0.9325	0.9330	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	287	269	261	265	269						270	10	261	287	169 min.
	TD	251	236	246	272	262						253	14	236	272	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	556	526	505	508	515						522	21	505	556	300 min.
	TD	563	516	541	594	604						564	36	516	604	
ASTM D1603	Carbon Black Content (percent, %)															
		2.31	2.37									2.34	0.04	2.31	2.37	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/23/2014**
Date Reported: **6/28/2014**
Client Sample ID: **R#F14A253040 L#CEE810110**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140572**
TRI Control No.: **98347**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz)															
	Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		84	83	83	84	84	83	83	83	83	84	83	0	83	84	80 MARV
ASTM D1505	Density (grams/ $cm.^3$)															
		0.9324	0.9329	0.9327								0.9326	0.0002	0.9324	0.9329	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	239	312	300	279	275						281	28	239	312	169 min.
	TD	260	253	285	269	259						265	12	253	285	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	454	575	576	533	535						535	50	454	576	300 min.
	TD	570	578	639	586	585						592	27	570	639	
ASTM D1603	Carbon Black Content (percent, %)															
		2.08	2.29									2.19	0.14	2.08	2.29	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **6/24/2014**
Date Reported: **6/28/2014**
Client Sample ID: **R#F14A254054 L#CEE810110**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G140583**
TRI Control No.: **98376**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz)															
	Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		85	86	85	83	84	84	83	85	84	85	84	1	83	86	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9340	0.9335	0.9341								0.9338	0.0003	0.9335	0.9341	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	248	236	242	243	259						246	9	236	259	169 min.
	TD	263	223	264	282	247						256	22	223	282	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	518	483	499	480	520						500	19	480	520	300 min.
	TD	569	496	581	613	551						562	43	496	613	
ASTM D1603	Carbon Black Content (percent, %)															
		2.31	2.27									2.29	0.03	2.27	2.31	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/11/2015**
Date Reported: **2/18/2015**
Client Sample ID: **R# F15B063029 L# CEK810150**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150096**
TRI Control No.: **102545**

		SPECIMENS														
		1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
METHOD	**DESCRIPTION**															
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz)															
	Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		83	83	80	81	80	84	82	82	81	81	82	1	80	84	80 MARV
ASTM D1505	Density (grams/ $cm.^3$)															
		0.9339	0.9346	0.9342								0.9342	0.0004	0.9339	0.9346	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	266	302	282	243	275						274	22	243	302	169 min.
	TD	284	279	273	288	297						284	9	273	297	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	570	635	625	513	604						589	50	513	635	300 min.
	TD	616	598	606	616	643						616	17	598	643	
ASTM D1603	Carbon Black Content (percent, %)															
		2.53	2.47									2.50	0.04	2.47	2.53	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 2.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/11/2015**
Date Reported: **2/18/2015**
Client Sample ID: **R# F15B065047 L# CEK810150**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150096**
TRI Control No.: **102546**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz)															
	Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		84	81	82	81	81	82	81	82	80	82	82	1	80	84	80 MARV
ASTM D1505	Density (grams/ $cm.^3$)															
		0.9354	0.9347	0.9338								0.9346	0.0008	0.9338	0.9354	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	290	285	273	298	272						284	11	272	298	169 min.
	TD	266	289	270	305	241						274	24	241	305	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	548	528	543	569	520						541	19	520	569	300 min.
	TD	585	649	625	650	541						610	47	541	650	
ASTM D1603	Carbon Black Content (percent, %)															
		2.03	2.20									2.12	0.12	2.03	2.20	2 - 3

(End of Table 2)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 3.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/11/2015**
Date Reported: **2/18/2015**
Client Sample ID: **R# F15B066064 L# CEK810150**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150096**
TRI Control No.: **102547**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		83	82	82	81	82	83	83	82	81	84	82	1	81	84	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9335	0.9336	0.9347								0.9340	0.0007	0.9335	0.9347	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	251	256	267	272	262						262	8	251	272	169 min.
	TD	272	305	258	305	275						283	21	258	305	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	503	518	528	526	525						520	10	503	528	300 min.
	TD	514	561	491	566	505						528	34	491	566	
ASTM D1603	Carbon Black Content (percent, %)															
		2.40	2.16									2.28	0.17	2.16	2.40	2 - 3

(End of Table 3)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

TABLE 4.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/11/2015**
Date Reported: **2/18/2015**
Client Sample ID: **R# F15B067081 L# CEK810150**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150096**
TRI Control No.: **102548**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		83	84	83	83	83	82	81	83	82	81	82	1	81	84	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9348	0.9346	0.9339								0.9344	0.0005	0.9339	0.9348	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	268	285	264	269	266						270	8	264	285	169 min.
	TD	230	285	236	282	256						258	25	230	285	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	519	560	521	515	529						529	18	515	560	300 min.
	TD	520	614	553	603	591						576	39	520	614	
ASTM D1603	Carbon Black Content (percent, %)															
		2.45	2.41									2.43	0.03	2.41	2.45	2 - 3

(End of Table 4)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/12/2015**
Date Reported: **2/18/2015**
Client Sample ID: **R# F15B071007 L# CEK810140**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150100**
TRI Control No.: **102555**

		SPECIMENS														
		1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
METHOD	**DESCRIPTION**															
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz)															
	Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		80	81	81	80	81	80	82	80	81	80	80	1	80	82	80 MARV
ASTM D1505	Density (grams/ $cm.^3$)															
		0.9338	0.9346	0.9345								0.9343	0.0004	0.9338	0.9346	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	227	239	249	239	256						242	11	227	256	169 min.
	TD	257	282	258	282	200						256	34	200	282	
	Elongation at Break (percent, %)					*Gauge Length = 2.0 in.*										
	MD	485	505	534	508	534						513	21	485	534	300 min.
	TD	583	640	608	624	486						588	61	486	640	
ASTM D1603	Carbon Black Content (percent, %)															
		2.31	2.23									2.27	0.06	2.23	2.31	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/13/2015**
Date Reported: **2/18/2015**
Client Sample ID: **R# F15B072024 L# CEK810140**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150101**
TRI Control No.: **102556**

		SPECIMENS														
		1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
METHOD	**DESCRIPTION**															
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz)															
	Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		81	82	80	81	84	81	81	81	81	81	81	1	80	84	80 MARV
ASTM D1505	Density (grams/ $cm.^3$)															
		0.9339	0.9332	0.9327								0.9333	0.0006	0.9327	0.9339	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	260	233	233	236	231						239	12	231	260	169 min.
	TD	239	243	270	249	259						252	13	239	270	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	533	500	511	493	491						506	17	491	533	300 min.
	TD	569	564	614	588	615						590	24	564	615	
ASTM D1603	Carbon Black Content (percent, %)															
		2.22	2.83									2.52	0.43	2.22	2.83	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/16/2015**
Date Reported: **2/18/2015**
Client Sample ID: **R# F15B073041 L# CEK810140**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150108**
TRI Control No.: **102576**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		82	81	81	82	81	81	81	82	82	81	81	1	81	82	80 MARV
ASTM D1505	Density (grams/ $cm.^3$)															
		0.9367	0.9367	0.9367								0.9367	0.0000	0.9367	0.9367	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	275	272	255	275	244						264	14	244	275	169 min.
	TD	236	259	249	265	247						251	11	236	265	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	516	515	475	516	464						497	26	464	516	300 min.
	TD	554	576	565	610	579						577	21	554	610	
ASTM D1603	Carbon Black Content (percent, %)															
		2.34	2.29									2.32	0.03	2.29	2.34	2 - 3

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/18/2015**
Date Reported: **2/24/2015**
Client Sample ID: **R#F15B074058 L#CEK810140**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150120**
TRI Control No.: **102739**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		81	81	81	81	81	81	81	81	82	81	81	0	81	82	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9367	0.9367	0.9367								0.9367	0.0000	0.9367	0.9367	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	292	269	288	288	281						284	9	269	292	169 min.
	TD	266	295	194	256	275						257	38	194	295	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	554	508	554	544	541						540	19	508	554	300 min.
	TD	613	659	464	593	630						592	75	464	659	
ASTM D1603	Carbon Black Content (percent, %)															
		2.33	2.27									2.30	0.04	2.27	2.33	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 2.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/18/2015**
Date Reported: **2/24/2015**
Client Sample ID: **R#F15B075075 L#CEK810140**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150120**
TRI Control No.: **102740**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		82	81	81	83	81	81	81	81	82	81	81	1	81	83	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9361	0.9361	0.9361								0.9361	0.0000	0.9361	0.9361	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	245	279	267	272	291						271	17	245	291	169 min.
	TD	275	269	236	272	272						265	16	236	275	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	549	535	524	529	546						537	11	524	549	300 min.
	TD	638	611	558	516	623						589	51	516	638	
ASTM D1603	Carbon Black Content (percent, %)															
		2.31	2.32									2.32	0.01	2.31	2.32	2 - 3

(End of Table 2)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 3.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/18/2015**
Date Reported: **2/24/2015**
Client Sample ID: **R#F15B076092 L#CEM810770**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150120**
TRI Control No.: **102741**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		81	81	81	80	81	81	81	81	81	81	81	0	80	81	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9355	0.9355	0.9355								0.9355	0.0000	0.9355	0.9355	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	260	262	285	236	228						254	23	228	285	169 min.
	TD	281	272	261	252	241						261	16	241	281	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	503	524	560	530	521						528	21	503	560	300 min.
	TD	614	599	578	574	545						582	26	545	614	
ASTM D1603	Carbon Black Content (percent, %)															
		2.36	2.31									2.33	0.04	2.31	2.36	2 - 3

(End of Table 3)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 4.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/18/2015**
Date Reported: **2/24/2015**
Client Sample ID: **R#F15B077110 L#CEM810770**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150120**
TRI Control No.: **102742**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		81	82	81	81	81	82	81	81	81	81	81	0	81	82	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9361	0.9361	0.9361								0.9361	0.0000	0.9361	0.9361	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	278	279	267	269	241						267	15	241	279	169 min.
	TD	242	262	236	275	259						255	16	236	275	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	523	533	525	520	524						525	5	520	533	300 min.
	TD	551	580	543	611	605						578	31	543	611	
ASTM D1603	Carbon Black Content (percent, %)															
		2.31	2.26									2.29	0.04	2.26	2.31	2 - 3

(End of Table 4)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/19/2015**
Date Reported: **2/24/2015**
Client Sample ID: **R#F15B081017 L#CEM810770**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150122**
TRI Control No.: **102746**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		82	82	82	81	81	81	82	82	82	82	81	0	81	82	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9361	0.9361	0.9361								0.9361	0.0000	0.9361	0.9361	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	251	259	261	243	256						254	7	243	261	169 min.
	TD	269	262	258	265	241						259	11	241	269	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	515	541	543	506	529						527	16	506	543	300 min.
	TD	599	591	603	593	541						585	25	541	603	
ASTM D1603	Carbon Black Content (percent, %)															
		2.27	2.32									2.29	0.04	2.27	2.32	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/20/2015**
Date Reported: **2/27/2015**
Client Sample ID: **R#F15B083034 L#CEM810770**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150126**
TRI Control No.: **102761**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		81	82	81	81	81	81	81	81	82	81	81	0	81	82	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9339	0.9348	0.9353								0.9347	0.0007	0.9339	0.9353	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	248	259	249	239	228						245	12	228	259	169 min.
	TD	275	262	264	259	275						267	8	259	275	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	523	521	526	506	478						511	20	478	526	300 min.
	TD	625	613	629	608	639						623	13	608	639	
ASTM D1603	Carbon Black Content (percent, %)															
		2.14	2.25									2.19	0.08	2.14	2.25	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/23/2015**
Date Reported: **2/27/2015**
Client Sample ID: **R#F15B084051 L#CEM810770**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150138**
TRI Control No.: **102800**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994*	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		87	85	90	86	83	82	88	89	89	85	86	3	82	90	80 MARV
ASTM D1505*	Density (grams/ cm.^{3})															
		0.9340	0.9340	0.9340								0.9340	0.0000	0.9340	0.9340	0.939 max.
ASTM D6693* Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	259	282	287	259	286						275	14	259	287	169 min.
	TD	267	274	279	283	270						275	7	267	283	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	497	544	548	515	541						529	22	497	548	300 min.
	TD	634	628	625	628	602						623	12	602	634	
ASTM D1603*	Carbon Black Content (percent, %)															
		2.17	2.18									2.18	0.01	2.17	2.18	2 - 3

**Tested at TRI, TX*

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/24/2015**
Date Reported: **2/27/2015**
Client Sample ID: **R#F15B085068 L#CEM810770**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150139**
TRI Control No.: **102801**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		81	81	82	81	82	81	82	82	81	82	81	0	81	82	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9361	0.9361	0.9361								0.9361	0.0000	0.9361	0.9361	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	260	236	267	229	266						252	18	229	267	169 min.
	TD	263	256	242	272	259						258	11	242	272	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	531	505	546	486	546						523	27	486	546	300 min.
	TD	591	608	588	590	575						590	12	575	608	
ASTM D1603	Carbon Black Content (percent, %)															
		2.26	2.31									2.28	0.03	2.26	2.31	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/26/2015**
Date Reported: **3/5/2015**
Client Sample ID: **R#F15B086085 L#CEM810870**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150158**
TRI Control No.: **102869**

		SPECIMENS														
		1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
METHOD	**DESCRIPTION**															
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"														72 min.
		83	**81**	**81**	**82**	**81**	**81**	**81**	**81**	**82**	**81**	**81**	**1**	**81**	**83**	**80 MARV**
ASTM D1505	Density (grams/ cm.^{3})															
		0.9361	**0.9361**	**0.9361**								**0.9361**	**0.0000**	**0.9361**	**0.9361**	**0.939 max.**
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	**259**	**267**	**305**	**265**	**270**						**273**	**18**	**259**	**305**	**169 min.**
	TD	**278**	**257**	**254**	**265**	**206**						**252**	**27**	**206**	**278**	
	Elongation at Break (percent, %)					*Gauge Length = 2.0 in.*										
	MD	**517**	**528**	**574**	**525**	**555**						**540**	**24**	**517**	**574**	**300 min.**
	TD	**633**	**593**	**581**	**624**	**483**						**583**	**60**	**483**	**633**	
ASTM D1603	Carbon Black Content (percent, %)															
		2.39	**2.20**									**2.29**	**0.13**	**2.20**	**2.39**	**2 - 3**

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

TABLE 2.

MATERIAL PROPERTIES

CLIENT: AMEC Foster Wheeler Environment & Infrastructure

PROJECT: Cripple Creek/Squaw Gulch Valley

Date Received: **2/26/2015**
Date Reported: **3/5/2015**
Client Sample ID: **R#F15B087103 L#CEM810870**
Material Description: **80mil LLDPE Microspike Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G150158**
TRI Control No.: **102870**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5994	Thickness (mils)															
	Apparatus: Dead-weight dial micrometer with gauge points tapered at an angle of 60° +/- 2° to the horizontal with the tip rounded to a radius of 0.8+/-0.1 mm(0.031+/-0.004 in), with a specified force of 0.56+/-0.05 N (2+/-0.2 oz) Loading Time: 5 sec Specimen Size: 4" x 4"															72 min.
		82	81	81	81	81	81	81	81	81	81	81	0	81	82	80 MARV
ASTM D1505	Density (grams/ cm.^{3})															
		0.9367	0.9367	0.9367								0.9367	0.0000	0.9367	0.9367	0.939 max.
ASTM D6693 Type IV	Tensile Properties:															
	Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2° C (73.4+/-3.6° F), and 50+/-5% relative humidity. Rate of Separation: 2"/min															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	272	273	295	262	254						271	15	254	295	169 min.
	TD	258	239	266	254	272						258	13	239	272	
	Elongation at Break (percent, %) *Gauge Length = 2.0 in.*															
	MD	539	513	554	524	512						528	18	512	554	300 min.
	TD	603	547	611	578	619						591	29	547	619	
ASTM D1603	Carbon Black Content (percent, %)															
		2.27	2.16									2.22	0.08	2.16	2.27	2 - 3

(End of Table 2)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

1160 North Gilbert Street, Anaheim, CA 92801, www.precisionlabs.net
Precision Geosynthetic Laboratories International dba TRI Environmental, Inc.

Appendix K.2

40-mil LLDPE Smooth Geomembrane Conformance Results

TABLE 1.

MATERIAL PROPERTIES

CLIENT: AMEC

PROJECT: Cripple Creek

Date Received: **10/9/2014**
Date Reported: **10/13/2014**
Client Sample ID: **R#F14D402025 L#CEH810040**
Material Description: **40mil LLDPE Smooth Geomembrane**

QC'd By: Maria Espitia
TRI Job No.: **G141050**
TRI Control No.: **100853**

METHOD	DESCRIPTION	SPECIMENS 1	2	3	4	5	6	7	8	9	10	Avg.	Std. Dev.	Min	Max	Proj. Specs.
ASTM D5199	Thickness (mils)															
Procedure B	*Apparatus:Dead weight dial Micrometer with 6.35 mm (0.250 in) dia presser foot and a pressure of 43.10 kPA (6.38 psi) provided by a 142 gm dead weight. Loading time: 5 sec Specimen Size: 10pcs.-3in. Diameter.*															38 min.
		42	42	43	41	43	42	42	42	43	42	42	1	41	43	40 min. ave.
ASTM D1505	Density (grams/ cm.^{3})															
		0.9346	0.9346	0.9346								0.9346	0.0000	0.9346	0.9346	0.939 max.
ASTM D6693	Tensile Properties:															
Type IV	*Test Specimens: Type IV, Width of narrow section:0.25in, Length of narrow section:1.3in, Width Overall:0.75in, Length Overall: 4.5in Conditioning: Conducted test in standard laboratory atmosphere of 23+/-2^0 C (73.4+/-3.6^0 F), and 50+/-5% relative humidity. Rate of Separation: 2"/min*															
	Tensile Strength at Break (lbs/ in.- width)															
	MD	226	228	238	215	230						227	8	215	238	140 min.
	TD	212	229	216	219	212						218	7	212	229	
	Elongation at Break (percent, %) *Gauge Length = 2.5 in. (NSF Modified)*															
	MD	748	760	831	717	795						770	44	717	831	650 min.
	TD	729	831	766	747	726						760	43	726	831	
ASTM D1603	Carbon Black Content (percent, %)															
		2.30	2.31									2.30	0.00	2.30	2.31	2 - 3

(End of Table 1)

LEGENDS:
MD - MACHINE DIRECTION
TD- TRANSVERSE DIRECTION

Appendix K.3

80-mil LLDPE DSMS Exposed Geomembrane Conformance Technical Memorandum & Test Results

Technical Memorandum

To:	Ron Roberts (CC&V)	Date:	June 11, 2015
From:	Andrea Meduna, PE (Amec Foster Wheeler)	Project No.:	74201125N0.****.****
cc:	Ron DiDonato (CC&V) Scott Redabaugh, (CC&V) Jeff Gaul, (CC&V) Robert Redd, (Amec Foster Wheeler)		
Re:	Test Results of Exposed LLDPE Geomembrane Liner in Phase 1 of SGVLF		

BACKGROUND

This memorandum presents the results of laboratory testing conducted on two samples of 80-mil double-sided textured Linear Low Density Polyethylene (LLDPE) geomembrane deployed on the east side ("Victor Side") of the Phase 1 Squaw Gulch Valley Leach Facility (SGVLF) (refer to AMEC drawing A200) from October 8, 2014 through November 6, 2014 that has been left exposed to ultraviolet radiation to the present date (approximately 217 to 246 days). According to the project technical specification outlined below, the geomembrane cannot be exposed for longer than 180 days.

Section 02776.0 Geomembrane
- 3.06 Fill Placement,
  - H. Drain Cover Fill,
    7. Contractor shall place drain cover fill at a rate such that the geomembrane liner is not exposed to ultraviolet light for more than 180 days.

After deployment of the geomembrane, it was recommended by Amec Foster Wheeler to cover the geomembrane liner prior to winter to protect from clay and rocks rolling onto the deployed geomembrane, ultraviolet light, and the overall exposure to the elements. As of May 6, 2015, a majority of the geomembrane liner in the area stated above had not been covered with drain cover fill material as required.

It was recommended by Amec Foster Wheeler to either remove all geomembrane liner exposed for more than 180 days or perform testing on geomembrane from each resin lot (two) that had been deployed. Amec Foster Wheeler sampled areas of the deployed geomembrane liner from the two resin lots that had been deployed to perform testing. After the samples were taken the holes in the geomembrane liner were repaired.

Amec Foster Wheeler Environment & Infrastructure, Inc.
2000 S. Colorado Blvd., Suite 2-1000
Denver, CO 80222
Tel: +1 (303) 935-6505
Fax: +1 (303) 935-6575
amecfw.com

Continued.

The laboratory testing consisted of the following:

- ASTM D5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes
- ASTM D1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique
- ASTM D1603 Standard Method for Carbon Black Content in Olefin Plastics
- ASTM D638/GRI GM 17, Type IV Standard Test Method for Tensile Properties of Plastics

The purpose of the testing is to evaluate the integrity of the geomembrane liner after being exposed to ultraviolet light/sunlight, rain, snow, and wind. Testing was performed by TRI Environmental, Inc. to remain consistent with the initial conformance testing.

GEOMEMBRANE PROPERTY TESTING

The above testing procedures were performed on the two samples taken from the exposed geomembrane. The exposed geomembrane liner test results were compared to the same resin lot and nearest roll number that was tested after manufacturing as part of the third party conformance testing program. The test results are presented in Table 1 and attached to this memorandum. The test results suggest the exposed LLDPE geomembrane liner still meet the minimum requirements of the technical specifications.

Table 1. Geomembrane Testing Results

Roll Number	Lot Number	Average Thickness (mils)	Average Density g/cm^3)	Carbon Black (%)	Avg. Break Strength Machine Direction (ppi)	Avg. Break Strength Transverse Direction (ppi)	Avg. Break Elongation Machine Direction (%)	Avg. Break Elongation Transverse Direction (%)
F14A251011	CEE810110	84.6	0.938	2.43	253	267	536	527
F14A251004	CEE810110	82	0.932	2.49	269	266	537	595
F14A242028	CEE810120	85.7	0.938	2.35	268	259	517	565
F14A242020	CEE810120	82	0.931	2.34	263	245	517	561
Specification		80	0.939	2 to 3	169	169	300	300

Exposed geomembrane sample test results
Testing results from nearest roll produced during conformance testing

CONCLUSIONS

The following conclusions are based on the attached laboratory test results:

- There is no evidence indicating a significant reduction in material properties of the exposed geomembrane.

Continued.

- The difference of tested material properties of the third party conformance samples and the exposed geomembrane liner is relatively small.
- Exposed geomembrane liner properties still exceed the minimum requirements of the project technical specifications.

RECOMMENDATIONS

The following recommendations are offered based on the attached laboratory test results:

- Allow the deployed geomembrane liner to remain in-place.
- Amec Foster Wheeler Representatives will visually inspect the area prior and during drain cover fill placement for any anomalies that could be due to being left exposed.
    - Should any area be suspect, Amec Foster Wheeler will sample the area and wait for laboratory testing. All costs associated with removal of material over failed liner should be the responsibility of the contractor based on their decision to leave it exposed for longer than the allowable 180 days.
- The geomembrane liner exposed for greater than 180 days within the Phase 1 SGVLF should be covered with drain cover fill as soon as possible for protection against ultraviolet radiation.

GEOMEMBRANE TEST RESULTS

TRI Client: Amec Foster Wheeler
Project: Cripple Creek / Squaw Gulch / CALIPROJECT7755

Material: 80 mil Microspike LLDPE Geomembrane
Sample Identification: P - 103 **Roll: 251011** **Lot: 810110**
TRI Log #: E2400-74-01

PARAMETER	TEST REPLICATE NUMBER										MEAN	STD. DEV.	
	1	2	3	4	5	6	7	8	9	10			
Thickness (ASTM D 5994)											Spec: Average:80		
Thickness (mils)	88.3	81.9	82.8	81.5	82.2	81.6	83.2	87.4	88.5	89.0	**84.6**	3	
									Initial Average: 82		**81.5**	<< min	
Density (ASTM D 1505)											Spec: 0.939 (max)		
Density (g/cm3)	0.938	0.938	0.938					Initial Average 0.9320			**0.938**	0.000	
Carbon Black Content (ASTM D 1603, mod.)											Spec: Range 2-3		
% Carbon Black	2.42	2.43							Initial Test: 2.49		**2.43**	0.01	
Tensile Properties (ASTM D 638/GRI GM 17, 2 ipm strain rate, Type IV specimen - LLDPE)													
MD Yield Strength (ppi)	177	180	178	171	164						**174**	7	
TD Yield Strength (ppi)	178	177	177	175	169						**175**	4	
MD Break Strength (ppi)	256	207	243	278	283				Initial Avg: 269		**253**	31	Spec: 169 (min)
TD Break Strength (ppi)	277	266	261	260	270				Initial Avg: 266		**267**	7	
MD Yield Elongation (%)	20	22	21	22	21						**21**	1	
TD Yield Elongation (%)	23	24	21	23	24						**23**	1	
MD Break Elongation (%)	542	428	507	597	606				Initial Avg: 537		**536**	73	Spec: 300 (min)
TD Break Elongation (%)	546	523	514	516	538				Initial Avg: 595		**527**	14	

MD Machine Direction TD Transverse Direction

TRI ENVIRONMENTAL, INC.
9063 BEE CAVES RD. – AUSTIN, TX 78733 – USA | PH: 800.880.TEST OR 512.263.2101

GEOMEMBRANE TEST RESULTS

TRI Client: Amec Foster Wheeler
Project: Cripple Creek / Squaw Gulch / CALIPROJECT7755

Material: 80 mil Microspike LLDPE Geomembrane
Sample Identification: P - 65 **Roll: 242028** **Lot: 810120**
TRI Log #: E2400-74-01

PARAMETER	TEST REPLICATE NUMBER										MEAN	STD. DEV.	
	1	2	3	4	5	6	7	8	9	10			
Thickness (ASTM D 5994)											Spec: Average:80		
Thickness (mils)	84.9	86.6	81.2	88.2	86.1	86.2	87.1	81.6	86.9	88.2	**85.7**	2	
									Initial Avg: 82		**81.2**	<< min	
Density (ASTM D 1505)											Spec: 0.939 (max)		
Density (g/cm3)	0.938	0.938	0.938						Initial Test 0.9310		**0.938**	0.000	
Carbon Black Content (ASTM D 1603, mod.)											Spec: Range 2-3		
% Carbon Black	2.34	2.36							Initial Test: 2.34		**2.35**	0.01	
Tensile Properties (ASTM D 638/GRI GM 17, 2 ipm strain rate, Type IV specimen - LLDPE)													
MD Yield Strength (ppi)	156	157	160	159	158						**158**	2	
TD Yield Strength (ppi)	166	169	176	175	172						**172**	4	
MD Break Strength (ppi)	273	259	268	281	260				Initial Avg: 263		**268**	9	Spec: 169 (min)
TD Break Strength (ppi)	264	239	263	271	259				Initial Avg: 245		**259**	12	
MD Yield Elongation (%)	30	29	26	26	26						**27**	2	
TD Yield Elongation (%)	21	20	18	20	19						**20**	1	
MD Break Elongation (%)	529	496	507	546	508				Initial Avg: 517		**517**	20	Spec: 300 (min)
TD Break Elongation (%)	573	522	571	592	569				Initial Avg: 561		**565**	26	

MD Machine Direction TD Transverse Direction

TRI ENVIRONMENTAL, INC.
9063 BEE CAVES RD. – AUSTIN, TX 78733 – USA | PH: 800.880.TEST OR 512.263.2101