Kacy Murillo (adpce.ad)

Subject: RE: Eco-Vista Class 4 Landfill - Cell 8A Notification of Construction

From: Brad Fureigh [mailto:bfureigh@promusengineering.com]
Sent: Tuesday, March 28, 2023 6:00 PM
To: Annette Cusher (adpce.ad) <Annette.Cusher@adeq.state.ar.us>
Cc: David Conrad <dconrad@wm.com>; Simmons, Carl <CSimmons@wm.com>; Blake Small <bsmall@wm.com>; dtenniso@wm.com; Reynolds, Jodi <jreyno10@wm.com>
Subject: Eco-Vista Class 4 Landfill - Cell 8A Notification of Construction

Good afternoon Annette,

Please see attached the notification of construction schedule for proposed Cell 8A at the Eco-Vista Class 4 Landfill. Please feel free to contact us at your convenience if you have any questions concerning this notification.

Thanks!

Brad N. Fureigh, PE
Principal Engineer | Promus Engineering, LLC
M: (501) 554-4547
bfureigh@promusengineering.com
www.promusengineering.com

PROMUS ENGINEERING

95 Arlington Dr.
Ward, AR 72176

T. (888) 811-9066
www.promusengineering.com

March 28, 2023

Ms. Annette Cusher, P.E.
Office of Land Resources, Facility Permits
Arkansas Energy & Environment
Division of Environmental Quality
5301 Northshore Drive
North Little Rock, Arkansas 72118
via Email: cusher@adeq.state.ar.us

RE: Notification of Construction Schedule
Eco-Vista Class 4 Landfill – Cell 8A Construction
AFIN: 72-00144; Permit No. 0290-S4-R2

Dear Ms. Cusher:

On behalf of our client, Eco-Vista, LLC, Promus Engineering, LLC is notifying the Arkansas Energy & Environment, Division of Environmental Quality (DEQ) of the tentative schedule for construction of the bottom liner and leachate collection system for Cell 8A at the Eco-Vista Class 4 Landfill.

Notification of Construction Schedule

This notification is being submitted in accordance with Site Specific Permit Condition 7. The clay liner and leachate collection system construction activities are planned to begin around April 1, 2023 with substantial completion planned for approximately July 2023. This schedule is considered tentative and may change due to weather delays. Construction of Cell 8A will generally consist of installing roughly 5.5-acres of compacted clay bottom liner and leachate collection system.

Below is a list of companies that will be coordinating construction activities during construction of Cell 8A.

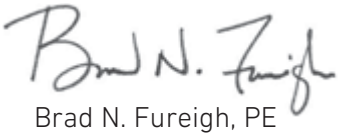
General Contractor:	SFC Contract Services
Geosynthetics Installer:	Lone Star Lining Company
CQA Services:	Promus Engineering, LLC
Surveying:	Mason Surveying & Consulting, LLC

The Earthwork Contractor has completed and documented more than 500,000 square feet of clay liner during the last three years and as a result, Promus is requesting that the DEQ waive the test fill requirements described by Regulation 22.428(c)(11) via Regulation 22.624. Following construction of Cell 8A, a documentation report will be submitted to the DEQ in accordance with Site Specific Permit Condition 8. A separate construction notification will be provided to the DEQ Office of Water Quality in accordance with Site Specific Permit Condition 6.

If you have any questions regarding this construction notification, please contact me via phone at 501.554.4547 or e-mail at bfureigh@promusengineering.com.

Sincerely,

PROMUS ENGINEERING, LLC



Brad N. Fureigh, PE
Principal Engineer

Attached: Eco-Vista Class 4, Cell 8A Construction Drawings & Technical Specifications

cc: David Conrad – WM, Engineer
Carl Simmons – WM, Sr. District Manager
Blake Small – WM, District Manager
Jodi Reynolds – WM, Environmental Protection Manager
Permanent Operating Record

Cell 8A Construction Drawings & Technical Specifications

220207

CELL 8A CONSTRUCTION DRAWINGS

ECO VISTA LANDFILL

2210 WASTE MANAGEMENT DRIVE
TONTITOWN, ARKANSAS 72762
SITE ENTRANCE AT:
N 36° 08" 38.40" (36.143999°)
W 94° 15' 20.92" (-94.255811°)

PROMUS PROJECT NUMBER: 220124

PREPARED BY:

PROMUS ENGINEERING

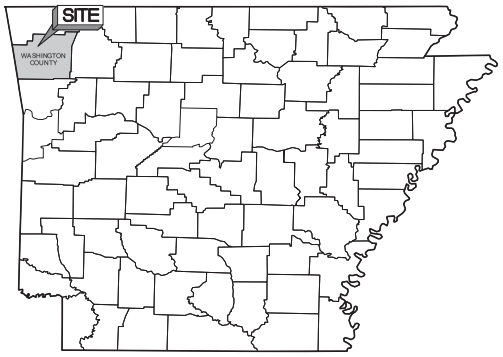
WWW.PROMUSENGINEERING.COM | PHONE: (888) 811-9066

PREPARED FOR:

ECO-VISTA, LLC

WASTE MANAGEMENT

OWNER CONTACT: MR. DAVID CONRAD
ENGINEER, MID-SOUTH AREA
100 TWO PINE DRIVE, NORTH LITTLE ROCK, ARKANSAS



VICINITY MAP

SITE LOCATION MAP

DRAWINGS SHEETS

Sheet Number	Sheet Title
1	COVER SHEET
2	EXISTING CONDITIONS
3	PROPOSED SUBGRADE GRADING PLAN
4	PROPOSED CLAY LINER GRADING PLAN
5	PROPOSED EROSION AND SEDIMENT CONTROL PLAN
6	COMPONENT THICKNESS CERTIFICATION PLAN
7	CROSS-SECTIONS
8	CONSTRUCTION DETAILS I
9	CONSTRUCTION DETAILS II

REV | DATE | DES. BY | DRA. BY | APPR. BY | DESCRIPTION

PREPARED FOR: WASTE MANAGEMENT

PREPARED BY: PROMUS ENGINEERING www.promusengineering.com

COVER SHEET

CELL 8-I CONSTRUCTION DRAWINGS
ECO VISTA CLASS 4 LANDFILL
TONTITOWN, ARKANSAS

PROJECT NO.: 220124
SHEET NUMBER
1

Last Saved By: JAMES Date: 7/1/2022 4:42 PM File Path: M:\PROJECTS-ACTIVE\220124-WMEV-ECOVISTA-C4-CELL8-DESIGN\DRAWINGS\01-COVER SHEET.DWG

REV	DATE	DES. BY	DRA. BY	APPR. BY	DESCRIPTION
-	-	-	-	-	-

PREPARED FOR: WM WASTE MANAGEMENT

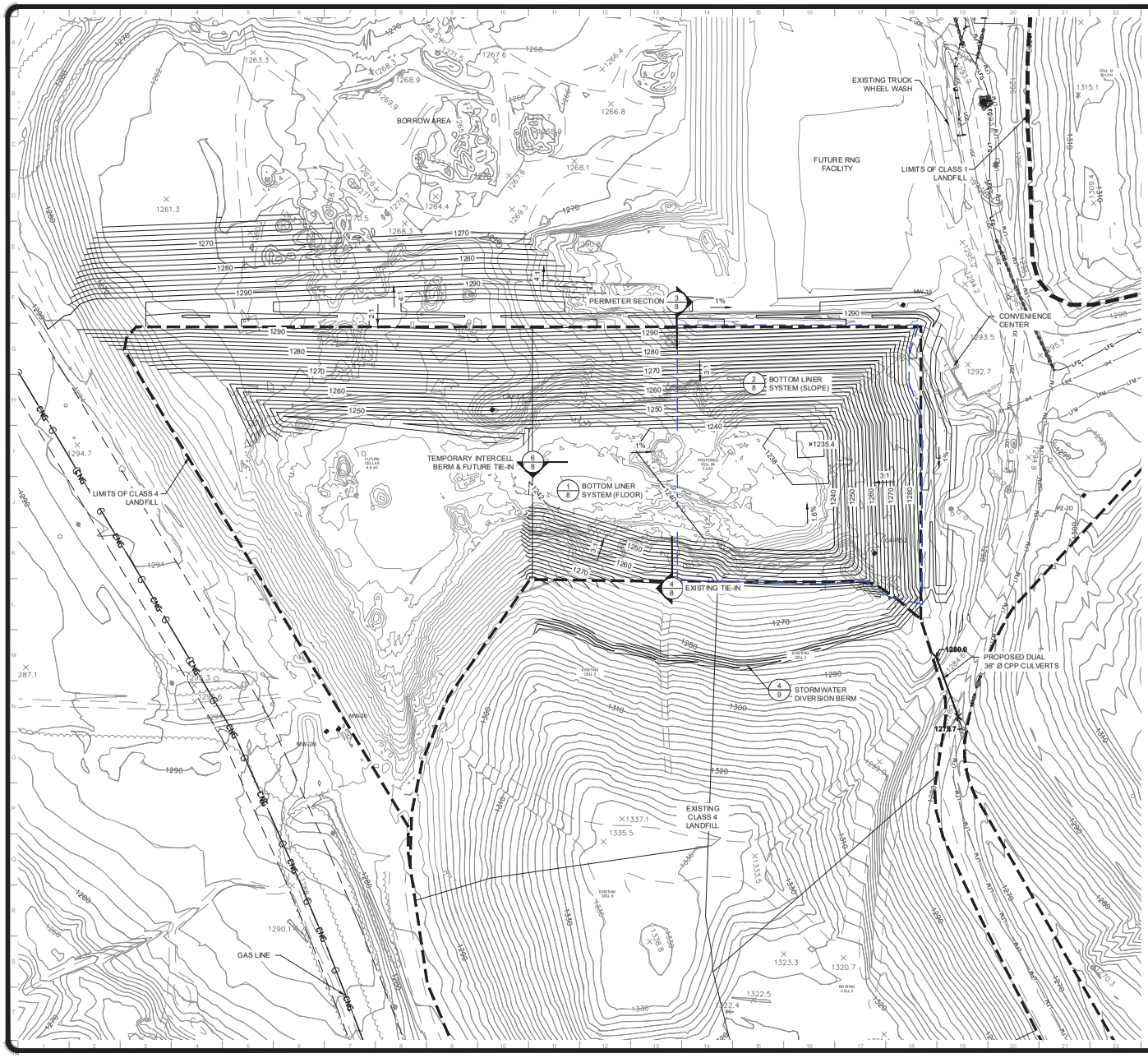
PREPARED BY: PROMUS ENGINEERING
www.promusengineering.com

CELL 8-I CONSTRUCTION DRAWINGS
ECO VISTA CLASS 4 LANDFILL
TONTITOWN, ARKANSAS

EXISTING CONDITIONS

PROJECT NO. 220124
SHEET NUMBER 2

Last Saved By: JAMES Date: 7/11/2022 11:55 AM File Path: M:\PROJECTS-ACTIVE\220124-WMEV-ECOVISTA-C4-CELL8-DESIGN\DRAWINGS\02-EXISTING CONDITIONS.DWG



LEGEND

- PROPERTY BOUNDARY
- PERMITTED LIMITS OF WASTE
- CELL LIMITS
- CELL 1 — LANDFILL CELL DESIGNATION
- 1000 — EXISTING CONTOURS
- 1000 — PROPOSED CONTOURS

NOTES:

1. THE COORDINATE GRID AND SURVEY MONUMENT LOCATIONS SHOWN IN THESE PLANS ARE BASED ON ARKANSAS STATE PLANE COORDINATE SYSTEM, NAD-83, NORTH ZONE, US FOOT. ELEVATIONS ARE SHOWN IN FEET ABOVE MEAN SEA LEVEL.
2. PROPERTY BOUNDARY, WASTE LIMITS, PROPOSED GRADES AND DISPOSAL AREA WERE OBTAINED FROM PERMIT DRAWINGS PREPARED BY FTN AND ASSOCIATES, DATED JULY 2021 (DEQ DOC 80453).
3. EXISTING TOPOGRAPHY WAS OBTAINED FROM THE FLYOVER SURVEY PERFORMED BY SOUTHERN RESOURCES MAPPING CORPORATION DATED DECEMBER 2, 2021 AND GROUND SURVEY PERFORMED BY MASON SURVEYING DATED MAY 22, 2022. THE 2021 SURVEY WAS MERGED WITH THE 2022 SURVEY IN THE CELL 8A AND SURROUNDING AREA.
4. CONTRACTOR IS RESPONSIBLE FOR MANAGING ALL STORMWATER IN RELATION TO THE CELL CONSTRUCTION WORK INCLUDING, BUT NOT LIMITED TO, DE-WATERING CELL AND RELATED BORROW PITS.
5. CONTRACTOR IS RESPONSIBLE FOR VERIFICATION OF EXISTING CONDITIONS SHOWN ON THIS DRAWING AND LOCATIONS OF UNDERGROUND UTILITIES PRIOR TO INITIATING CONSTRUCTION.
6. CONTRACTOR SHALL VERIFY THE LOCATION OF EXISTING ANCHOR TRENCHES, FORCE MAINS, UTILITIES, AND OTHER FEATURES ALONG PREVIOUSLY CONSTRUCTED CELLS PRIOR TO DITCH EXCAVATIONS, PIPE INSTALLATIONS, ROAD CONSTRUCTION OR OTHER WORK.
7. CONTRACTOR SHALL STABILIZE EXTERIOR SLOPES AND DISTURBED AREA OUTSIDE CELL LINER LIMITS WITH VEGETATION OR OTHER PERMANENT MEASURES (RIPRAP, ETC.) AS SOON AS PRACTICAL.
8. DO NOT DAMAGE EXISTING MONITORING WELLS/PROBES. THE CONTRACTOR WILL BE RESPONSIBLE FOR ANY COST (REPLACEMENT, PERMITTING, SAMPLING, ETC.) ASSOCIATED WITH REESTABLISHING THE MONITORING FEATURE, IF DAMAGED.

REV	DATE	DES. BY	DRA. BY	APPR. BY	DESCRIPTION
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PREPARED FOR: WM WASTE MANAGEMENT

PREPARED BY: PROMUS ENGINEERING www.promusengineering.com

PROPOSED SUBGRADE GRADING PLAN

CELL 8-I CONSTRUCTION DRAWINGS
ECO VISTA CLASS 4 LANDFILL
TONTITOWN, ARKANSAS

PROJECT NO.: 220124

SHEET NUMBER 3

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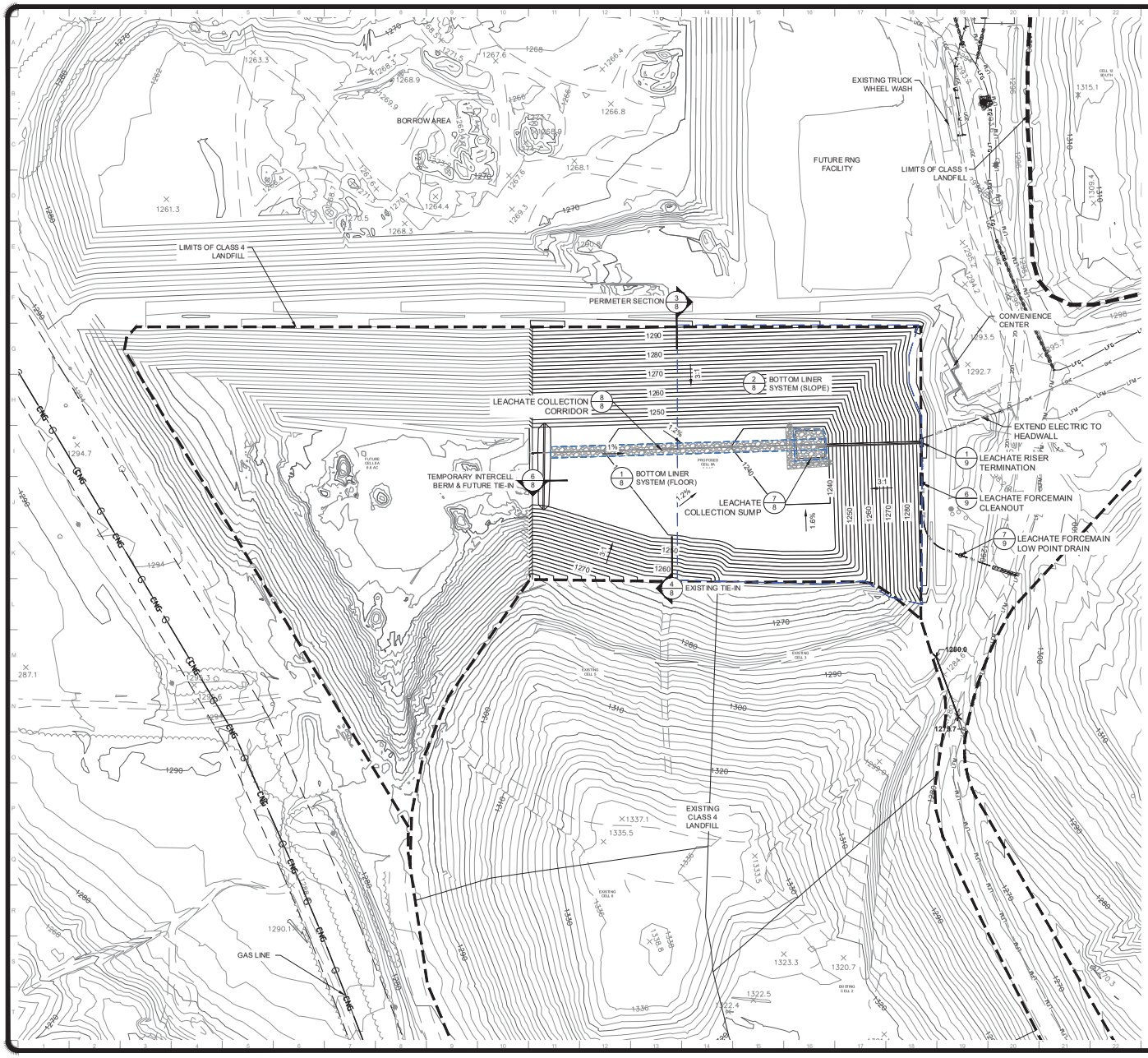

NOTES:

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7. CONTRACTOR SHALL STABILIZE EXTERIOR SLOPES AND DISTURBED AREA OUTSIDE CELL LINER LIMITS WITH VEGETATION OR OTHER PERMANENT MEASURES (RIPRAP, ETC.) AS SOON AS PRACTICAL.
8. DO NOT DAMAGE EXISTING MONITORING WELLS/PROBES. THE CONTRACTOR WILL BE RESPONSIBLE FOR ANY COST (REPLACEMENT, PERMITTING, SAMPLING, ETC.) ASSOCIATED WITH REESTABLISHING THE MONITORING FEATURE, IF DAMAGED.

REV	DATE	DES. BY	DRA. BY	APPR. BY	DESCRIPTION
-	-	-	-	-	-

PREPARED FOR: WASTE MANAGEMENT

PREPARED BY: PROMUS ENGINEERING www.promusengineering.com

PROPOSED CLAY LINER GRADING PLAN

CELL 8-I CONSTRUCTION DRAWINGS
ECO VISTA CLASS 4 LANDFILL
TONTITOWN, ARKANSAS

PROJECT NO.: 220124

SHEET NUMBER
4

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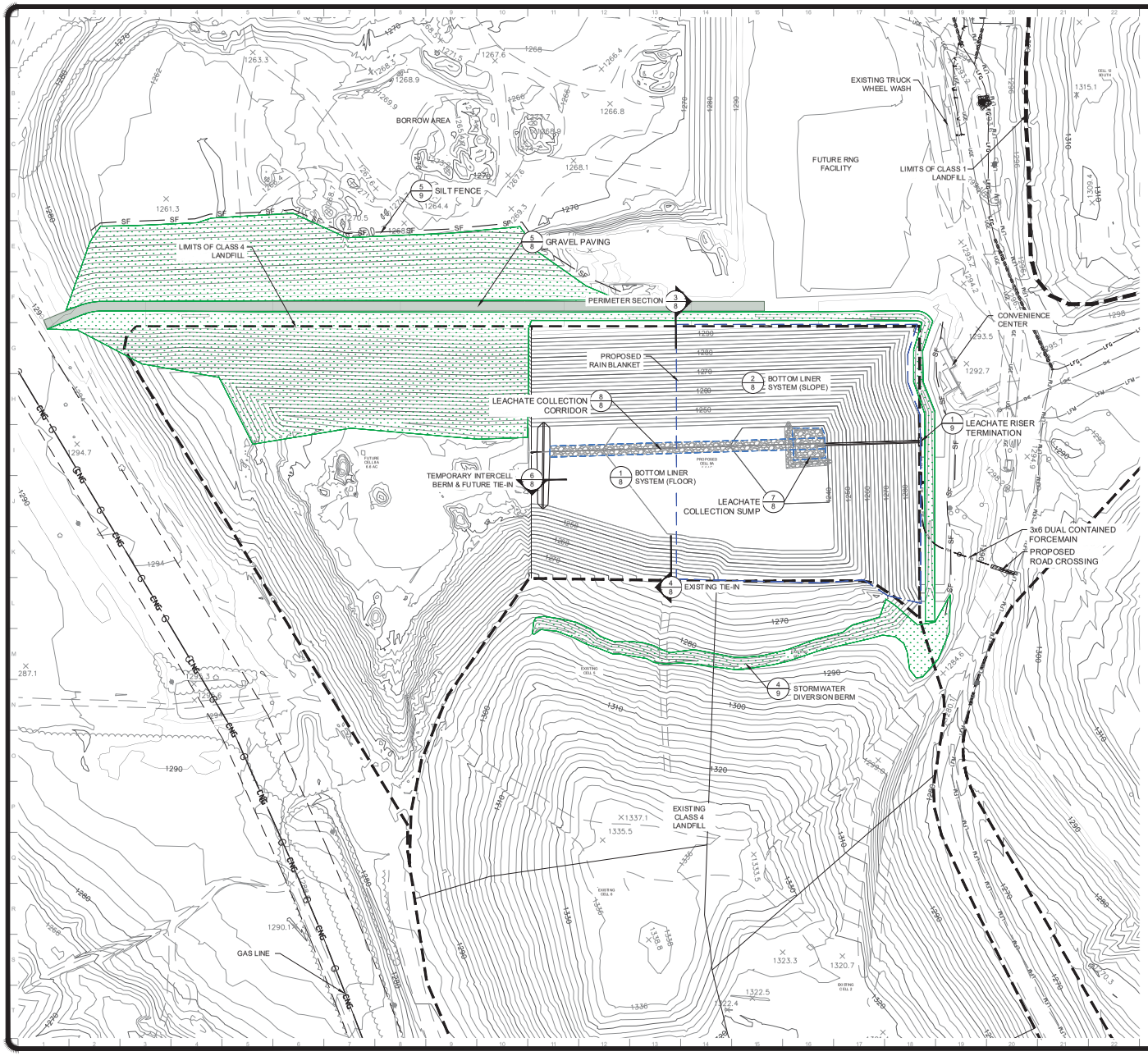

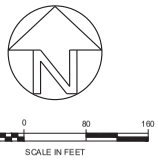

TABLE 1	
HDPE PIPE DR	MINIMUM LONG TERM COLD BENDING RADIUS OF HDPE
9 OR LESS	20 X PIPE OD
11, 13.5	25 X PIPE OD
17, 21	27 X PIPE OD
26	34 X PIPE OD
32.5	42 X PIPE OD
41	52 X PIPE OD
FITTING OR FLANGE PRESENT	100 X PIPE OD

LEGEND

- PROPERTY BOUNDARY
- PERMITTED LIMITS OF WASTE
- CELL LIMITS
- CELL 1 — LANDFILL CELL DESIGNATION
- 1000 — EXISTING CONTOURS
- 1000 — PROPOSED CONTOURS
- AREA OF SEEDING
- GRAVEL PAVING
- SF — SILT FENCE

NOTES:

1. THE COORDINATE GRID AND SURVEY MONUMENT LOCATIONS SHOWN IN THESE PLANS ARE BASED ON ARKANSAS STATE PLANE COORDINATE SYSTEM, NAD-83, NORTH ZONE, US FOOT. ELEVATIONS ARE SHOWN IN FEET ABOVE MEAN SEA LEVEL.
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REV	DATE	DES. BY	DRA. BY	APPR. BY	DESCRIPTION

PREPARED FOR: WASTE MANAGEMENT

PREPARED BY: PROMUS ENGINEERING www.promusengineering.com

PROPOSED EROSION AND SEDIMENT CONTROL PLAN

CELL 8-I CONSTRUCTION DRAWINGS
ECO VISTA CLASS 4 LANDFILL
TONTITOWN, ARKANSAS

PROJECT NO.: 220124

SHEET NUMBER
5

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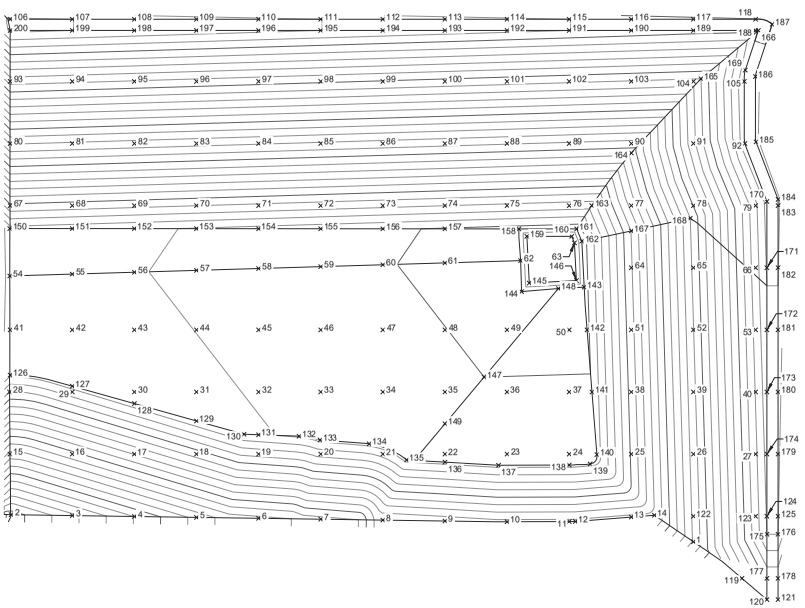

CERTIFICATION NOTES:

1. SURVEYOR SHALL "STACK" POINTS (i.e. USE SAME NORTHING AND EASTING) FOR THICKNESS VERIFICATION OF LINER SYSTEM COMPONENTS.
2. THICKNESS SHALL BE MEASURED PERPENDICULAR TO THE SURFACE. MINIMUM THICKNESS OF LINER COMPONENTS ON SLOPE SHALL BE ADJUSTED TO ACCOUNT FOR SLOPE (I.E. 2.108 FEET MINIMUM THICKNESS FOR RECOMPACTED SOIL LINER ON SLOPES, AND 1.05 FEET MINIMUM THICKNESS FOR PROTECTIVE COVER ON SLOPES).
3. HORIZONTAL TOLERANCE FOR ALL POINTS SHALL BE 0.1 FEET.
4. VERTICAL TOLERANCES SHALL BE AS FOLLOWS:
   - SUBGRADE: AT OR BELOW DESIGN DESIGN GRADE. ALLOWABLE BELOW GRADE DEPTHS CREATING A THICKER CLAY LINER ARE AT THE DISCRETION OF THE CQA ENGINEER.
   - SOIL LINER: 0.0 TO 0.1 FEET **ABOVE** DESIGN AND MEETING MINIMUM THICKNESS.
   - PC / DRAINAGE LAYER: 0.0 TO 0.1 FEET **ABOVE** DESIGN AND MEETING MINIMUM THICKNESS.

Point Table

Point #	Description	Elevation	Northing	Easting
1	CLAY	1266.25	664420.93	645124.84
2	CLAY	1281.00	664442.75	644575.60
3	CLAY	1276.50	664442.02	644624.84
4	CLAY	1271.93	664441.29	644674.84
5	CLAY	1267.36	664440.56	644724.84
6	CLAY	1264.52	664439.83	644774.84
7	CLAY	1262.67	664439.09	644824.84
8	CLAY	1257.90	664438.36	644874.84
9	CLAY	1257.18	664437.63	644924.84
10	CLAY	1256.59	664437.05	644974.84
11	CLAY	1256.59	664437.22	645024.84
12	CLAY	1256.59	664437.24	645029.79
13	CLAY	1256.37	664440.81	645074.84
14	CLAY	1256.29	664442.29	645093.42
15	CLAY	1264.75	664491.51	644574.68
16	CLAY	1260.70	664491.51	644624.84
17	CLAY	1255.90	664491.51	644674.84
18	CLAY	1251.09	664491.51	644724.84
19	CLAY	1247.34	664491.51	644774.84
20	CLAY	1245.26	664491.51	644824.84
21	CLAY	1243.18	664491.51	644874.84
22	CLAY	1240.99	664491.51	644924.84
23	CLAY	1241.03	664491.51	644974.84
24	CLAY	1241.10	664491.51	645024.84
25	CLAY	1250.29	664491.51	645074.84
26	CLAY	1266.95	664491.51	645124.84
27	CLAY	1283.61	664491.51	645174.84
28	CLAY	1248.08	664541.51	644574.37
29	CLAY	1244.74	664541.51	644624.84
30	CLAY	1242.84	664541.51	644674.84

Point Table

Point #	Description	Elevation	Northing	Easting
31	CLAY	1242.38	664541.51	644724.84
32	CLAY	1241.87	664541.51	644774.84
33	CLAY	1241.38	664541.51	644824.84
34	CLAY	1240.89	664541.51	644874.84
35	CLAY	1240.40	664541.51	644924.84
36	CLAY	1240.20	664541.51	644974.84
37	CLAY	1240.23	664541.51	645024.84
38	CLAY	1250.79	664541.51	645074.84
39	CLAY	1267.45	664541.51	645124.84
40	CLAY	1284.11	664541.51	645174.84
41	CLAY	1243.48	664591.51	644574.84
42	CLAY	1242.95	664591.51	644624.84
43	CLAY	1242.47	664591.51	644674.84
44	CLAY	1241.98	664591.51	644724.84
45	CLAY	1241.49	664591.51	644774.84
46	CLAY	1241.00	664591.51	644824.84
47	CLAY	1240.51	664591.51	644874.84
48	CLAY	1240.02	664591.51	644924.84
49	CLAY	1239.53	664591.51	644974.84
50	CLAY	1239.42	664591.51	645024.84
51	CLAY	1251.29	664591.51	645074.84
52	CLAY	1267.95	664591.51	645124.84
53	CLAY	1284.61	664591.51	645174.84
54	CLAY	1243.12	664634.88	644574.54
55	CLAY	1242.62	664636.39	644624.84
56	CLAY	1242.12	664637.89	644674.84
57	CLAY	1241.62	664639.39	644724.84
58	CLAY	1241.12	664640.89	644774.84
59	CLAY	1240.61	664642.39	644824.84
60	CLAY	1240.11	664643.89	644874.84

Point Table

Point #	Description	Elevation	Northing	Easting
61	CLAY	1239.61	664645.40	644924.84
62	CLAY	1239.01	664647.22	644985.73
63	CLAY	1237.00	664661.52	645029.03
64	CLAY	1251.79	664641.51	645074.84
65	CLAY	1268.45	664641.51	645124.84
66	CLAY	1285.11	664641.51	645174.84
67	CLAY	1249.53	664691.51	644574.84
68	CLAY	1249.03	664691.51	644624.84
69	CLAY	1248.53	664691.51	644674.84
70	CLAY	1248.03	664691.51	644724.84
71	CLAY	1247.53	664691.51	644774.84
72	CLAY	1247.03	664691.51	644824.84
73	CLAY	1246.53	664691.51	644874.84
74	CLAY	1246.03	664691.51	644924.84
75	CLAY	1245.53	664691.51	644974.84
76	CLAY	1245.03	664691.51	645024.84
77	CLAY	1254.69	664691.51	645074.84
78	CLAY	1270.08	664691.51	645124.84
79	CLAY	1285.61	664691.51	645174.84
80	CLAY	1266.19	664741.51	644574.84
81	CLAY	1265.69	664741.51	644624.84
82	CLAY	1265.19	664741.51	644674.84
83	CLAY	1264.69	664741.51	644724.84
84	CLAY	1264.19	664741.51	644774.84
85	CLAY	1263.69	664741.51	644824.84
86	CLAY	1263.19	664741.51	644874.84
87	CLAY	1262.69	664741.51	644924.84
88	CLAY	1262.19	664741.51	644974.84
89	CLAY	1261.69	664741.51	645024.84
90	CLAY	1261.19	664741.51	645074.84

Point Table

Point #	Description	Elevation	Northing	Easting
91	CLAY	1275.47	664741.51	645124.84
92	CLAY	1289.14	664741.51	645166.28
93	CLAY	1282.85	664791.51	644574.84
94	CLAY	1282.35	664791.51	644624.84
95	CLAY	1281.85	664791.51	644674.84
96	CLAY	1281.35	664791.51	644724.84
97	CLAY	1280.85	664791.51	644774.84
98	CLAY	1280.35	664791.51	644824.84
99	CLAY	1279.85	664791.51	644874.84
100	CLAY	1279.35	664791.51	644924.84
101	CLAY	1278.85	664791.51	644974.84
102	CLAY	1278.35	664791.51	645024.84
103	CLAY	1277.85	664791.51	645074.84
104	CLAY	1277.35	664791.51	645124.84
105	CLAY	1289.58	664791.51	645165.73
106	CLAY	1296.51	664841.51	644574.84
107	CLAY	1296.01	664841.51	644624.84
108	CLAY	1295.51	664841.51	644674.84
109	CLAY	1295.01	664841.51	644724.84
110	CLAY	1294.51	664841.51	644774.84
111	CLAY	1294.01	664841.51	644824.84
112	CLAY	1293.51	664841.51	644874.84
113	CLAY	1293.01	664841.51	644924.84
114	CLAY	1292.51	664841.51	644974.84
115	CLAY	1292.01	664841.51	645024.84
116	CLAY	1291.40	664841.51	645074.84
117	CLAY	1290.78	664841.51	645124.84
118	CLAY	1290.17	664841.51	645174.84
119	CLAY	1274.64	664391.51	645163.85
120	CLAY	1278.00	664374.37	645183.94

Point Table

Point #	Description	Elevation	Northing	Easting
121	CLAY	1278.00	664374.37	645192.94
122	CLAY	1266.45	664441.51	645124.84
123	CLAY	1283.11	664441.51	645174.84
124	CLAY	1286.15	664441.51	645183.94
125	CLAY	1286.15	664441.51	645192.94
126	CLAY	1243.78	664555.10	644574.84
127	CLAY	1243.34	664546.15	644624.84
128	CLAY	1242.92	664532.17	644674.84
129	CLAY	1242.58	664518.18	644724.84
130	CLAY	1242.32	664507.47	644763.10
131	CLAY	1242.17	664507.06	644774.84
132	CLAY	1241.81	664505.90	644807.37
133	CLAY	1241.50	664502.87	644824.28
134	CLAY	1241.32	664499.80	644863.79
135	CLAY	1241.11	664486.82	644893.98
136	CLAY	1241.27	664485.02	644924.84
137	CLAY	1241.50	664482.51	644967.93
138	CLAY	1241.50	664482.70	645024.84
139	CLAY	1241.25	664483.59	645041.67
140	CLAY	1241.05	664491.09	645047.11
141	CLAY	1240.24	664541.51	645043.15
142	CLAY	1239.43	664591.51	645039.22
143	CLAY	1239.00	664625.88	645036.90
144	CLAY	1239.19	664622.29	644986.47
145	CLAY	1237.00	664629.18	644992.68
146	CLAY	1237.00	664631.16	645030.61
147	CLAY	1240.00	664553.49	644956.34
148	CLAY	1238.88	664624.77	645016.12
149	CLAY	1240.59	664515.93	644924.84
150	CLAY	1243.38	664673.05	644574.56

Point Table

Point #	Description	Elevation	Northing	Easting
151	CLAY	1242.87	664673.02	644624.84
152	CLAY	1242.36	664672.99	644674.84
153	CLAY	1241.85	664672.95	644724.84
154	CLAY	1241.34	664672.92	644774.84
155	CLAY	1240.83	664672.89	644824.84
156	CLAY	1240.32	664672.85	644874.84
157	CLAY	1239.80	664672.82	644924.84
158	CLAY	1239.20	664672.78	644984.30
159	CLAY	1237.00	664666.78	644990.75
160	CLAY	1237.00	664666.76	645026.85
161	CLAY	1238.72	664672.75	645030.85
162	CLAY	1238.72	664662.87	645034.96
163	CLAY	1244.85	664691.51	645042.96
164	CLAY	1258.64	664733.84	645074.84
165	CLAY	1278.00	664793.64	645130.93
166	CLAY	1290.14	664832.51	645177.08
167	CLAY	1252.09	664671.16	645074.84
168	CLAY	1268.00	664681.37	645122.28
169	CLAY	1289.61	664800.59	645166.56
170	CLAY	1288.69	664694.85	645183.94
171	CLAY	1288.15	664641.51	645183.94
172	CLAY	1287.65	664591.51	645183.94
173	CLAY	1287.15	664541.51	645183.94
174	CLAY	1286.65	664491.51	645183.94
175	CLAY	1286.00	664427.00	645183.94
176	CLAY	1286.00	664427.00	645192.94
177	CLAY	1280.61	664391.51	645183.94
178	CLAY	1280.61	664391.51	645192.94
179	CLAY	1286.65	664491.51	645192.94
180	CLAY	1287.15	664541.51	645192.94

Point Table

Point #	Description	Elevation	Northing	Easting
181	CLAY	1287.65	664591.51	645192.94
182	CLAY	1288.14	664641.51	645192.94
183	CLAY	1288.63	664691.51	645192.94
184	CLAY	1288.67	664696.52	645192.94
185	CLAY	1289.14	664742.81	645175.23
186	CLAY	1289.61	664795.42	645174.73
187	CLAY	1290.03	664837.47	645188.19
188	CLAY	1290.17	664832.51	645174.84
189	CLAY	1290.78	664832.51	645124.84
190	CLAY	1291.40	664832.51	645074.84
191	CLAY	1292.01	664832.51	645024.84
192	CLAY	1292.51	664832.51	644974.84
193	CLAY	1293.01	664832.51	644924.84
194	CLAY	1293.51	664832.51	644874.84
195	CLAY	1294.01	664832.51	644824.84
196	CLAY	1294.51	664832.51	644774.84
197	CLAY	1295.01	664832.51	644724.84
198	CLAY	1295.51	664832.51	644674.84
199	CLAY	1296.01	664832.51	644624.84
200	CLAY	1296.51	664832.51	644574.84

REV	DATE	DES. BY	DRA. BY	APPR. BY	DESCRIPTION

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COMPONENT THICKNESS CERTIFICATION PLAN

CELL 8-I CONSTRUCTION DRAWINGS
ECO VISTA CLASS 4 LANDFILL
TONTITOWN, ARKANSAS

PROJECT NO.: 220124
SHEET NUMBER
6

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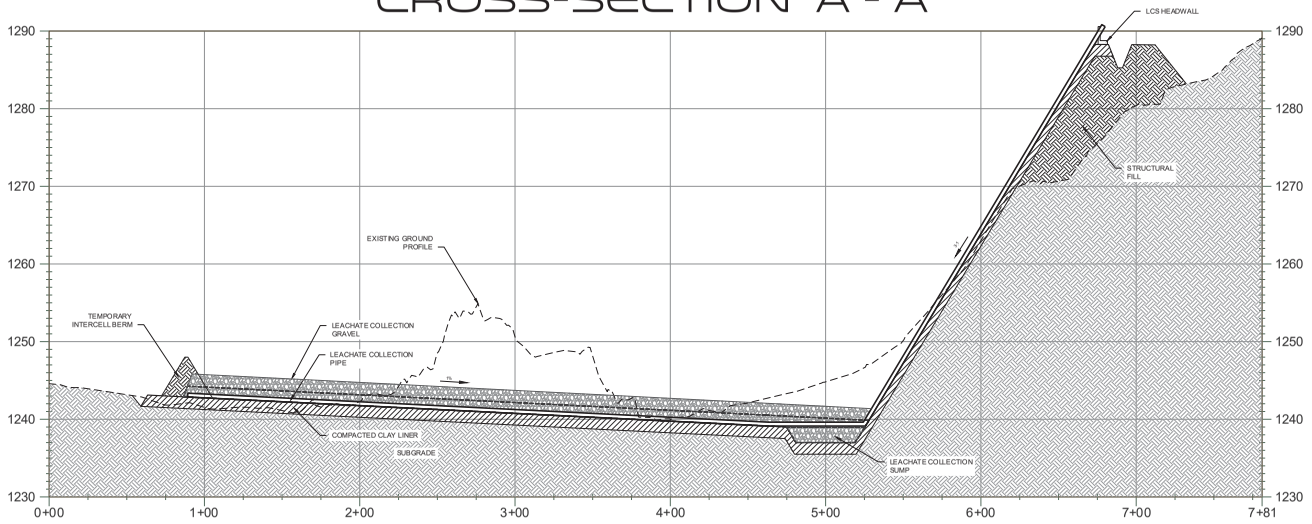
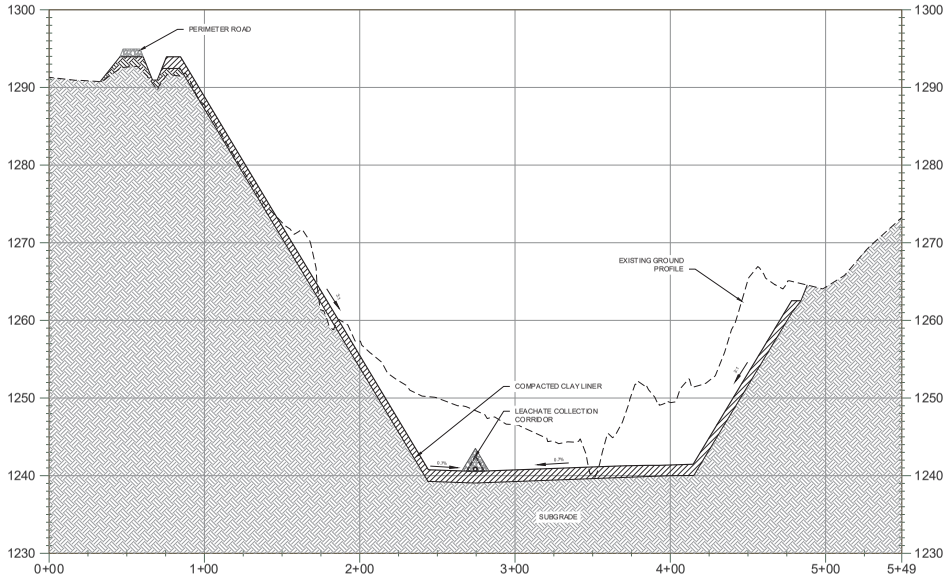
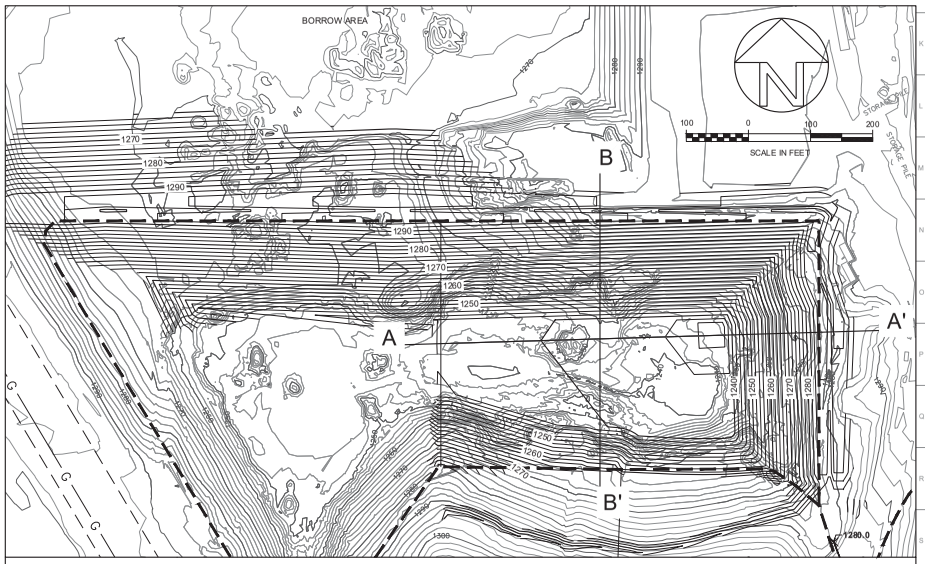
CROSS-SECTION A - A'



CROSS-SECTION B - B'





CROSS-SECTION KEY MAP

REV	DATE	DES. BY	DRA. BY	APPR. BY	DESCRIPTION
-	-	-	-	-	-

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CROSS-SECTIONS

CELL 8-I CONSTRUCTION DRAWINGS
ECO VISTA CLASS 4 LANDFILL
TONTITOWN, ARKANSAS

PROJECT NO.: 220124

SHEET NUMBER
7

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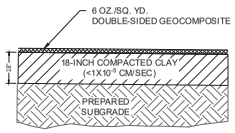
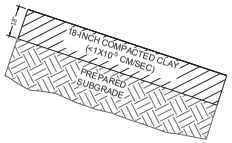


1/8 BOTTOM LINER SYSTEM (FLOOR)
NTS



2/8 BOTTOM LINER SYSTEM (SLOPE)
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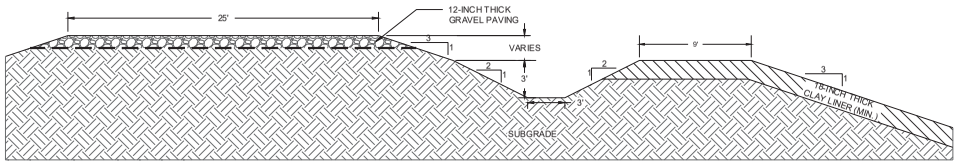

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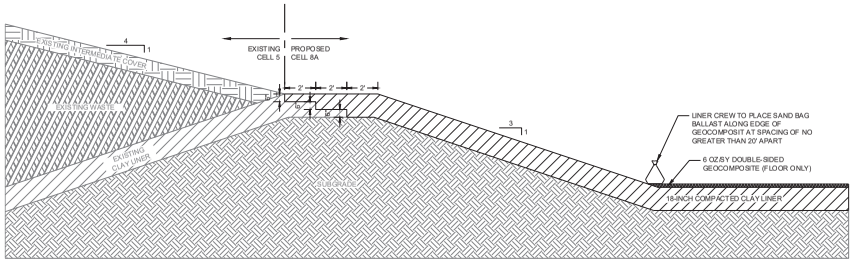

4/8 EXISTING TIE-IN
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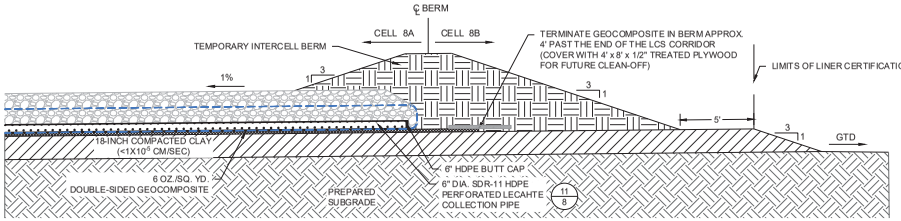

6/8 TEMPORARY INTERCELL BERM & FUTURE TIE-IN
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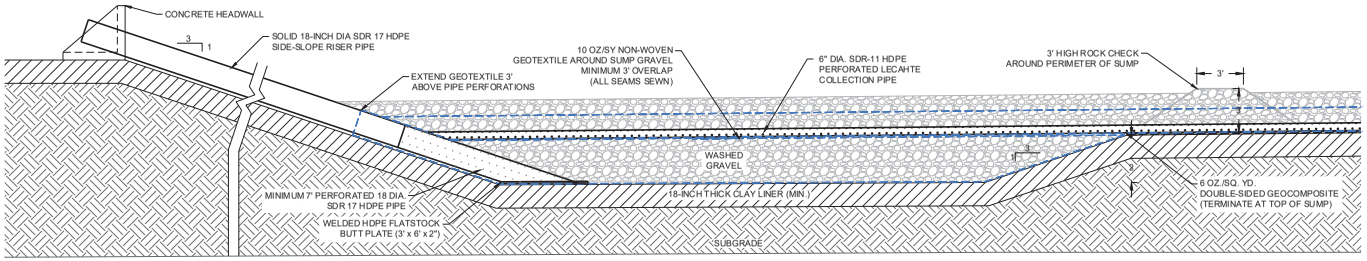

7/8 LEACHATE COLLECTION SUMP
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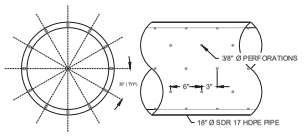
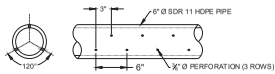


10/8 LEACHATE RISER PIPE PERFORATIONS
NTS



11/8 LEACHATE COLLECTION PIPE PERFORATIONS
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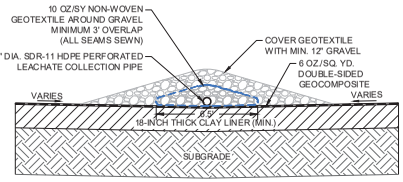

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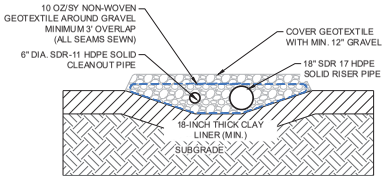

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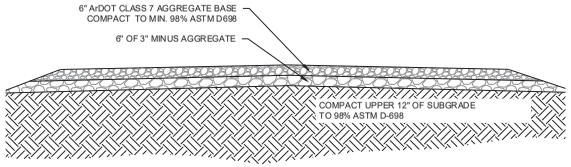

5/8 GRAVEL PAVING
NTS

REV	DATE	DES. BY	DRA. BY	APPR. BY	DESCRIPTION

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CONSTRUCTION DETAILS I

CELL 8-I CONSTRUCTION DRAWINGS
ECO VISTA CLASS 4 LANDFILL
TONTITOWN, ARKANSAS

PROJECT NO.: 220124
SHEET NUMBER
8

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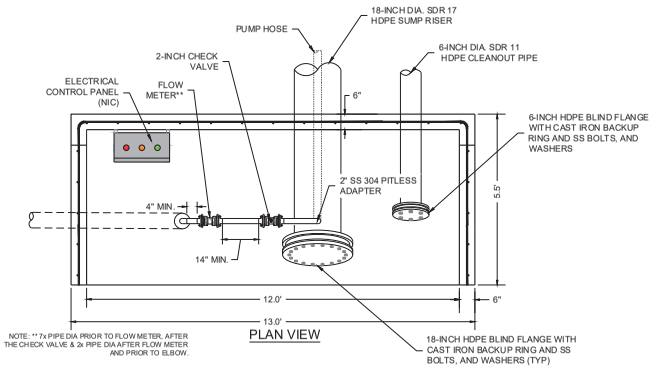
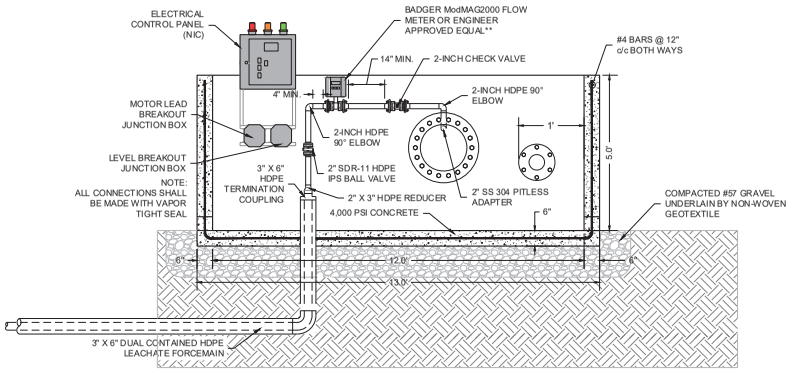
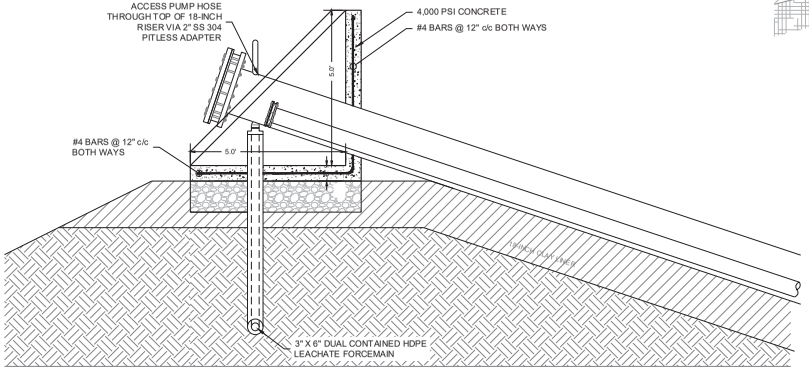


NOTE: ** 7x PIPE DIA PRIOR TO FLOW METER, AFTER THE CHECK VALVE & 2x PIPE DIA AFTER FLOW METER AND PRIOR TO ELBOW.

PLAN VIEW

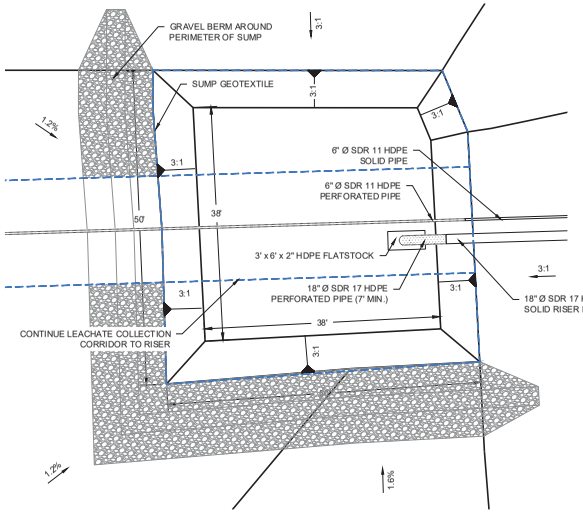


FRONT VIEW

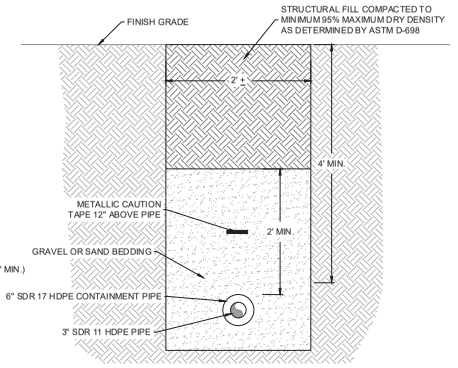


SIDE VIEW

1 9 LEACHATE RISER TERMINATION
NTS



2 9 LEACHATE COLLECTION SUMP PLAN VIEW
NTS



3 9 LEACHATE FORCEMAIN TRENCH
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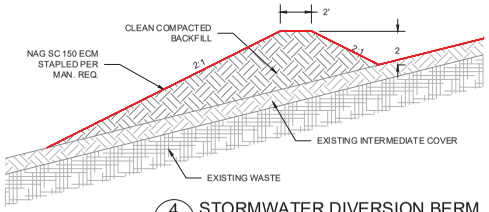

4 9 STORMWATER DIVERSION BERM
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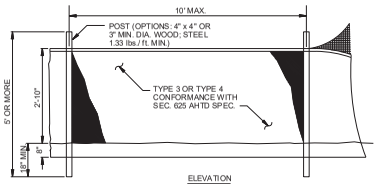

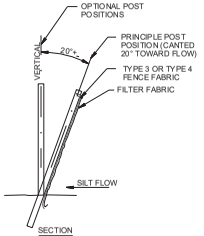

5 9 SILT FENCE
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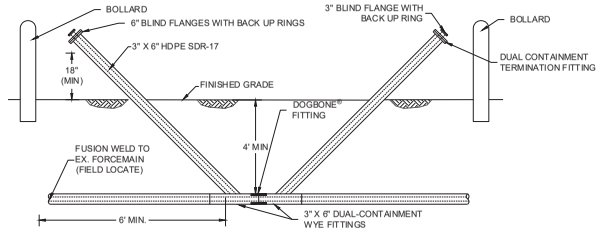
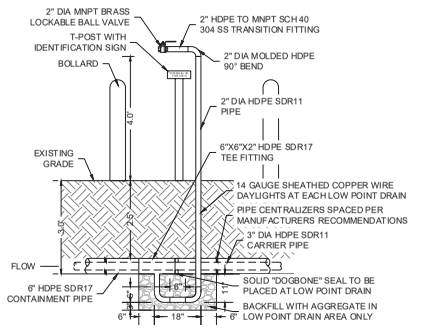


6 9 LEACHATE FORCEMAIN CLEANOUT
NTS



NOTES:

1. FOUR BOLLARDS SHALL BE PLACED ON 2' X 2' SPACING AROUND LOW POINT DRAIN.
2. THE TRENCH SHOULD BE OVER EXCAVATED IN THIS AREA TO ALLOW FOR THE LOW POINT DRAIN.

7 9 LEACHATE FORCEMAIN LOW POINT DRAIN
NTS

REV	DATE	DES. BY	DRA. BY	APPR. BY	DESCRIPTION

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CONSTRUCTION DETAILS II

CELL 8-I CONSTRUCTION DRAWINGS
ECO VISTA CLASS 4 LANDFILL
TONTITOWN, ARKANSAS

PROJECT NO.: 220124
SHEET NUMBER
9

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Date: 7/11/2022 3:56 PM

TABLE OF CONTENTS
TECHNICAL SPECIFICATIONS

SECTION 01 11 00
SUMMARY OF WORK

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The Project consists of construction of a solid waste landfill disposal cell, designed in accordance with the requirements of 40 CFR Part 257, Subtitle D regulations. More specifically, the project consists of construction of Cell-9A Construction at Two Pine Landfill located in North Little Rock, Arkansas. This construction will require mass excavation, placement of structural fill, construction of prepared subgrade and engineered buffer, construction of the compacted soil and geosynthetic liners, and construction of the leachate collection system. The construction will also require installation of ancillary civil improvements such as roads, force mains, etc.

B. The Landfill Construction Contractor shall furnish all material, labor, equipment and incidentals for the construction of the Work shown on the Contract Drawings and Technical Specifications, less the specified Owner-supplied materials. The scope of work covered by this Contract includes, but is not limited to, the following:

1. All site work including site preparation, clearing and grubbing, stripping and stockpiling of topsoil in the cell area of the landfill. Unsuitable soil materials will be processed and compacted or removed as necessary. Disposal areas for unsuitable materials will be provided at the Site as directed by Owner.
2. Contractor shall construct and maintain temporary and permanent erosion and sedimentation controls as directed by Contract Documents, or as needed to maintain compliance with Local, State or Federal stormwater requirements and facility permits.
3. Construct and maintain permanent and temporary perimeter and access roads and ditches/channels necessary for performance of the Work. Temporary haul road locations will require approval by Owner.
4. Construct and maintain, during the construction period, temporary dewatering devices as needed to prevent excessive construction delays due to saturation and ponding of water from storm events.
5. Furnish materials, labor, and equipment necessary to maintain borrow areas free of ponded water. Coordination between Contractor and Owner is essential.
6. Excavate on-site soils; haul, place, and compact on-site fill and backfill to construct the perimeter berms, interior berms, floor base grade, and other fill areas to the lines and grades shown on the Contract Drawings. Excess cut from construction area is to be stockpiled at an on-site location as directed by the Owner and be neatly graded and dressed to shed water. Stockpiles which are to remain after Contractor demobilization must be grassed.
7. Construct Prepared Subgrade to the lines and grades shown on the Contract Drawings.
8. Remove Rock Pinnacles in areas shown on the Contract Drawings to a depth of 2-feet below top of subgrade.
9. Construct Compacted Soil Liner to the lines and grades shown on the Contract Drawings and maintain the surface until accepted by geosynthetics installer and covered with geocomposite or approved by Owner.

10. As directed by Owner, unload and neatly stockpile/stage geosynthetic materials and piping to an on-site location as they are delivered to the Site. Geosynthetic materials and piping include geocomposite, geotextile, HDPE piping, fittings and valves.
11. Excavate and backfill rain blanket anchor trench in accordance with the Contract Drawings.
12. Furnish material, labor, equipment and incidentals for construction of the leachate collection piping for leachate collection system in accordance with Contract Documents. The leachate collection system includes a 6-inch diameter perforated and solid HDPE pipe for leachate collection and clean out, 18-inch diameter perforated and solid HDPE pipe for the leachate riser, and gravel with geotextile wrap (around pipe). Owner will supply the non-woven geotextile.
14. Establish vegetative cover over all disturbed areas as shown on the Contract Drawings.
15. Provide all necessary labor, materials, and incidentals to maintain horizontal and vertical control of the Work during construction. The Owner's Surveyor-of-Record may by be contracted by the Contractor to control his work. The Owner's Surveyor-of-Record will provide final certification of the Work against the Contract Drawings and shall produce "as-built" drawings.

C. The Owner has awarded a separate contract for construction of the geosynthetics and the Leachate Pumping System (electrical and mechanical) for the project. The Contractor shall coordinate work tasks with these contractors.

D. The Owner will be conducting landfill disposal and other operations simultaneously with the Work. The Contractor shall coordinate with the Owner to prevent interruption of daily business at the facility.

E. The Contractor shall cooperate with the Owner and other contractors so that the Owner's work or work by other contractors can be carried out smoothly without interfering or delaying the Work.

1.02 WORK HOURS

Unless otherwise approved by the Owner, construction activities at the site and material deliveries to the Facility shall be limited to the posted “open” hours for the facility.

1.03 DELIVERY, STORAGE, AND HANDLING

Delivered materials shall be stockpiled, stored, or staged in areas approved by the Owner or CQA Representative.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

- END OF SECTION 01 11 00 -

SECTION 01 22 00
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Payment shall be made as a Lump Sum item unless specifically stated otherwise on the Bid Form and only be made for Work as specifically described in these Specifications and the Contract Documents. All other work shall be considered incidental to the Work. No payment shall be made for defective work or work beyond the lines and grades of the required Work.

B. If required because of a change in scope as approved by the Owner, the Owner's surveyor shall take all measurements and compute all revised pay quantities, using methods sufficiently accurate to satisfy the Owner. The Owner's measurements shall be performed by a professional surveyor registered in the state of location of the facility.

C. Unless specified as a Lump Sum item, all Contract prices shall be based on a price per unit of measurement for materials or services. The Contract Price shall be adjusted for the actual quantities installed as approved by the Owner.

D. The Owner's surveyor shall take all measurements and compute all preliminary pay quantities, using methods sufficiently accurate to satisfy the Owner. The Owner's measurements shall be performed by a professional surveyor registered in the state of location of the facility.

E. The Engineer and/or CQA Representative shall verify all measurements and determine final pay quantities to be approved by the Owner.

F. Payment shall only be made for Work as specifically described in these Specifications and the Contract Documents. All other work to complete the project to the design intent of the Drawings shall be considered incidental to the Work. No payment shall be made for defective work or work beyond the lines and grades of the required Work.

G. Payment shall only be made for approved, in-place materials and Work, unless specifically permitted otherwise by these Specifications.

1.02 REFERENCES

A. Contract Documents

PART 2 – PRODUCTS

Products are defined herein specific to the various aspects of construction. Products are considered to include those purchased and delivered to the site as well as those constructed on the site.

PART 3 - EXECUTION

3.01 UNIT PRICE SCHEDULE

A. See Contract Documents, Bid Form. Items will not be measured for payment unless specifically stated on the Bid Form.

3.02 CONTRACT PAY ITEMS

A. See Contract Documents, Exhibit A. Items will not be measured for payment unless specifically stated on the Bid Form.

B. Pay Item - Mobilization and Demobilization:

1. Measurement - The Work required for this item will be measured on the basis of satisfactory evidence of mobilization of sufficient labor, equipment and material to adequately advance the Work.
2. Payment - The Lump Sum Price for Mobilization and Demobilization shall be payment in full for all labor, equipment, material and other incidentals to the site, as well as Contractor provided utilities and ongoing related expenses, considered normal for administration of the work. Clearing and grubbing outside the limits of work (as detailed by the Project Manager), required by the Contractor for staging areas and parking areas will be paid as part of this item. Twenty-five (25) percent of the Lump Sum price bid will be paid with the first payment request following satisfactory evidence of mobilization of sufficient labor, equipment and material to adequately progress the work of this contract. Twenty-five (25) percent of the Lump Sum price bid will be paid with the payment request subsequent to the payment request in which the initial payment for this item is made. Fifty (50) percent of the Lump Sum price bid will be paid with the Final Payment request. The total price paid for this item in the first two installments shall not exceed six (6) percent of the original Contract amount for the Contract.

C. Pay Item – Stormwater Control:
1. Measurement - The Contractor is responsible for purchase, installation, and construction of any temporary stormwater control structures necessary to complete the Work and managing stormwater levels in disturbed areas. Measurement shall be according to percentage of pay item complete.
2. Payment - The Contract Price for Stormwater Control shall be full compensation for completing necessary stormwater controls, including all labor, material, equipment, and other incidentals. Final payment shall be Lump Sum based upon project completion as agreed upon by the Owner and Contractor.

D. Pay Item – Stormwater Diversion Berm:
1. Measurement - The Contractor is responsible for providing all labor, equipment, and materials to construct a Stormwater Diversion Berm on the north slope of the existing Class 4 landfill as shown on the Drawings. The quantity for the calculation shall be the measured linear distance of the Stormwater Diversion Berm. The Surveyor of Record shall determine the actual length of the Stormwater Diversion Berm.
2. Payment - The Contract Price for Stormwater Diversion Berm shall be full compensation for the Stormwater Diversion Berm, including all labor, material, equipment, and other incidentals. Final payment shall be Lump Sum based upon task completion as agreed upon by the Owner and Contractor.

E. Pay Item – Surveying
1. Measurement - The Contractor is responsible for providing all labor, equipment, and materials to necessary for construction layout and to maintain horizontal and vertical control within the construction area. Measurement shall be according to percentage of pay item complete.
2. Payment - The Contract Price for Surveying shall be full compensation for construction layout and maintaining horizontal and vertical control, including all labor, material, equipment, and other incidentals. Final payment shall be Lump Sum based upon project completion as agreed upon by the Owner and Contractor.

F. Pay Item – Unload Geosynthetics & Piping
1. Measurement - The Contractor is responsible for providing all labor, equipment, and materials to carefully unload and stage the geosynthetic materials and piping. Measurement shall be according to percentage of pay item complete.
2. Payment - The Contract Price for Unloading and staging geosynthetics and piping shall be full compensation including all labor, material, equipment, and other incidentals. Final payment shall be Lump Sum based upon project completion as agreed upon by the Owner and Contractor.

G. Pay Item – Rock Pinnacle Removal
    1. Measurement - The Contractor is responsible for providing all labor, equipment, and materials to remove Rock Pinnacles within the construction area as shown on the Drawings to a depth of 2-feet below top of subgrade. The quantity for the calculation shall be based on the number of pinnacles removed.
    2. Payment - The Contract Price for Rock Pinnacle Removal shall be full compensation for the Rock Pinnacle Removal, including all labor, material, equipment, and other incidentals. Final payment shall be Lump Sum based upon task completion as agreed upon by the Owner and Contractor.

H. Pay Item – Excavation
    1. Measurement - The volume of excavated soils shall be calculated by the average end area method based on topographic surveys of the ground surface before and after excavation within the limits of shown on the Contract Drawings, less the volume of soils used for Backfill, Structural Fill, Prepared Subgrade, and/or Granular Drainage Layer as shown on the Drawings. No additional allowances shall be permitted for unauthorized excavation beyond the depths or limits of Excavation as set forth by the Drawings or Specifications.
    2. Payment - The Contract Unit Price for Excavation shall be full compensation for Excavation and Stockpiling, including all labor, material, equipment, and other incidentals, such as, excavating, moving, placing and segregating, stockpiling, stockpile grading and maintenance, dewatering, and erosion and sedimentation control materials and practices as required to comply with the Drawings and Specifications (unless specifically identified as a pay item). Final payment shall be based on the actual excavated quantity calculated from a physical survey as shown on approved Record Drawings. Stockpiles will not be measured to determine pay quantities.

I. Pay Item – Structural Fill/Subgrade Placement
    1. Measurement - The volume of in-place Structural Fill (not including Prepared Subgrade) soils shall be calculated by the average end area method based on topographic surveys of the ground surface before fill placement and after fill placement and compaction to the lines and grades as provided in the contract drawings. No additional allowances shall be permitted for unauthorized structural fill beyond the lines or grades as set forth by the contract drawings.
    2. Payment - The Contract Unit Price for Structural Fill shall be full compensation for Structural Fill, including all labor, material, equipment, and other incidentals, such as, haul road construction and maintenance, excavating and moving fill, stockpile grading and maintenance, dewatering, fill placement and compaction and erosion and sedimentation control materials and practices as required to comply with the Drawings and Specifications (unless specifically identified as a pay item). Final payment shall be based on the actual installed quantity calculated from a physical survey as shown on approved Record Drawings.

J. Pay Item – Soil Liner
    1. Measurement - The volume of in-place Landfill Compacted Soil Liner shall be calculated by multiplying the measured plan area of approved Landfill Compacted Soil Liner, appropriately adjusted for slope and based on a topographic survey of the finished subgrade surface, times the minimum specified thickness of Landfill Compacted Soil Liner as shown on the Drawings. No additional allowances shall be permitted for shrinkage, swelling, creep or unauthorized fill placed beyond the depths or limits of Landfill Compacted Soil Liner as set forth by the Drawings or Specifications. The Owner shall estimate actual volume of Landfill Compacted Soil Liner as directed by this Specification and shall produce Record Drawings of the ground surface before (subgrade) and after placement of Landfill Compacted Soil Liner.
    2. Payment - The Contract Unit Price for Landfill Compacted Soil Liner shall be full compensation for Landfill Compacted Soil Liner, including all labor, material, equipment, and other incidentals, such as haul road construction and maintenance, excavating and moving clay liner soils, moisture conditioning and compacting clay liner soils, dewatering, stockpile grading and maintenance, and

erosion and sedimentation control materials and practices as required to comply with the Drawings and Specifications (unless specifically identified as a pay item). Final Payment shall be based upon the volume calculated from a physical survey as shown on an approved Record Drawing.

K. Pay Item – Existing Cell Tie-In
   1. Measurement - The Contractor is responsible for providing all labor, equipment, and materials to carefully remove the protective cover soils and reveal the area required to complete the composite bottom liner Tie-In. The quantity for the calculation shall be the measured linear distance of liner tie-in. The Surveyor of Record shall determine the actual length of Liner Tie-In as directed by this Specification and shall show the Tie-In on Record Drawings.
   2. Payment - The Contract Price for Existing Cell 7 Tie-In shall be full compensation for composite bottom liner Tie-In, including all labor, material, equipment, and other incidentals. Final payment shall be Lump Sum based upon project completion as agreed upon by the Owner and Contractor.

L. Pay Item – Overbuild Materials
   1. Measurement - The quantity of overbuild materials as indicated on the Drawings and Specifications shall be calculated. The quantity for the calculation shall be the measured linear distance of in-place plywood on the edge of geomembrane liner. The Surveyor of Record shall determine the actual length of Overbuild Materials installed as directed by this Specification and shall show the Overbuild Materials on Record Drawings.
   2. Payment - The Contract Unit Price for Overbuild Materials shall be full compensation for Overbuild Materials, including labor, material, equipment, and other incidentals. Final payment shall be based on the actual length of Overbuild Materials installed as shown on approved Record Drawings.

M. Pay Item – Temporary Intercell Berm
   1. Measurement - The Contractor is responsible for providing all labor, equipment, and materials to construct the Temporary Intercell Berm on the west side of Cell 8A as shown on the Drawings. The quantity for the calculation shall be the measured linear distance of the Temporary Intercell Berm. The Surveyor of Record shall determine the actual length of the Temporary Intercell Berm.
   2. Payment - The Contract Price for the Temporary Intercell Berm shall be full compensation for the Temporary Intercell Berm, including all labor, material, equipment, and other incidentals. Final payment shall be Lump Sum based upon task completion as agreed upon by the Owner and Contractor.

N. Pay Item – Rain Blanket Anchor Trench
   1. Measurement - The quantity of Rain Blanket Anchor Trench excavated and backfilled and approved as indicated on the Drawings and Specifications shall be calculated. The quantity for the calculation shall be the measured linear distance of in-place, approved Rain Blanket Anchor Trench. No additional allowances shall be permitted for unauthorized trenches beyond the depths or limits of Rain Blanket Anchor Trench as set forth on the Drawings or Specifications. The Surveyor of Record shall determine the actual length of Anchor Trench installed as directed by this Specification and shall show the Anchor Trench on Record Drawings.
   2. Payment - The Contract Unit Price for the Rain Blanket Anchor Trench shall be full compensation for Rain Blanket Anchor Trench, including all excavation and backfill, labor, material, equipment, and other incidentals. Final payment shall be based on the actual length of Tie-In as shown on approved Record Drawings.

O. Pay Item – Leachate Collection System Corridor
   1. Measurement - The quantity of the Leachate Collection Corridor shall be measured along the center of the approved, in-place Leachate Collection Piping located in the center collection corridor. No additional allowances shall be permitted for wyes, tees, bends, valves, fittings, gravel, geotextile or other special or unauthorized piping or fittings beyond the limits of Leachate Collection System Corridor as set forth on the Drawings or Specifications. The Surveyor of Record shall determine

the actual length of HDPE Piping installed as directed by this Specification and shall show the HDPE piping location, dimensions, fittings and SDR on Record Drawings.

2. Payment - The Contract Unit Price for the Leachate Collection Corridor shall be full compensation for the Leachate Collection Corridor, including all excavation, bedding, gravel, geotextile, backfill, fittings, pipe welding, labor, material, equipment, and other incidentals as required to comply with the Drawings and Specifications. Final Payment shall be based upon the length calculated from a physical survey as shown on an approved Record Drawing.

P. Pay Item – Leachate Collection Sump and Risers

1. Measurement - The quantity of Leachate Sump, Riser Pipes and Cleanout Pipe shall be Lump Sum for the construction of the sump as detailed in the project Drawings including detailed grading, piping, gravel and geotextile. No additional allowances shall be permitted for piping, wyes, tees, bends, valves, fittings, or other specials or unauthorized piping or fittings beyond the details as set forth on the Drawings or Specifications. The Surveyor of Record shall show the Leachate Collection Sump dimensions and details on Record Drawings.
2. Payment - The Contract Unit Price for Leachate Sump, Riser Pipes and Cleanout Pipe shall be full compensation for the Leachate Sump, Riser Pipes and Cleanout Pipe, including all labor, material, equipment, and other incidentals as required to comply with the Drawings and Specifications. Final Payment shall be based upon the percentage of the task completed as approved by the Technical Representative.

Q. Pay Item – Leachate Collection Riser Headwall

1. Measurement - The Contractor is responsible for providing all labor, equipment and materials to construct the Leachate Riser Headwall and related appurtenances, including all labor, material, equipment, and other incidentals, such as piping, fittings, valves, flow meter, pipe fitting/welding, electric, controls, pumps, etc. as required to complete the project in accordance with the project Drawings and Specifications. Measurement shall be according to percentage of pay item complete.
2. Payment - The Contract Price for the Leachate Riser Headwall shall be full compensation for the Leachate Riser Headwall, including all labor, material, equipment, and other incidentals. Final payment shall be Lump Sum based upon task completion as agreed upon by the Owner and Contractor.

R. Pay Item – Leachate Force Main

1. Measurement - The Contract Unit Price for installation of Dual Containment Leachate Force Main shall be full compensation for Dual Containment Leachate Force Main, including all labor, material, equipment, and other incidentals, such as piping, fittings, valves, pipe fitting/welding, manhole fabrication, testing, etc. as required to complete the project in accordance with the project Drawings and Specifications. The Surveyor of Record shall determine the actual length of Dual Containment Leachate Force Main installed as directed by this Specification and shall show the piping location, dimensions, fittings and SDR on Record Drawings.
2. Payment - The Contract Unit Price for Dual Containment Leachate Force Main shall be full compensation for Dual Containment Leachate Force Main, including all excavation, bedding, backfill, fittings, connections to existing pipe, labor, gravel, material, equipment, and other incidentals as required to comply with the Drawings and Specifications. Final Payment shall be based upon the length calculated from a physical survey as shown on an approved Record Drawing.

S. Pay Item – Vegetation and Stabilization of Disturbed Areas

1. Measurement - The area of Seeding shall be calculated as the measured plan area of approved, in-place Seeding, appropriately adjusted for slope and based on a survey of the finished Seeding. No additional allowances shall be permitted for preparing seed beds; furnishing and applying topsoil, lime, seed, fertilizer, mulch and water; or unauthorized material placed beyond the limits of Seeding as set forth on the Drawings or Specifications. The Contractor shall make his own estimate of the actual area of Seeding installed as directed by this Specification.

2. Payment - The Contract Unit Price for Seeding shall be full compensation for Seeding, including all labor, material, equipment, and other incidentals, such as, seed, fertilizer, mulch, preparation of seed beds, and water as required to establish growth and maintain growth until final acceptance. Final payment shall be based upon the area calculated from a physical survey as shown on an approved Record Drawing.

T. Pay Item – Silt Fence
   1. Measurement - The Contractor is responsible for furnishing, installing and maintaining erosion controls in accordance with the Record Drawings and all environmental permits maintained by the Owner for the Site. Measurement of erosion controls shall be according to percentage of project complete.
   2. Payment - The Contract Price for Erosion Control shall be full compensation for Erosion Control, including all labor, material, equipment, and other incidentals. Final payment shall be Lump Sum based upon percentage of project completion as agreed upon by the Owner and Contractor.

U. Pay Item – Perimeter Road – Aggregate Base
   1. Measurement - The volume of in-place Perimeter Road Aggregate Base shall be determined by the measured area of completed and approved Perimeter Road as measured around the edge of road. No additional allowances shall be permitted for shrinkage, swelling, creep or unauthorized aggregate placed beyond the depths or limits of Perimeter Road as set forth on the Drawings or Specifications.
   2. Payment - The Contract Unit Price for Perimeter Road Aggregate Base shall be full compensation for the Perimeter Road Aggregate Base, including all labor, material, equipment, and other incidentals. Final payment shall be based upon the area of completed and approved roadway as determined by the Surveyor of Record from a physical survey around the edge of road as shown on an approved Record Drawing.

V. Pay Item – Perimeter Road – Aggregate Subbase
   1. Measurement - The volume of in-place Perimeter Road Aggregate Subbase shall be determined by the measured area of completed and approved Perimeter Road as measured around the edge of road. No additional allowances shall be permitted for shrinkage, swelling, creep or unauthorized aggregate placed beyond the depths or limits of Perimeter Road as set forth on the Drawings or Specifications.
   2. Payment - The Contract Unit Price for Perimeter Road Aggregate Subbase shall be full compensation for the Perimeter Road Aggregate Subbase, including all labor, material, equipment, and other incidentals. Final payment shall be based upon the area of completed and approved roadway as determined by the Surveyor of Record from a physical survey around the edge of road as shown on an approved Record Drawing.

W. Pay Item – Performance & Payment Bond
   1. Measurement – The Performance Bond shall be based on 100% of the proposed project amount.
   2. Payment - Payment shall be Lump Sum and will be paid with the first invoice if the Contractor has provided documentation of the Performance Bond.

3.03 INCIDENTALS

Some items are considered incidental to the Work and shall not be measured or paid. Items not specifically listed as a pay item are considered incidental.

- END OF SECTION 01 22 00 -

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall designate a Project Manager representative and submit the name and contact information of the representative to the Owner and CQA Consultant.
B. The Contractor shall coordinate material supply, construction, and inspection to assure efficient and orderly completion of the Work.
C. The Contractor shall notify the Owner in writing when coordination of the Owner's or other contractors' activities is required.

1.02 PROJECT PERSONNEL

The following list of project personnel is provided for reference:

A. The Owner's Representative is:

Dave Conrad
Waste Management, Inc.
100 Two Pine Drive
North Little Rock, AR 72117
dconrad@wm.com

B. The Engineer is:

Brad N. Fureigh, PE
Promus Engineering, LLC
(501) 554-4547
bfureigh@promusengineering.com

C. The CQA Engineer is:

Brad N. Fureigh, PE
Promus Engineering, LLC
(501) 554-4547
bfureigh@promusengineering.com

D. The CQA Representative is:

TBD

E. The Surveyor-of-Record is:

Johnny Mason, PE, PS
Mason Surveying & Consulting, Inc.
PO Box 571
Gentry, AR 72734
(479) 238-3109
johnny@masonsurveying.com

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

- END OF SECTION 01 31 00 -

SECTION 01 32 33
PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

Contractor shall take or have a professional photographer take digital photographs to document construction progress, means and methods, and conformance of construction details for the Work.

1.02 REFERENCES

A. Construction Quality Assurance (CQA) Plan.
B. Construction Drawings (Contract Documents).

1.03 SUBMITTALS

A. Contractor shall identify planned photographer and camera to be utilized and shall include make, model, and sensor resolution of the planned camera(s).
B. Contractor shall make weekly electronic submittals to CQA Consultant and Owner of construction progress, means and methods and conformance digital photographs.
C. Submittals shall include electronic media or distribution of original, unaltered photograph files.
D. Submittal shall include the name and contact information for the photographer.

1.04 USAGE RIGHTS

If a professional photographer is used for the project, Contractor shall obtain and transfer copyright usage rights from photographer to Owner and CQA Consultant for unlimited reproduction of photographic documentation. Copyright and usage shall be transferred via a Copyright Transfer Agreement presented with each Submittal. Contractor agrees to transfer all copyright usage rights for all photographs taken by the Contractor, their employees or subcontractors, to the Owner and CQA Consultant for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHIC MEDIA

Digital Images: Provide unaltered, original images in JPG or PNG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.01 CONSTRUCTION PHOTOGRAPHS

Prior to implementing any work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section and the CQA Plan.

3.02 CONSTRUCTION PROGRESS PHOTOGRAPHS

A. Contractor should take or have taken construction progress photographs from a common vantage point or points at least weekly, or more frequently as needed to document the progress of construction (e.g. daily during geosynthetics installation). Contractor shall photograph major milestones of construction

such as completion of excavation, completion of compacted soil liner, completion of geosynthetics installation, completion of leachate collection system, etc.

B. Common vantage point should be identified prior to construction and coordinated with CQA Representative. Vantage points should produce an image at full depth of field, capable of an overall view of the construction area. Multiple vantage points may be needed for large construction areas or multiple construction areas.
C. Construction progress photos should show the progress of the construction effort over time and shall include major construction milestones.

3.03 MEANS AND METHOD PHOTOGRAPHS

A. Contractor shall take or have taken photographs to document the means and methods of construction.
B. Photographs should include full-frame photographs (close-up) of each piece of construction equipment to document make, model for each piece of equipment utilized.
C. Photographs should also include wide frame photographs showing equipment being utilized in the construction effort.
D. Photographs should be made to document personnel actions during construction when equipment is not utilized (e.g. rock pickers, shovel grading, plate tamping, etc.).
E. Photograph loading and unloading, storage, and stockpiling of materials on-site.

3.04 CONFORMANCE PHOTOGRAPHS

A. The Contractor shall take or have taken photographs to document construction conformance with the Drawings and Specifications.
B. Photographs shall be taken to document conformance with details as illustrated in the Drawings.
C. Photographs of materials and materials markings, tags, etc. shall be made to document conformance with the Drawings and Specifications.

- END OF SECTION 01 32 33 -

SECTION 01 33 00
SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

This Section includes submittal procedures and types of submittals required prior to the beginning of certain phases of the Work, prior to incorporation of products in the Work, and during progress of the Work.

1.02 DEFINITIONS

The following list of definitions is provided for reference.

A. Samples: Physical examples prepared to illustrate materials, equipment or workmanship and to establish standards by which work will be judged as complying with contract requirements.
B. Shop drawings: Drawings, diagrams, illustrations, schedules and performance charts, prepared to illustrate a portion of work in detail.
C. Product data: Dated, printed literature of a product manufacturer which describes product, minimum specifications and installation procedures.
D. Submittals: General term including samples, shop drawings and product data, as applicable.

1.03 INITIAL SUBMITTALS

Submit the following to the Engineer for review not more than seven (7) days after issuance of the Notice to Proceed:

1. Schedule of Values (refer to the Contract Documents)
2. Initial Construction Schedule (refer to the Contract Documents)
3. Construction Management Plan (refer to the Contract Documents)
4. Site-Specific Health and Safety Plan (refer to the Contract Documents)
5. Spill Prevention, Control, and Countermeasures Plan (refer to the Contract Documents)
6. Schedule of Submittals (refer to this Section)

1.04 PROGRESS SUBMITTALS

A. Submit the following to the Engineer for review during progress of the Work, allowing fourteen (14) days for review and approval before the product is utilized in the Work:
    1. Construction Progress Schedule updates (refer to the Contract Documents)
    2. Shop Drawings and product data
B. Submit the following to the Engineer for review at the completion of the Work:
    1. Closeout Submittals (refer to Section 01 77 00)
    2. Construction Surveying information (refer to Section 01 71 23)
C. Submit all other submittals not mentioned above but specified in individual specification Sections, allowing fourteen (14) days for review and approval before the product is utilized in the Work.

1.05 SCHEDULE OF SUBMITTALS

A. The Schedule of Submittals shall include the following:
    1. List of all submittals required, with applicable Specification Section number and paragraph number indicated
    2. The planned dates for Contractor's submittals
    3. The dates approved submittals will be required from the Engineer
    4. The planned dates of manufacture, delivery, and installation of products

B. Update the Schedule of Submittals throughout the project. Provide copies with each submittal and as otherwise directed by the Engineer. Add the following information to the Schedule of Submittals at each update:
   1. Submittal description
   2. Date sent to Engineer
   3. Date returned to Contractor from Engineer
   4. Status of submittal
   5. Date of resubmittal and return (if applicable)
   6. Projected date of product delivery to Site

1.06 SHOP DRAWINGS

All details on Shop Drawings submitted for approval shall clearly show the relationships of the various parts to the main members and lines of the structure or equipment. Where correct fabrication of the Work depends upon field measurements, such measurements shall be made and noted on the Shop Drawings before being submitted for approval.

1.07 PRODUCT DATA

Product data as specified in individual specification sections shall include, but not be limited to, the following: standard prepared data for manufactured products such as the manufacturer's product specification and installation instructions, availability of colors and patterns, manufacturer's printed statements of compliance and applicability, product photographs, production or quality control inspection and test reports and certifications, mill reports, and printed product warranties, as applicable to the Work.

1.08 GENERAL PROCEDURES FOR SUBMITTALS

A. Submit, with reasonable promptness and in such sequence as shown on the Schedule of Submittals so as to cause no delay in the contract work or in the work or of other contractors, all shop drawings, product data record drawings, and other submittals required by the Contract Documents. No extension of time will be authorized because of the contractor's failure to transmit complete and acceptable submittals sufficiently in advance of incorporation of products in the Work.
B. Submittal packages shall be transmitted as electronic copy (PDF).
C. Submittals shall clearly indicate any deviations or variations from the requirements of the Contract Documents.
D. All submittals shall be furnished with the following information:
   1. number and title of the submittal
   2. date of submittal
   3. name of Contractor, subcontractor, an manufacturer, as applicable
   4. clear identification of contents and location where product is to be installed
   5. Contractor's certification statement as defined in section 1.08.E below
   6. Specification Section reference
   7. Contract Drawing number reference, if applicable
E. Each submittal shall bear a stamp or specific written indication that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal. The certification shall be signed by the Contractors authorized representative, and shall read as follows:

   "By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers, and similar data, and I have checked and coordinated each item with other applicable approved Shop Drawings and all Contractor requirements"

F. Submittal packages that do not include the Contractor's certification statement will be returned to the Contractor, without review at the Engineer's option, for non-conformance with this requirement.
G. Each submittal shall utilize a unique submittal identification numbering system that incorporates the submittal section number, the submittal number, and submission revisions.
H. The Contractor shall not begin any work affected by the submittal which has been returned with the notations "Revise and Resubmit" or "Not Acceptable" until a revision or correction of the submittal has been resubmitted and returned with the notations "Approved" or "Approved as Noted". Corrections noted on the submittals shall be followed without exception. The contractor shall be responsible for and bear all costs of damages that may result from the ordering of any material or from proceeding with any part of the Work prior to review and approval by the Engineer of the necessary submittals.
I. The Engineer's review and approval are to determine conformance with information given in the Contract Documents and compatibility with the design concept of the completed project as a functioning whole as indicated in the Contract Documents. The Engineer's review and approval shall not relieve the Contractor from compliance with the Contract Documents and industry standards.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

- END OF SECTION 01 33 00 -

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor is responsible for Quality Control to achieve the requirements of the Specifications and the CQA Plan.
B. The Owner will employ and pay for the services of the CQA Consultant to perform construction monitoring and testing services to assure the Owner that the Work is completed according to the Drawings, Specifications and CQA Plan and to prepare a Construction Documentation Report for submittal to the regulatory authority in compliance with the facility solid waste permit.
C. Contractor shall cooperate with the CQA Consultant and CQA Representative(s) to facilitate the execution of its required services.
D. Employment of the CQA Consultant shall in no way relieve Contractor's obligations to perform the Work and supply materials in accordance with the Contract Documents, manufacturer's specifications, and industry standards.
E. The Contractor shall provide testing required to control construction quality at no additional cost to the Owner. Quality control testing and services do not include activities performed by the CQA Consultant and CQA Representative.

1.02 REGULATORY REQUIREMENTS

The Contractor shall comply with all applicable local, state, and federal regulations and all facility environmental permits.

1.03 REFERENCES

A. Construction Quality Assurance (CQA) Plan.
B. Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.
C. Conform to latest edition of reference standards as of date of Contract Documents or date other specified in specification sections.
D. Should specified reference or industry standards conflict with Contract Documents, request clarification from Engineer or Owner before proceeding.
E. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.04 DEFINITIONS, QUALITY PARTIES AND RESPONSIBILITIES

A. Definitions:
    1. Construction Quality Control (CQC) – A planned system of inspections that is used to directly monitor and control the quality of a construction project. CQC is normally performed by the earthwork contractor, or their contracted entities, and the geosynthetics installer, and is necessary to achieve quality in the constructed or installed system. CQC refers to measures taken by the installer or contractor to determine compliance with the requirements for materials and workmanship as stated in the plans and specifications for the project.
    2. Construction Quality Assurance (CQA) – A planned system of activities that provides the Owner and permitting agency assurance that the facility was constructed as specified in the design. CQA includes inspections, testing, verifications, audits, and evaluations of materials and workmanship necessary to determine and document the quality of the constructed facility. CQA refers to measures

taken by the CQA organization to assess if the installer or contractor is in compliance with the plans and specifications for a project.

3. Manufacturing Quality Control (MQC) - A planned system of inspections and/or testing that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum or maximum specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract plans.

B. Parties and Responsibilities:
   1. Contractor – The Contractor is responsible for the quality of the constructed project in accordance with the Contract Documents. The Contractor may employ personnel or entities to provide QC services.
   2. CQA Consultant – The CQA Consultant is a firm contracted by the Owner to provide CQA services for the project and to provide a construction documentation report sufficient for submittal to the regulatory agency for approval of the facility to receive waste in a newly constructed cell, for approval of a final cover system, or for projects requiring CQA services.
   3. CQA Engineer – The CQA Engineer is a professional engineer registered to practice in the State in which the facility/project resides and who oversees the CQA services. The CQA Engineer is typically an employee of the CQA Consultant.
   4. CQA Representative – The CQA Representative(s) are representatives of the CQA Consultant that should be present, full-time, during construction activities pertinent to the Project. The CQA Representative(s) perform the CQA observations, inspections, testing, and sampling and work under the direction of the CQA Engineer to satisfy the requirements of the CQA Plan and Specifications.

1.05 CONTRACTORS QUALITY CONTROL

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce Work of specified quality.
B. Comply fully with manufacturers' instructions. If manufacturers' instructions conflict with Contract Documents, request clarification from Engineer or Owner before proceeding.
C. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
D. Work shall be performed by persons qualified to produce workmanship of specified quality.

1.06 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual specification sections or as needed, require material or product suppliers or manufacturers to provide qualified staff personnel (representatives) to observe and document site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, testing and adjusting of equipment as applicable, and initiation of instructions when necessary.
B. Submit qualifications of manufacturers' and suppliers' representatives to CQA Representative 14 days in advance of required observations. Representatives are subject to approval by CQA Consultant or Owner.
C. The suppliers' or manufacturers' representatives shall report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

1.07 QUALITY ASSURANCE SERVICES

A. The construction of the Project shall be monitored as outlined in the CQA Plan.
B. The Contractor shall be aware of the activities and requirements outlined in the CQA Plan and shall account for these activities in the construction schedule.

1. The minimum testing frequencies for CQA are presented in the CQA Plan. Actual test frequencies may vary. CQA testing, or lack thereof, does not relieve the Contractor from its responsibility to complete the Work in accordance with the CQA Plan, Contract Documents, and industry standards.
2. Sampling locations shall be selected by the CQA Representative. If necessary, the location of routine in-place moisture content and dry unit weight tests shall be determined using a non-biased sampling plan.
3. Additional testing may be performed at the CQA Representative's discretion.

C. If the Contractor decides to proceed with work prior to CQA testing or receipt of CQA test results, it shall be understood that the contractor is proceeding “at risk”. The Owner, Engineer, or CQA Consultant will not be responsible for delays attributable to failing test results or testing/retesting requirements.
D. If a defective area is discovered in the material, the CQA Representative shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Representative shall determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Representative deems appropriate.
E. After determining the extent and nature of a defect, the CQA Representative shall notify the Contractor and schedule appropriate retests when the defective work has been corrected.
F. The Contractor shall correct defective work to the satisfaction of the CQA Representative. The cost of corrective actions shall be borne by the Contractor.
G. All retests recommended by the CQA Representative must verify that the defect has been corrected before any additional work is performed by the Contractor in the area of the deficiency.

1.08 QUALIFICATIONS AND DUTIES OF CQA CONSULTANT AND LABORATORIES

A. The CQA Consultant shall be an approved testing, inspection, and quality control/assurance organization, independent from the Contractor and Owner.
B. The CQA Consultant shall be Responsible for the overall administration of the quality assurance procedures. The CQA Consultant shall be responsible for on-site observation, sampling and testing, and testing laboratories. Field and laboratory testing shall be conducted by the CQA Consultant or an independent third-party testing organization.
C. The CQA Consultant may utilize in-house or sub-contract laboratory firms including, but not limited to:
    1. Soils Quality Assurance Laboratory(ies).
    2. Geosynthetics Quality Assurance Laboratory(ies)
D. The CQA Consultant shall maintain a full-time Professional Engineer licensed in the state of the Project.
E. Testing equipment shall be calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards (NBS) or accepted values of natural physical constants.

1.09 LIMITS ON AUTHORITY OF CQA CONSULTANT

A. The CQA Consultant shall not release, revoke, alter, or expand the scope of the Contract Documents.
B. The CQA Consultant shall not approve or accept any portion of the Work and shall not assume any duties of the Contractor, Engineer, or Owner.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 CONTRACTORS RESPONSIBILITIES

A. Provide workmanship and Quality Control as necessary to meet the quality standards of the Work.
B. Cooperate with the CQA Consultant to provide access to the Work.
C. Furnish incidental labor and facilities:
    1. To provide access to work to be tested;

2. To obtain and handle samples at the project site or at the source of products to be tested;
3. To facilitate observations, inspections, and tests; and
4. For storage and curing of test samples.

D. Notify the CQA Consultant sufficiently in advance of operations to allow for assignment of personnel and scheduling and mobilization of personnel for tests and inspections.

- END OF SECTION 01 40 00 -

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall furnish, install and maintain required construction aids and barriers as required to mobilize for the Work, to complete the Work, to prevent public entry, and to protect the Work, existing facilities, trees and plants from construction operations and other temporary facilities required to complete the Work.
B. The Contractor shall provide and maintain methods, equipment and temporary construction, as necessary to provide controls over existing and environmental conditions at the construction site and related areas under Contractor's control.
C. The Contractor shall remove all temporary facilities and replace or repair facilities to the pre-construction condition at completion of the Work or when no longer necessary.

1.02 MOBILIZATION

A. Mobilize to the site and be prepared to initiate the construction activities within 10 days after receiving Notice to Proceed from the Owner.
B. Mobilization shall not be attempted unless the Contractor has:
    1. obtained all permits, licenses, site-specific training, OSHA training certificates necessary to perform the Work, where required
    2. received approval from the Owner for the location of temporary structures and storage areas
    3. submitted initial documents to the Engineer as listed in subsection 1.03 of Section 01 33 00
C. Mobilization includes but is not necessarily limited to: transportation of personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and all necessary temporary utilities; installation and relocation of necessary facilities at the site; and other preparatory work at the site.

1.03 TEMPORARY UTILITIES

A. Upon written approval from the Owner, Contractor may connect to existing power service to provide required temporary electricity to Contractor’s field offices. Electrical connections and payment for electrical services shall be made by the Contractor.
B. Non-potable water for soil compaction, dust control and other requirements will be provided by the Owner from the water truck loading station. Contractor shall fill, haul, and apply water as required. Contractor may also utilize on-site stormwater ponds as water source with approval from Owner.

1.04 TEMPORARY SANITARY FACILITIES

Provide and maintain temporary portable chemical toilet facilities. The facilities shall be provided at time of Contractor mobilization and shall be maintained in clean and sanitary condition until Substantial Completion. Provide a sufficient number of portable toilets for Contractor’s offices, Contractor’s work crews, Geosynthetic Installers, and authorized visitors in accordance with applicable health and safety regulations.

1.05 BARRIERS AND CLOSURES

Clearly mark open excavations deeper than five feet, temporary exposed high voltage power lines, and other construction operations that offer the potential for injury due to unauthorized entry. Mark and limit access using high visibility fencing consisting of high-density polyethylene safety fencing. Maintain fencing daily and replace damaged fencing as needed.

1.06 PROTECTION OF EXISTING UTILITIES

A. Coordinate and cooperate with the Owner and utility companies to locate and protect all utilities including pipelines, cables, power poles comma and other structures on the site prior to beginning the Work. Conform to the requirements specified below for locating an protection of utilities.
B. Underground and above-ground utilities shall be located and protected in accordance with pertinent State acts and regulations. The appropriate “One Call” service shall be utilized for locating utilities.
C. All utilities shall be protected from damage during construction, unless otherwise indicated to be removed or abandoned. If damaged, the utility shall be repaired as required by the utility owner at the Contractor's expense.
D. If a utility is encountered which is not shown on the Drawings or otherwise made known to the Contractor prior to beginning the Work, promptly take necessary steps to assure that the utility is not damaged or give written notice to the Owner or Engineer and to the owner of the utility. The Owner or Engineer will then review the conditions and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence of the utility.

1.07 PROTECTION OF INSTALLED WORK

A. Contractor shall protect installed Work and provide special protection where required in individual specification sections.
B. Contractor shall provide temporary and removable protection for installed Products and shall control activity in the immediate work area to minimize damage.
C. Contractor shall protect the Work until a certificate of completion is provided by Owner. All Work shall be protected, including removal of stormwater or seepage water, until the Work is approved to receive waste by the State regulatory agency, or as otherwise approved by the Owner.

1.08 SITE SECURITY

A. Contractor is responsible for providing security and facilities to protect the construction area from unauthorized entry, vandalism, or theft.
B. Contractor shall coordinate with the Owner’s security program.
C. Vehicular access to the site shall be restricted to authorized vehicles only. Allow entrance only to authorized persons with proper identification. Contractor shall maintain a log of security incidents. Require all visitors having access to the Site to sign in and sign out on a log.

1.09 CONSTRUCTION ROAD AND PARKING

A. Contractor shall construct and maintain temporary roads accessing existing roads to serve construction areas as required. Designated existing on-site roads shall be used for construction traffic, unless otherwise directed by the Owner.
B. Contractor’s employees shall park in the designated contractor parking area.
C. Contractor shall repair existing roads damaged by operation of their equipment as determined by the Owner to the satisfaction of the Owner and/or in compliance with applicable requirements of authorities having jurisdiction.

1.10 HAUL ROUTES

A. Comply with all local, state, and federal transportation laws and requirements when using public transportation routes.
B. Consult with the authority having jurisdiction in establishing public thoroughfares to be used for haul routes and site access.
C. Confine construction traffic to designated haul routes.

1.11 HOUSEKEEPING

A. Maintain areas free of trash and rubbish. Maintain the Site in a clean and orderly condition.
B. Supply all containers required for storage and removal of trash, rubbish, and debris resulting from the Work.
C. Remove trash and rubbish from Site at least twice each week and dispose off-site at an approved municipal solid waste facility, or on-site as designated by Owner. Burying of construction debris, cleared trees and shrubs, and other wastes resulting from the Work is strictly prohibited.
D. Provisions shall be made to minimize the transport of soil and debris from the construction area onto public roads. Soil and debris that are transported onto a road surface shall be removed. Removal of soil on roads that have resulted from Contractors negligence shall be performed at no additional cost to the Owner. Remove soil and debris from the roads using a street sweeper, shovels, or hand sweepers.

1.12 NOISE CONTROL

A. Contractor's vehicles and equipment shall have appropriate noise reduction and protection devices that will minimize noise levels to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards including 29 CFR 1926.52, and other applicable state, county, and local ordinance requirements.
B. Outfit all vehicles and equipment with mufflers and other sound attenuating equipment so that sound levels do not exceed 90 dBA when measured at a distance of 20 feet from any vehicle or equipment.
C. Noise shall also be controlled by compliance with required work hour restrictions and other limitations imposed by the Owner or authorities having jurisdiction

1.13 SURFACE WATER CONTROL

A. Provide methods to control surface water to prevent damage to the Work, the Site, and adjoining properties in conformance with the requirements indicated on the Drawings.
B. Divert water away from excavations and other construction areas, and direct drainage to proper runoff courses as required to prevent any erosion, damage, or nuisance to adjacent areas. Contractor shall be responsible for damages caused by water disposal operations.
C. Provide, operate, and maintain equipment and facilities of adequate size to control water.
D. Project shall be maintained free of ponded or pooled stormwater until project is approved by Owner or the State regulatory agency.

1.14 DUST CONTROL

A. Contractor shall control dust resulting from the Work at all times, including weekends, holidays, and hours when work is not in progress. Any impact to the adjacent properties caused by dust generated due to the Contractor's operations shall be the sole responsibility of the Contractor.
B. Maintain excavations, embankments, stockpiles, roads, and other areas within or outside the project boundaries free from particulates which could cause air pollution standards to be exceeded or cause a hazard or nuisance.
C. Provide all labor, materials and equipment (including water trucks and dust suppressant) needed to limit visible dust generation during the Work.
D. Chemical dust suppressants must be approved by the Owner.
E. Provide dust control measures required by all applicable regulatory requirements and the above described work restrictions, including but not limited to the following:
    1. Water and other wetting agents shall be used on a regularly scheduled basis and as needed for adequate dust control.
    2. Soil stockpiles shall be located as far away as possible from adjacent properties and only in locations approved by the Owner.

1.15 CONTROL OF POLLUTANTS

A. If fuel or other petroleum-based products will be stored on-site to support Contractor's equipment fleet, Contractor shall prepare and implement a Spill Prevention, Control, and Countermeasures Plan (SPCC plan). The SPCC plan shall be submitted to the Engineer for review and shall include, but not be limited to the following:
   1. Provisions for the prevention of spills as well as cleanup of spills of gasoline, diesel fuel, hydraulic fluids and lubricants.
   2. Provide relatively impervious secondary containment and spill protection devices at all on-site vehicle maintenance facilities.
   3. Collect all oil and other fluids discharged during vehicle maintenance operations in drums and dispose of properly. Waste containers remaining on site for any length of time when contractor is not present shall be left in secure areas, properly labeled and covered.
   4. Names and telephone numbers of local and state officials to be contacted in the event of a spill.
   5. List of subcontractors and contact information that may be used to manage off site impacts of spills.
   6. Fire prevention and firefighting measures to be employed for responses to fires that may occur in equipment or elsewhere on the Site.
   7. Services available from the local fire department and coordination with services of the Contractor's on-site personnel.

B. Contractor shall prevent disposal of wastes, effluents, chemicals, or other such substances into sanitary or storm sewers discharging off-site without treatment in accordance with permits obtained by the Contractor.

C. Fueling of equipment shall be performed away from storm drain inlets. If above-ground fuel storage tanks (AST's) are present on-site, the AST's shall be stored in approved bermed or lined containment areas.

D. Contractor shall provide systems for control of atmospheric pollutants. Prevent toxic concentrations of chemicals, and prevent harmful dispersal of pollutants into the atmosphere.

E. Contractors equipment used during construction shall conform to all current federal, state and local laws and regulations.

1.16 HEALTH AND SAFETY

A. All work shall be performed in accordance with applicable safety and health regulations, codes, and standards set forth by the proper authorities, including current OSHA regulations including 29 CFR 1910 and 29 CFR 1926 or later revision thereof.

B. Develop a Site-Specific Health and Safety Plan (SSHASP) signed by a Certified Industrial Hygienist (CIH) to provide for the safe execution of the work in compliance with all applicable OSHA regulations.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

- END OF SECTION 01 50 00 -

SECTION 01 57 13
TEMPORARY SOIL EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

Contractor shall construct temporary and permanent measures to control soil erosion and sediment transport within the construction limits. Erosion and sediment control measures shall be those that are needed prior to installation of permanent control features or that are needed temporarily to control erosion that develops during normal construction activities but are not associated with permanent control features specified for the Project.

1.02 REFERENCES

A. Erosion & Sediment Control Design & Construction Manual – ArDOT, 2016.
B. Standard Specifications – ArDOT, 2014.
C. American Association of state Highway Transportation Officials (ASSHTO):
    1. AASHTO M 288, Geotextile Specification for Highway Applications
D. ASTM International:
    1. ASTM D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
    2. ASTM D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity
    3. ASTM D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
    4. ASTM D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile

1.04 SUBMITTALS

Submit manufacturers' product data sheets for all erosion and sediment control materials, measures and devices showing conformance with the Drawings and Specifications and the pertinent state stormwater BMP manual listed above.

1.05 QUALITY ASSURANCE

Comply with the requirements of pollution control laws, rules and regulations of governmental authorities having jurisdiction and applicable permit conditions as presented on the Drawings, including but not limited to, the following:

1. Site specific stormwater pollution prevention plan (SWPPP), and
2. Industrial General Stormwater Permit ARR000231.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivered materials shall be stockpiled, stored, or staged in areas approved by the Owner or CQA Representative.
B. Products shall be delivered, handled, and stored in accordance with Section 01 60 00.

1.07 PROJECT REQUIREMENTS

The use of temporary control measures shall be coordinated with the permanent erosion control features specified elsewhere to the extent practical to assure effective and continuous erosion control.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

Proposed materials and source of supply shall be approved by Engineer or CQA Consultant as specified prior to delivery and use in construction.

2.02 MATERIALS

A. Temporary Vegetation
   1. Grass seed for temporary vegetation shall be as indicated on the Drawings.
   2. Mulch shall be as indicated on the Drawings.

B. Silt Fencing
   1. Geotextile fabric shall conform to the requirements of AASHTO M 288 for temporary silt fencing. Minimum total width of fabric shall be 36 inches or as otherwise indicated on the Drawings. Geotextile for temporary silt fence shall meet or exceed the following specifications:

Property	Test Method	Test Value (1)
Grab Tensile Strength	ASTM D 4632	100 lbs.
Permittivity	ASTM D 4491	0.05 sec^{-1}
AOS	ASTM D 4751	0.60 mm (max.)
Ultraviolet Resistance (% strength retained at 500 hrs)	ASTM D 4355	70%

(1) Minimum Average Roll Value (unless otherwise noted) in weakest principal direction

   2. Furnish steel posts and woven fence fabric for Type "C" fencing as indicated on the Drawings. Posts, woven fence fabric, and accessories for silt fencing shall conform to Section 621 of the Standard Specifications for Highway Construction, ArDOT 2014 Edition.

C. Construction Exit
   1. Aggregate for construction exit shall be as indicated on the Drawings.
   2. Geotextile to be installed under the aggregate shall be nonwoven geotextile conforming to the specifications for Survivability Class 1 geotextile as defined in AASHTO M 288.

D. Stone Check Dams
   1. Materials for check dams shall consist of geotextile and riprap as indicated on the Drawings.

E. Rolled Erosion Control Products
   1. Rolled Erosion Control Products (RECPs), including Erosion Control Blankets (ECB) shall be as specified on the Drawings and shall meet the manufacturer's published specification. ECB shall consist of machine-produced mat of straw or wood excelsior fiber covered on top and bottom sides with photodegradable extruded plastic or woven biodegradable nettings and sewn together with degradable thread.
   2. Anchors for Rolled Erosion Control Products shall consist of machine-made staples of No. 8 gage new steel wire formed into a "U" shape, or as otherwise specified or recommended by the material manufacturer. The size of staples when formed shall not be less than 8 inches in length with a throat of not less than 1 inch in width. Longer anchors may be required for loose soils. Other anchors, such as metal pins or plastic pegs, may also be used if approved in advance by the Engineer.

F. Other Erosion and Sediment Control Materials
   1. Furnish materials for stone filter rings, dust control, fabric and frame inlet protection, temporary diversion berms, slope and channel stabilization, storm drain outlet protection, and other measures

as indicated on the Drawings and in accordance with the Erosion & Sediment Control Design & Construction Manual – ArDOT, 2016.

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section and the CQA Plan.
B. Inspection:
   1. Prior to implementing any work of this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.
   2. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Contractor shall notify the Engineer and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or Engineer prior to installation of the Summary of Work will be construed as Contractor's acceptance of the related work of all other Sections.

3.02 GENERAL

A. Install temporary erosion and sediment control measures prior to any land disturbance and in accordance with the requirements stated on the Drawings.
B. Notify the Engineer in the event of conflict between these specification requirements and pollution control laws, rules, industry standards, or regulations of other federal, state, or local agencies.
C. All Work under this Contract shall be performed in such a manner that objectionable sediment shall not be created in water courses through or adjacent to the project area.
D. The Owner and Engineer shall have the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow, fill, and grading operations.
E. The Owner and Engineer shall also have the authority to direct the Contractor to:
   1. Alter the location, type, and number of erosion and sedimentation control devices from that shown on the Drawings due to changes in drainage patterns created during construction at no additional expense to the Owner; and
   2. Provide, at no additional cost to the Owner, immediate, temporary, or permanent erosion and sediment control measures to minimize adverse impact to streams on or adjacent to the property.
F. Incorporate all permanent erosion and sediment control measures (including vegetation) into the Project at the earliest practical time
G. Erosion control measures shown on the Drawings are minimal requirements. It is the responsibility of the Contractor to install additional measures as needed to control sediment, whether or not directed to add such measures by the Engineer or Owner.
H. Temporary erosion and sediment control measures shall conform to the requirements of this section and as indicated on the Drawings.

3.03 INSTALLATION OF SILT FENCING

A. Prior to any land disturbance or as otherwise indicated on the Drawings, install silt fencing as specified in this subsection. In slope areas greater than 30 percent slope, install two parallel silt fences.
B. Install silt fencing in accordance with details shown on the Drawings.
C. Temporary silt fences shall be installed at all locations on the construction limits where surface water can leave the construction area and at other locations within the construction limits as needed. This applies to all locations shown or noted on the Drawings and in other areas determined in the field by the Engineer to require fencing.

D. At the time of installation, the filter fabric will be rejected if it has defects, deterioration, or damage incurred during manufacture, transportation, storage, or installation and shall be replaced at the Contractor's expense.

3.04 CONSTRUCTION OF CONSTRUCTION EXIT

A. Construction exit shall be constructed at the required location and in accordance with the details and requirements indicated on the Drawings.
B. Any materials or mud spilled, dropped, washed, or tracked from vehicles from the site on to roadways or into storm drains shall be removed as indicated on the Drawings.

3.05 INSTALLATION OF ROLLED EROSION CONTROL PRODUCTS

A. Shipping, Handling, and Storage

All RECP's shall be shipped, handled, and stored in a strict accordance with the Manufacturer's recommendations.

B. Installation – General
1. Placing of RECP's shall be done immediately following seeding. Seeding shall be performed in accordance with section 32 92 19, Seeding and Mulching, of these Specifications.
2. RECPs shall be placed to the lines in grades shown on the Drawings. The earth surface shall be smooth and free from stones, clods, or debris which will prevent the contact of the RECP with the soil. Care shall be taken to preserve the required line, grade and cross section of the area.
3. RECPs shall be unrolled in the direction of the flow of water and shall be applied without stretching so that it will lie smoothly but loosely on the soil surface.
4. RECPs shall be rejected if they have defects, rips, holes, flaws, evidence of deterioration, or other damage at the time of installation.
5. The Engineer may require adjustments in the installation requirements to fit site conditions.

C. Installation – Channels

All ECP's installed in channels shall be unrolled parallel to the direction of waterflow. The first roll shall be centered longitudinally in the channel and anchored with staples. Subsequent rolls shall be installed outward to the edges of the channel and be lapped to allow installation of a common row of anchors. RECP ends shall be overlapped with the upstream ends on top ("shingled"). Refer to the Drawings and or the Manufacturer's installation guidelines for installation details.

D. Installation – Slopes

RECP's installed on slopes shall be oriented in vertical strips and anchored. Subsequent rolls shall be installed outward to the edges of the original role and be lapped to allow installation of a common row of anchors. RECP ends shall be shingled. Refer to the Drawings and or the Manufacturer's installation guidelines for installation details.

3.06 CONSTRUCTION OF OTHER TEMPORARY CONTROLS

Install and construct other required temporary erosion and sediment controls as indicated on the drawings, or as needed.

3.07 APPLICATION OF TEMPORARY GRASS AND MULCH

Apply temporary seed and mulch at required locations in accordance with the requirements indicated on the Drawings and Section 32 92 19, and as needed to prevent erosion.

3.08 INSPECTION AND MAINTENANCE

A. Temporary erosion and sediment control measures shall be inspected and maintained daily by the Contractor.
B. Remove sediment deposits when deposits reach approximately one-half the height of sediment barriers. Sediment shall be placed in areas approved by the Engineer or Owner and spread uniformly over the ground surface.
C. Replace silt fencing fabric when it has deteriorated, is torn, loose, or no longer effectively performs.
D. Replace or reconstruct other settlement barriers when the structures no longer effectively perform.
E. Maintain silt fencing, construction exit, and all other temporary erosion and sediment control measures until completion of the Work.

3.09 REMOVAL OF TEMPORARY CONTROL MEASURES

A. Temporary erosion and sediment control measures shall not be removed until approved by the Engineer. The upgradient areas shall be sufficiently stabilized with permanent erosion control measures prior to removal.
B. Sediment deposits remaining after silt fences are removed shall be dressed to conform with the existing grade, prepared, and seeded.
C. Check dams shall be removed after completion of construction activities. Coarse aggregate shall be deposited on-site at a location approved by the Owner.
D. Remove temporary slope drains when approved by the Engineer and Owner after a sufficient stand of grass has been established on the slope to control erosion. After removal of temporary slope drains, the disturbed areas shall be grassed with permanent grass.

- END OF SECTION 01 57 13 -

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Contractor shall comply with the requirements of the Contract Documents, and as specified herein, for supply and provision of products and materials required for completion of the Work.
B. Section includes:
   1. Definition of Products
   2. Transportation and Handling
   3. Storage and Protection
   4. Product Options
   5. Substitutions

1.02 DEFINITION OF PRODUCTS

The term “Products” refers to new material, machinery, components, equipment, fixtures, and systems forming the Work. Products do not include machinery and equipment used for preparation, fabrication, conveying, construction and direction of the Work. Products may also include existing materials or components required for reuse.

1.03 TRANSPORATION AND HANDLING

A. Comply with the requirements of individual specification sections.
B. Transport and handle products in accordance with manufacturers’ instructions.
C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
D. Provide equipment and personnel to handle products by methods to prevent soiling and damage.

1.04 STORAGE AND PROTECTION

A. Comply with the requirements of individual specification sections.
B. Store and protect products in accordance with manufacturers’ instructions, with seals and labels intact and legible. Store sensitive products in weathertight, climate-controlled enclosures.
C. For exterior storage of fabricated products, place in well-drained, relatively level area on sloped supports, above ground.
D. Provide offsite storage and protection when site does not permit on-site storage or protection.
E. Cover products subject to weather or environmental deterioration with opaque, impervious sheet covering. Provide ventilation to avoid condensation.
F. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing or contamination with foreign matter.
G. Provide equipment and personnel to store products by methods to prevent damage.
H. Arrange storage of products to permit access for inventory and inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

1.05 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications; no options or substitutions allowed.
C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

1.06 SUBSTITUTIONS

A. Engineer will consider requests for Substitutions only within 60 days after Effective Date of Agreement.
B. Subsequent Substitutions will be considered only when a product becomes unavailable through no fault of the Contractor. Improper planning will not be considered as a reason to increase Contract Price as a result of product substitution. Further, the Owner or Engineer is not obligated to accept substitutions even if equivalency can be demonstrated.
C. In addition to the provisions in the Contract Documents, a request constitutes a representation that the Contractor:
    1. Shall provide the same warranty for the Substitution as for the specified product.
    2. Shall coordinate installation and make changes to the Work which may be required for the Work to be completed with no additional cost to the Owner.
    3. Waves claim for additional costs or time extension which may subsequently become apparent.
    4. Shall reimburse Owner for review or redesign services associated with re approval by Engineer.
D. Substitutions will not be considered when they are indicated or implied on Shop Drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
E. Substitution submittal procedure:
    1. Submit copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
    2. Submit the number of copies required for all submittals, as specified in section 01 33 00.
    3. Submit shop drawings, product data and certified test results attesting to the proposed product equivalence. Product data shall be provided in side-by-side tables to demonstrate equivalency.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

- END OF SECTION 01 60 00 -

SECTION 01 71 23
FIELD ENGINEERING AND SURVEYING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

The Contractor shall provide field layout (lines and grades) of the Work and maintain and preserve all stakes and other markers as required to complete the Work and as requested by the CQA Representative.

1.02 QUALIFICATIONS

A. Site survey control/setup and final field location verification shall be performed by or under the supervision of a licensed engineer or land surveyor registered in the state where the project is located (the Surveyor), acceptable to the Owner.
B. Day to day surveying for control purposes may be performed by Contractor's own personnel.

1.03 SUBMITTALS

The Contractor shall:
A. Submit name, address, phone number and email address of the Surveyor.
B. On request of the CQA Representative, submit documentation to verify accuracy of field engineering work.
C. Submit survey data and record drawings as required in 3.04 and 3.05.

PART 2 – PRODUCTS

2.01 MATERIALS AND SURVEY EQUIPMENT

A. Provide materials and survey equipment as required to properly perform the surveys, including, but not limited to, instruments, tapes, rods, measures, mounts, and tripods, stakes and hubs, nails, ribbons, other reference markers, and other as required.
B. The survey instruments used for this work shall be precise and accurate to meet the needs of the project. All survey instruments should be capable of reading to a precision of 0.001 ft and with a setting accuracy of ±0.8 seconds.

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any work of this Section, the Contractor and his Surveyor shall become thoroughly familiar with the site, the site conditions, and all portions of the Work including the CQA Plan.
B. Inspection:
    1. Prior to implementing any work of this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.
    2. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to installation of the Field Engineering and Surveying will be construed as Contractor's acceptance of the related work of all other Sections.

3.02 SURVEY REFERENCE POINTS

A. Existing horizontal and vertical control points for the Project shall be identified by the Owner.
B. The Contractor shall locate and protect control points prior to starting site work and preserve all permanent reference points during construction.
C. The Contractor shall make no changes or relocations to control points without prior written approval from the Owner.
D. The Contractor shall report to the CQA Representative when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
E. The Contractor shall replace Project control points, which may be lost or destroyed at no additional cost to Owner. Replacements shall be re-established based on original survey control.
F. The Owner shall provide a minimum of two permanent benchmarks. Horizontal and vertical locations of the benchmarks shall be recorded on the Record Drawings.

3.03 PROJECT SURVEY REQUIREMENTS

A. Surveyor shall establish lines and levels, located and laid out, by instrumentation and similar appropriate means for all Work indicated by the Drawings or Specifications.
B. Surveyor shall locate existing sewers, culverts and other utilities shown on the Drawings. Utility locations shown on the drawings are approximate and shall be field-verified by the Contractor prior to construction as required to complete the Work.
C. Surveyor shall be familiar with surveying requirements as presented in facility CQA Plan.
D. Drawings shall include Northing and Easting grid (500' x 500' minimum spacing) with coordinate labels. Drawing shall denote the site datum (i.e. State Plane, site specific, etc.). The datum shall match the Drawings. State Plane coordinate system should be used when possible.
E. Drawings shall include soil component thickness certification points on a minimum grid spacing of 100 ft x 100 ft or as designated in the CQA Plan. Points shall also cover perimeter of certified area (edge of compacted clay liner and/or geosynthetic liner) and all grade breaks (toe of slope, crest of slope, midpoint of slope, trenches, etc.) on a minimum 100 ft spacing.
F. Drawings shall include a table showing point numbers, x, y, and z coordinates of all points (to hundredths of foot, i.e. 0.00), and calculated thicknesses for each layer at each point. Points must be "stacked" to allow layer thickness evaluation. Surveyor shall account for slope when using elevation differences of stacked points to determine thickness. Also, layer thickness requirements are minimum, and thicknesses cannot be rounded up. Table can either be on as-built drawing sheets, on separate sheet, or on 8.5x11 attachment.

3.04 RECORDS

A. The Contractor shall maintain a complete, accurate log of all control and survey work as it progresses.
B. On request of the CQA Representative, the contractor's Surveyor shall submit documentation to verify accuracy of field engineering work.
C. Upon completion of the Work, Contractor shall submit copies of final survey data and record drawings for Subgrade, Compacted Soil Liner, Leachate Collection Layer, leachate collection piping and any other piping, culverts, or utilities to the CQA Representative and Owner.
A. As-built drawing sheets shall include:
    a. Subgrade As Built
        i. Location and Point ID of certification points
        ii. As-built contours, 2' contours typ.
    b. Soil (Clay) Liner As-Built
        i. Location and Point ID of certification points
        ii. As-built contours, 2' contours typ.
        iii. Limits of constructed/surveyed soil (clay) liner

c. Protective Cover / Leachate Collection System As-Built
    i. As-built contours, 2' contours typ.
    ii. Alignment and top of pipe for leachate collection pipes, sump risers, cleanout pipes, and force main piping. Drawing shall denote what the elevations represent (i.e. top of pipe, top of gravel, top of geotextile, etc.). Shots shall be collected at minimum 50' frequency, plus grade and/or alignment change.
    iii. Limits of constructed/placed LCS sand or protective cover
d. Geomembrane Liner As-Built
    i. Illustrate geomembrane panels and seams (survey intersection of all seams)
    ii. Panel ID of each panel
    iii. Location (center) of destructive seam test locations (designated D-#)
    iv. Location of rain flaps with data points and contours.
    v. Locations of all tie-ins to existing cells.
    vi. Location of all anchor trenches; survey inside crest of anchor trench.
    vii. Limits of smooth liner and textured liner.
    viii. Limit of geocomposite/geotextile.
e. Leachate Conveyance System / Civil Improvements As-Built
    i. As-Built for ancillary construction (i.e. roads, ponds, ditches, force mains, etc.). Contours shall be depicted on 2-foot contour intervals for grading.
    ii. Inverts and rim elevations of all force mains, stormwater drainage pipes, manholes, drop inlets, junction boxes, and sediment pond outlet structures.
    iii. Inverts and rim elevations for leachate forcemain manholes and valve vaults.

3.05 DISTRIBUTION

The following shall be distributed to CQA firm upon completion of project:

A. Four (4) copies final signed, sealed as-built survey certification documents (Subgrade as-built, Compacted Soil Liner as-built, LCS as-built, Geomembrane as-built, point tables).

B. Electronic (PDF) copy of above certification documents – with electronic signature and seal,

C. Electronic (PDF) copy of Civil Improvements as-built – with electronic signature and seal,

D. AutoCAD electronic distribution of final as-builts, certification and civil improvements.

3.06 TIME IS OF THE ESSENCE

The CQA firm prepares a CQA Report that must be submitted to the regulatory agency for review and approval of the waste disposal cell, closure or related construction project. The as-built surveys are part of the documentation report and the report cannot be submitted until the surveys are included. The typical time frame for submittal of the CQA report is two weeks after completion of construction. Draft as-built documents shall be submitted for CQA Engineer review within one week after project completion. Note that as-built drawings can be completed for each element as it is completed – i.e. subgrade, soil liner, geomembrane, etc. such that only LCS as-built must be completed upon project completion. This greatly expedites survey turn around at end of project.

3.07 MISCELLANEOUS REQUIREMENTS

A. The surveyor shall number the stacked certification points similarly by layer, i.e. point 1231 (subgrade), 2231 (top soil liner), 3231 (top LCS), etc.
B. When surveying geomembrane liner, survey rod shall be fitted with blunt foot. No sharp points shall be allowed on liner.
C. Wooden grade stakes shall not be used when surveying or laying out earthen liners. Pin flags may be used for surveying soil liners.

D. The certification surveyor is ultimately responsible for verifying lines and grades and layer thickness. Layer thicknesses shall be confirmed by CQA Engineer review prior to giving final approval of contractor to move to next layer.

- END OF SECTION 01 71 23 -

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Contractor shall comply with the requirements of the Contract Documents, and as specified herein, for substantial completion procedures, final inspection, final application for payment, final payment and acceptance, and related topics. In the event of a conflict between this section and the Owner's agreement or contract, the Owner's agreement or contract shall govern.

B. Section includes:
   1. Closeout submittals
   2. Final cleaning and demobilization
   3. Substantial completion procedures
   4. Final inspection procedures
   5. Final Application for Payment
   6. Quality Control Report
   7. Project Record Documents

1.02 CLOSEOUT SUBMITTALS

Submit all project closeout documents referenced in the Contract Documents and specified in this section. Closeout documents include, but may not be limited to, the following:

1. Final Application for Payment
2. Quality Control Report(s)
3. Project Record Documents
4. Warranties (all warranties shall be transferable to Owner)

1.03 FINAL CLEANING AND DEMOBILIZATION

A. After completion of construction activities, Contractor shall be responsible for cleaning of the Site and demobilization prior to the Engineer's and Owner's final acceptance of the Work.

B. Demobilization shall include, but shall not be limited to, the following:
   1. Removal of all Contractor's equipment and materials from the site.
   2. Removal of temporary facilities.
   3. Disconnection and removal of temporary utilities.
   4. Removal and disposal of all trash, excess materials and debris created by or brought on-site during the Work.

1.04 SUBSTANTIAL COMPLETION PROCEDURES

A. When Contractor considers the Work to be substantially complete, Contractor shall submit to the Engineer a written notice that the Work (or designated portion thereof) is substantially complete.

B. Promptly after receipt of such notice, and when/if authorized by Owner, the Engineer and other required parties will inspect to determine the status of completion. The inspection will consist of a walkthrough of the Site, or designated portion thereof. The inspection is to determine whether the Work (or designated portion thereof) is substantially complete and consistent with the Contract Documents.

C. If the Engineer or Owner determines that the work (or designated portion thereof) is not substantially complete, the Engineer or Owner will promptly notify the Contractor in writing. Contractor shall remedy the deficiencies in the Work and send a second written notice to the Owner and Engineer. A reinspection will then be made.

1.05 FINAL INSPECTION PROCEDURES

A. When Contractor considers the Work is complete, Contractor shall submit written certification that the Work is completed and ready for final inspection.
B. The Engineer and/or Owner and other required parties will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
C. If the Engineer and./or Owner considers that the Work is incomplete or defective:
    1. The Engineer or Owner will promptly notify the Contractor, listing any incomplete or defective work.
    2. Contractor shall take immediate steps to complete such work or remedy the stated deficiencies and send a second written certification to the Owner and/or Engineer that the Work is complete and ready for final inspection.
    3. The Owner and/or Engineer will then reinspect the work.
D. When the Owner and Engineer finds that the Work is acceptable under the Contract Documents the Engineer will request the Contractor to make closeout submittals.

1.06 FINAL APPLICATION FOR PAYMENT

A. Submit the final application for payment, accompanied by all required documentation, in accordance with all procedures and requirements stated in the Contract Documents.
B. The Final Application for Payment will not be approved by the Owner and Engineer until all required documentation is submitted, including proof of payment of all subcontractors and suppliers.

1.07 PROJECT RECORD DOCUMENTS

A. Maintain at the site one set of the following documents, which shall constitute the Project Record Documents:
    1. Contract Documents including Change Orders and other modifications to the contract.
    2. Engineer's and Owners Field Orders or written instructions.
    3. Approved product submittals including shop drawings, product data and samples.
    4. Record survey drawings and data.
    5. Other documentation specified in individual sections and as required by the Owner and/ or Engineer.
B. Make Project Record Documents available by the Engineer or Owner at all times.
C. At Contract closeout, deliver Project Record Documents to the Engineer for the Owner.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

- END OF SECTION 01 77 00 -

SECTION 03 30 00
CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Furnish and install Cast-in-Place Concrete as shown on the Drawings and as specified in this Section.
B. This section covers formwork, rebars and all other reinforcing materials, equipment and methods for mixing, placing, testing, finishing, curing, etc. all plain and reinforced, cast in place, normal weight concrete.

1.02 REFERENCES

A. Construction Quality Assurance (CQA) Plan.
B. All work, testing and inspection shall be in accordance with the applicable sections, and references therein, of the specifications and standards of the following:
   1. Locally Adopted Building Code
   2. American Concrete Institute (ACI)
   3. Concrete Reinforcing Steel Institute (CRSI)
   4. ASTM International (ASTM)
   5. PS-1-U.S. Product Standard for Softwood Plywood
C. In conflicts between this specification, industry standards and/or local building codes, the more stringent requirements shall govern.

1.03 SUBMITTALS

A. Shop drawings shall be submitted for the following:
   1. All form work where appropriate and requested.
   2. Placement of all reinforcing steel.
B. Identification of concrete supplier and proposed mix design.
C. A trial mix prepared by an independent testing laboratory for each class of concrete and for each size and gradation of aggregate proposed for the project. The preliminary mix design submittals shall contain the applicable information all components of the mix. After mix is established and approved, substitutions shall not be made. (See subsection 3.08)
D. Certificates of compliance for each of the following:
   1. Cement
   2. Aggregate
   3. Fly Ash
   4. Admixture(s)
E. Strength and slump test results.
F. The Contractor shall notify the Owner in writing a minimum of 7 days prior to starting construction of the Cast-in-Place Concrete. The notice shall state the material to be used, the equipment to be used, the date and time that placement operations will start, and the name of the person in the field who will be in charge of the construction of the Cast-in-Place Concrete.
G. If work is interrupted for reasons other than inclement weather, the Contractor shall notify the Owner and CQA Representative a minimum of 24 hours prior to the resumption of work.

1.04 QUALITY ASSURANCE

A. Owner will retain the services of a CQA Consultant to determine conformance of materials and constructed work with the specifications in accordance with Section 01 40 00.

B. If a defective area is discovered in the Cast-in-Place Concrete, the CQA Representative shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Representative shall determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Representative deems appropriate.
C. After determining the extent and nature of a defect, the CQA Representative shall notify the Contractor and schedule appropriate retests when the defective work has been corrected.
D. The Contractor shall correct defective work to the satisfaction of the CQA Representative. The cost of corrective actions shall be borne by the Contractor.
E. All retests recommended by the CQA Representative must verify that the defect has been corrected before any additional work is performed by the Contractor in the area of the deficiency.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivered materials shall be stockpiled, stored, or staged in areas approved by the Owner or CQA Representative.
B. Contractor shall take care to protect stockpiled materials from damage and soiling.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

Proposed materials and source of supply shall be approved by Engineer or CQA Consultant as specified prior to delivery and use in construction.

2.02 FORMWORK

A. Forms for surfaces which will be exposed to view shall be plywood, steel or lined forms meeting the architectural requirements of the project. Metal or fiberglass forms shall be used for joist and waffle slabs.
B. Form ties shall be designed by the Contractor.
C. Form releasing agent shall be non-staining "Form Oil" as manufactured by Texaco, Sinclair or Nox Crete Form Coating, or Engineer-approved equivalent.

2.03 REINFORCING MATERIAL

A. Bars shall be deformed billet steel bars conforming to ASTM A 615. All bars #4 and larger shall be Grade 60. All bars #3 and smaller shall be Grade 40. All bars shall be shop fabricated and bent cold. Bars shall be free from defects and kinks and from bends not indicated on the Drawings or approved bending diagrams.
B. Mesh reinforcement shall be electrically welded, plain wire fabric conforming to ASTM A 185. Wire shall be cold drawn mild steel conforming to ASTM A 82.
C. Tie wire shall be of black annealed steel, 16 gage minimum.
D. Metal accessories per CRSI.
E. Synthetic reinforcing fibers shall be engineered synthetic fibers made of polypropylene fiber with a specific gravity of 0.90, ignition temperature of 1100°F and tensile strength of 80-110 KSI. Synthetic fibers shall be added at a rate of 1.5 pounds per cubic yard of concrete and to be mixed with the concrete at the batching plant and after all other ingredients have been added. Mix for a minimum of five minutes before placing concrete. A source of synthetic fibers is Fibermesh® as manufactured by Sika company in Chattanooga TN.

2.04 CONCRETE

A. Cement shall be an American brand approved by the engineer, conforming to ASTM C 150, Type 1, unless another type is specified. For exposed surface one brand shall be used throughout.

B. All concrete exposed to freezing and de-icing agents shall have a minimum of 564 pounds (6 bags) of cement per cubic yard with a maximum water/cement ratio of 0.5 lbs/lb and 5 percent entrained air.
C. Coarse aggregate shall be crushed stone or gravel having clean, hard durable uncoated particles sized within the limits of ASTM C 33, Table 2, Size No. 57.
D. Fine aggregate shall be clean, hard, durable natural siliceous river sand with uncoated grains free from all organic material or other impurities meeting ASTM C 33. Manufactured sand shall not be used.
E. Mixing water shall be clean, potable, free from oil, acids, salts, alkalies and injurious amounts of vegetable matter.
F. Ready-Mix Concrete:
    1. Comply with requirements of ASTM C94.
    2. During hot weather, or under conditions contributing to rapid set of concrete, a shorter mixing time than specified in ASTM C94 may be required.
    3. When air temperature is between 85°F and 90°F, reduce mixing and delivery time from 90 minutes to 75 minutes, and when air temperature is above 90°F, reduce mixing and delivery time to 60 minutes.

2.05 ADMIXTURES

A. All exterior concrete shall have an air entraining agent (ASTM C 260) equal to Masterbuilders MBVR to produce a plastic mix with 6% ± 1% of entrained air. It shall be included in the trial design mixes submitted to the Engineer for approval.
B. All interior concrete shall have an air entraining agent (ASTM C 260) equal to Masterbuilders MBVR to produce a plastic mix with 2% - 3% of entrained air. It shall be included in the trial design mixes submitted to the Engineer for approval.
C. No other admixture shall be used without the written permission of the Engineer.

2.06 JOINT FILLER

Expansion joint filler shall be preformed resilient, non-extruding, non-bituminous, fiber type conforming to ASTM D 1751 or D 544.

2.07 WATERSTOPS

Flexible polyvinyl, 3/8 inch by 6 inch ribbed type with center bulb.

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section and the CQA Plan.
B. Inspection:
    1. Prior to implementing any work of this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.
    2. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to installation of the [Title] will be construed as Contractor's acceptance of the related work of all other Sections.

3.02 FORMWORK

A. Where applicable forms shall be placed according to approved Shop Drawings.

B. Erect forms to required dimensions and cross sections, free of surface defects, tied, shored and braced to movement and leakage of mortar. Any defective formwork and/or defective concrete shall be removed at Contractor's expense.
C. Metal and/or fiberglass pans that are bent, badly rusted, cracked or otherwise damaged shall not be used and shall be removed from the site.
D. Provide forms for footings if soil or other conditions are such that earth trench forms are unsuitable. Omission of forms shall be approved by the Engineer.
E. Construct forms so they can be removed readily without hammering or prying against the concrete.
F. Provide box outs, bulkheads with keys, cleanouts, expansion joint strips, and other related items and features.
G. Chamfer all exposed outside corners unless otherwise instructed.
H. Tolerances shall be within the limitations set forth in ACI 347.

3.03 FORM COATING

Immediately before the placing of reinforcing, faces of all forms in contact with the concrete shall receive a thorough coating of the liquid form releasing agent specified, applied in compliance with the manufacturer's instructions. After oiling, any surplus oil on the form surfaces shall be removed.

3.04 REMOVAL OF FORMS

No forms shall be removed without the approval of the Engineer. In general and under normal conditions the Engineer will approve removal of forms as follows:

1. Concrete beams, slabs and other members which span between definite supports shall attain 70% of the specified 28-day strength before removal of the forms. Shores for cantilevered beams and slabs shall remain in place for at least an additional 21 days.
2. Pan forms may be removed after three days if pans are designed for early removal. Soffit boards shall not be disturbed and shall not be removed for a minimum of eight days.
3. Under ordinary weather conditions, wall forms, column forms, side of beam forms and other vertical forms for concrete which do not span between definite supports may be removed after two days.
4. Forms for footings may be removed after 24 hours under ordinary weather conditions.
5. When ambient air temperature falls below 45°F during the curing period form removal shall take place based on job cured test cylinder strength only.
6. After removing forms, horizontal members shall be promptly re-shored at mid span until the 28-day strength of concrete is attained. No floor shall be loaded in excess of live load for which designed unless adequate shores are placed beneath members supporting the concentration of load.
7. Under no circumstances shall wood be buried in full or left in contact with earth. All wood formwork shall be removed unless noted or specified otherwise.
8. Care shall be taken in the removal of the forms to avoid damage to concrete surfaces. Immediately after the forms are removed, all damaged or imperfect work shall be patched, or, if the work, is severely damaged or unacceptable, it shall be rebuilt. Remove all fins from exposed concrete surfaces immediately on removal of forms.
9. Forms to be reused shall be thoroughly cleaned and repaired. Split, frayed, delaminated, or otherwise damaged forms shall not be used.

3.05 REINFORCING STEEL

A. Shop fabricate from approved Shop Drawings. Bars shall not be heated for bending. Return all horizontal bars 2' 0" (or provide individual corner bars) at all corners and intersections in all concrete walls and footings. All bars marked continuous shall be lapped with a Class "C" tension splice, including at corners. Splices shall be located as shown in accordance with CRSI Standards. Provide diagonal corner bars at corners of all openings in slabs and walls. Use 2 #5 X 4' 0" each corner, each face. If embedment length

is not available provide standard hook. General placement and bar coverage shall be in accordance with ACI 318.

B. At job site store at least 12" above ground. Bars shall be free of foreign matter, soiling and oxidation. A thin coating of orange rust resulting from short exposure will not be considered objectionable.
C. Reinforcement which has been exposed for bonding with future work shall be protected from corrosion by heavy wrappings of burlap saturated with a bituminous material.
D. Notify the Engineer at least 24 hours prior to scheduled placement of concrete for inspection of reinforcing steel. No concrete shall be poured until reinforcement placement is approved. Such approval shall not relieve the Contractor of his responsibility for correctness and compliance with the Contract Documents.

3.06 PRODUCTION OF CONCRETE

A. Concrete shall be produced in an approved central mixing plant in accordance with ASTM C 94.
B. Unless otherwise called for on the drawings, concrete shall develop a compressive strength at 28 days, when tested in accordance with the applicable sections of ASTM, as follows:
    1. Interior floor slabs and footings - 3000 psi
    2. Columns, beams, walks, curbs and concrete exposed to the weather - 4000 psi.

3.07 PLACING CONCRETE

A. Concrete shall be placed in compliance with the applicable sections of the ACI. Special attention shall be given to the requirements for slump, testing, curing, tolerances and placing during severe weather.
B. Forms shall be free of ice, water, hardened concrete, and debris and items to be embedded shall be in position.
C. Subgrades shall be sprinkled sufficiently to eliminate water loss from concrete. Concrete shall not be placed on frozen ground.
D. Concrete shall be transported by methods to avoid segregation. Do not use vibrators to transport concrete in forms. Concrete shall be placed rapidly and continuously and as close to its final position as possible. If construction joints are required they shall be placed at a location causing the least effect on the structural integrity of the work.
E. Concrete shall be consolidated by vibration, spading and rodding. Work concrete around reinforcement and embedded items.
F. Provide a drainage system for all retaining walls that are a part of the structure.
G. Coordinate all drawings for proper slope of floor to drains in toilets, showers and similar areas.

3.08 TESTING AND LABORATORY SERVICES

A. The verification and control of concrete mixes shall be the work of an independent testing laboratory. The selection of laboratory and cost of testing shall be paid for by the Owner unless other arrangements are made.
B. Test aggregates, cement and water for specifications compliance. During construction, the Engineer may require field inspection, sampling, and testing of cement, aggregates, etc. testing laboratory in order to determine if the requirements of this specification section are being satisfied.
C. Prepare trial mix for each class of concrete, make and break test cylinders. A minimum of two cylinders shall be tested at 7 days and 28 days.
D. Make slump test and air content test at job site for each sample tested for compressive strength.
E. Test cylinders shall be made and tested as follows:
    1. One (1) set of five (5) cylinders shall be made for each fifty (50) cubic yards or fraction thereof for each class of concrete in each days' pour. Of each set of test cylinders, two (2) shall be broken at seven (7) days, two (2) shall be broken at 28 days, and one (1) held in reserve.
    2. Test cylinders will normally be laboratory cured. However, the Engineer may require tests on field cured specimens to check the adequacy of curing operations.

F. Reports on all tests conducted by the laboratory shall be rendered promptly and distributed as follows:
    1. Engineer: One (1) copy
    2. Contractor: Two (2) copies
G. Report of control cylinders for job placed concrete shall contain the following:
    1. Location of concrete in project
    2. Time of batching, Time of sampling
    3. Concrete and ambient air temperatures
    4. Concrete Slump
    5. Concrete Air Content (if applicable)
    6. Other information furnished by the Contractor
H. Contractor shall advise testing laboratory in advance of operations to allow for assignment of testing personnel and shall provide reasonable labor and assistance in obtaining, handling and storing test samples at the site.
I. Contractor shall observe procedures of laboratory personnel molding and handling test specimens and if he observes any irregularities of procedures, he shall report them in writing to the Engineer within 48 hours.
J. Contractor shall keep a daily log recording quantities of each class of concrete used, the area location of each quantity of concrete relating to its controlling cylinder and the slump of this concrete, and general weather conditions. The contractor shall furnish this information to the laboratory for inclusion in the test report. The Contractor shall obtain delivery tickets showing the class and strength of concrete, the size of coarse aggregate and the slump order. The Contractor shall identify these tickets relative to the area of placement of the concrete and shall retain them on file. He shall produce the tickets should the Engineer so request.

3.09 PRODUCT PROTECTION

A. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.
B. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the CQA Representative and at no additional cost to Owner.

- END OF SECTION 03 30 00 -

SECTION 31 05 19.13
GEOTEXTILE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

The Contractor (Installer) shall furnish all labor, materials (unless specifically noted to be Owner-supplied), tools, supervision, transportation, and installation equipment necessary for the installation of woven and nonwoven Geotextile, as specified herein, as shown on the Drawings, and in accordance with the Construction Quality Assurance (CQA) Plan.

1.02 DEFINITIONS

The following list of definitions is provided for reference.

A. Minimum Average Roll Value (MARV) shall be based on Manufacturer's data and shall be calculated as the mean value of the property of interest plus or minus two standard deviations, as appropriate. Where material properties vary among the machine and cross machine directions, the MARV shall apply to the direction providing the lowest value (when a minimum value is specified) or the highest value (when a maximum value is specified).

1.03 REFERENCES

A. Construction Quality Assurance (CQA) Plan.
B. Latest version of ASTM International (ASTM) standards:
    1. ASTM D3786, Standard Test Method for Bursting Strength of Textile Fabrics-Diaphram Bursting Strength Tester Method
    2. ASTM D4533, Standard Test Method for Trapezoidal Tearing Strength of Geotextiles
    3. ASTM D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
    4. ASTM D4751, Standard Test Methods for Determining Apparent Opening Size of a Geotextile
    5. ASTM D4833, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
    6. ASTM D5261, Standard Test Method for Measuring Mass per Unit Area of Geotextiles
    7. ASTM D6241, Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe
    8. ASTM D7238, Standard Test method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus
C. Latest version of Geosynthetic Research Institute (GRI) standards:
    1. GRI GT-12(a), Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials
    2. GRI GT-13(a), Test Methods and Properties for Geotextiles Used as Separation Between Subgrade Soil and Aggregate.
D. Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.

1.04 SUBMITTALS

A. The Contractor shall submit the proposed material source(s), material/product designation(s), and material specifications to the Engineer a minimum of fourteen (14) days prior to delivery of the Geotextile to the site.
B. The Contractor shall submit the following information and samples to the Engineer a minimum of seven (7) days prior to the delivery of the Geotextile to the site:

1. Identification of the specific rolls to be used for the project (roll inventory).
2. Manufacturer's Material Certifications for each roll of Geotextile to be delivered to the site. As a minimum, the Manufacturer or Contractor shall perform the tests at the frequencies given in the CQA Plan on the materials prior to shipping the material to the site, as applicable.

1.05 QUALITY ASSURANCE

A. Owner will retain the services of a CQA Consultant to determine conformance of materials and constructed work with the specifications in accordance with Section 01 40 00.
B. Conformance testing of the Geotextile may be performed by the CQA Consultant on samples collected at the Manufacturer or upon delivery at the Site. Conformance samples will be collected as directed by the CQA Plan or at the discretion of the CQA Engineer.
C. The installation of the Geotextile shall be monitored as outlined in the Construction Quality Assurance (CQA) Plan.
D. The Contractor shall be aware of the activities and requirements outlined in the CQA Plan and shall account for these activities in the construction schedule.
    1. The minimum testing frequencies for CQA are presented in the CQA Plan. Actual test frequencies may vary. CQA testing, or lack thereof, does not relieve the Contractor from its responsibility to complete the Work in accordance with the CQA Plan, Specifications, and industry standards.
    2. Sampling locations shall be selected by the CQA Representative.
    3. Additional testing may be performed at the CQA Representative's discretion.
E. If a defective area is discovered in the Geotextile, the CQA Representative shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Representative shall determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Representative deems appropriate.
F. After determining the extent and nature of a defect, the CQA Representative shall notify the Contractor and schedule appropriate re-observation or retests when the defective work has been corrected.
G. The Contractor shall correct defective work to the satisfaction of the CQA Representative. The cost of corrective actions shall be borne by the Contractor.
H. All retests recommended by the CQA Representative must verify that the defect has been corrected before any additional work is performed by the Contractor in the area of the deficiency.

1.06 MANUFACTURING QUALITY CONTROL

A. The Manufacturer shall sample and test the Geotextile material, at minimum frequencies specified in the Waste Management Geosynthetic Specification Tables (attached hereto) to demonstrate that the material conforms to the requirements of the Project, as applicable.
B. Sampling shall, in general, be performed on sacrificial portions of the material such that repair of the material is not required.
C. Samples that do not meet the specified properties shall result in rejection of the applicable rolls.
D. At the Manufacturer's discretion and expense, additional testing of individual rolls may be performed to further identify the non-complying rolls and/or to qualify individual rolls.

1.07 PACKING AND LABELING

A. Geotextile shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers.
B. Geotextile rolls shall be marked or tagged with the following information:
    1. manufacturer's name;
    2. product identification;
    3. lot or batch number;
    4. roll number; and
    5. roll dimensions.

C. If any special handling is required, it shall be so marked on the Geotextile itself; e.g., "This Side Up" or "This Side Against Soil to be Retained".

1.08 DELIVERY, STORAGE, AND HANDLING

A. Transportation of the Owner-provided Geotextile is the responsibility of the Owner.
B. Transportation of the Contractor-provided Geotextile is the responsibility of the Contractor. The Contractor shall be liable for all damages to the materials incurred prior to and during transportation to the Site.
C. Unloading, handling, storage, and care of the Geotextile upon delivery, prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damages to the materials incurred prior to final acceptance of the lining system by the Owner.
D. Delivered materials shall be stockpiled, stored, or staged in areas approved by the Owner or CQA Representative.
E. The Geotextile shall be protected from sunlight, moisture, excessive heat or cold, puncture, or other damaging or deleterious conditions. The geotextile shall be protected from mud, dirt and dust. Any additional storage procedures required by the Manufacturer shall be the Contractor's responsibility.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

Proposed materials and source of supply shall be approved by Engineer or CQA Consultant as specified prior to delivery and use in construction.

2.02 NON-WOVEN GEOTEXTILES

A. Material manufacturers must be approved by the Engineer and the Owner.
B. Geotextile shall meet or exceed the criteria specified in the CQA Plan and the Waste Management Geosynthetic Specification Tables. The Manufacturer shall provide test results for these procedures, as well as a certification that the material properties meet or exceed the specified values.
C. In addition to the applicable property values listed in the Waste Management Geosynthetic Specification Tables, the Geotextile shall retain their structure during handling, placement, and long-term service.
D. The Contractor shall supply documentation demonstrating the in-ground durability of the proposed Geotextile. This documentation shall be submitted to the Engineer at least 7 days prior to the start of installation. Approval of the geotextile products based on the documentation is at the discretion of the Engineer.

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section and the CQA Plan.
B. Inspection:
    1. Prior to implementing any work of this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.
    2. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to installation of the Geotextile will be construed as Contractor's acceptance of the related work of all other Sections.

3.02 HANDLING AND PLACEMENT

A. The Contractor shall handle all Geotextile in such a manner as to ensure they are not damaged.
B. The Contractor shall take the necessary precautions to prevent damage to underlying layers during placement of the Geotextile.
C. After unwrapping the Geotextile from its opaque cover, the Geotextile shall not be left exposed for a period in excess of 20 days unless a longer exposure period is approved by the CQA Representative, based on a formal demonstration from the Contractor that the Geotextile is stabilized against U.V. degradation for the proposed period of exposure. The manufacturer may approve in writing an extended period but it must not affect the material warranty.
D. The Contractor shall take care not to entrap stones, excessive dust, or moisture in the Geotextile during placement.
E. The Contractor shall weight all deployed Geotextile with sandbags, or the equivalent, to adequately ballast the geotextile for environmental conditions. Such sandbags shall be installed during placement and shall remain until replaced with protective soil cover or other components of the liner system.
F. The Contractor shall examine the entire Geotextile surface after installation to ensure that no potentially harmful foreign objects are present. The Contractor shall remove any such foreign objects and shall replace any damaged geotextile.

3.03 GEOTEXTILE SEAMS

Geotextile seams shall be constructed in accordance with manufacturer recommendations and as indicated on the Drawings. The Contractor shall submit proposed seaming procedures to the Engineer for approval prior to installation of the material.

3.04 PLACEMENT OF SOIL COVER MATERIALS

The Contractor shall place all soil materials on top of the Geotextile, in such a manner as to ensure that:

1. the Geotextile and underlying materials are not damaged,
2. minimum slippage occurs between the Geotextile and underlying layers,
3. material remains overlapped as specified and excess stresses are not produced in the Geotextile.

3.05 PRODUCT PROTECTION

A. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.
B. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the CQA Representative and at no additional cost to Owner.

- END OF SECTION 31 05 19.13 -

SECTION 31 05 19.26
GEOCOMPOSITE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor (Installer) shall furnish all labor, materials, tools, supervision, transportation, and installation equipment necessary for the installation of Geocomposite, as specified herein, as shown on the Drawings, and in accordance with the Construction Quality Assurance (CQA) Plan.
B. The Installer shall be prepared to install Geocomposite in conjunction with the geosynthetics and other components of the liner and leachate collection systems.

1.02 DEFINITIONS

The following list of definitions is provided for reference.
A. Minimum Average Roll Value (MARV) shall be based on Manufacturer's data and shall be calculated as the mean value of the property of interest plus or minus two standard deviations, as appropriate. Where material properties vary among the machine and cross machine directions, the MARV shall apply to the direction providing the lowest value (when a minimum value is specified) or the highest value (when a maximum value is specified).

1.03 REFERENCES

A. Construction Quality Assurance (CQA) Plan.
B. Latest version of ASTM International (ASTM) standards:
    1. ASTM D792, Test Methods for Density and Specific Gravity of Plastics by Displacement
    2. ASTM D1505, Test Method for Density of Plastics by the Density-Gradient Method
    3. ASTM D1603, Test Method for Carbon Black in Olefin Plastics
    4. ASTM D4218, Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
    5. ASTM D4353, Practice for Sampling of Geosynthetics and Rolled Erosion Control Products
    6. ASTM D4491, Test Methods for Water Permeability of Geotextiles by Permittivity
    7. ASTM D4533, Standard Test Method for Trapezoidal Tearing Strength of Geotextiles
    8. ASTM D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
    9. ASTM D4716, Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
    10. ASTM D4751, Standard Test Methods for Determining Apparent Opening Size of a Geotextile
    11. ASTM D4873, Guide for Identification, Storage and Handling of Geosynthetic Rolls and Samples
    12. ASTM D5035, Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
    13. ASTM D5199, Test Method for Measuring the Nominal Thickness of Geosynthetics
    14. ASTM D5261, Standard Test Method for Measuring Mass per Unit Area of Geotextiles
    15. ASTM D6241, Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe
    16. ASTM D6364, Standard Test Method for Determining Short-Term Compression Behavior of Geosynthetics
    17. ASTM D7005, Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposite
    18. ASTM D7179, Standard Test Method for Determining Geonet Breaking Force
    19. ASTM D7238, Standard Test method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus
C. Latest version of Geosynthetic Research Institute (GRI) standards:
    1. GRI GN2, Joining and Attaching Geonets and Drainage Composites

2. GRI GN4, Test Methods, Required Properties and Testing Frequency for Biplanar Geonets and Biplanar Geonet Composites
3. GRI GT-13(a), Test Methods and Properties for Geotextiles Used as Separation Between Subgrade Soil and Aggregate.

D. Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.

1.04 SUBMITTALS

A. The Contractor/Installer or Manufacturer shall submit the proposed material source(s), material/product designation(s), and material specifications to the Engineer a minimum of fourteen (14) days prior to delivery of the Geocomposite to the site.

B. The Contractor/Installer or Manufacturer shall submit the following information and samples to the Engineer a minimum of seven (7) days prior to the delivery of the Geocomposite to the site:
1. Identification of the specific rolls to be used for the project (roll inventory).
2. Manufacturer's Material Certifications for each roll of Geocomposite to be delivered to the site. As a minimum, the Manufacturer or Contractor shall perform the tests at the frequencies given in the CQA Plan on the materials prior to shipping the material to the site, as applicable.

1.05 QUALITY ASSURANCE

A. Owner will retain the services of a CQA Consultant to determine conformance of materials and constructed work with the specifications in accordance with Section 01 40 00.

B. Conformance testing of the Geocomposite may be performed by the CQA Consultant on samples collected at the Manufacturer or upon delivery at the Site. Conformance samples will be collected as directed by the CQA Plan or at the discretion of the CQA Engineer.

C. The construction of the Geocomposite shall be monitored as outlined in the Construction Quality Assurance (CQA) Plan.

D. The Contractor/Installer shall be aware of the activities and requirements outlined in the CQA Plan and shall account for these activities in the construction schedule.
1. The minimum testing frequencies for CQA are presented in the CQA Plan. Actual test frequencies may vary. CQA testing, or lack thereof, does not relieve the Contractor from its responsibility to complete the Work in accordance with the CQA Plan and Specifications.
2. Sampling locations shall be selected by the CQA Representative.
3. Additional testing may be performed at the CQA Representative's discretion.

E. If a defective area is discovered in the Geocomposite, the CQA Representative shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Representative shall determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Representative deems appropriate. Repairs will be made in accordance with subsection 3.04 herein.

F. After determining the extent and nature of a defect, the CQA Representative shall notify the Contractor/Installer and schedule appropriate re-observation or retests when the defective work has been corrected.

G. The Contractor/Installer shall correct defective work to the satisfaction of the CQA Representative. The cost of corrective actions shall be borne by the Contractor/Installer.

H. All retests recommended by the CQA Representative must verify that the defect has been corrected before any additional work is performed by the Contractor/Installer in the area of the deficiency.

1.06 MANUFACTURING QUALITY CONTROL

A. The Manufacturer shall sample and test the Geocomposite material, at minimum frequencies specified in GRI-GN4, the CQA Plan, and the Waste Management Geosynthetic Specification Tables (attached hereto) to demonstrate that the material conforms to the requirements of the Project, as applicable.
B. Sampling shall, in general, be performed on sacrificial portions of the material such that repair of the material is not required.
C. Samples that do not meet the specified properties shall result in rejection of the applicable rolls.
D. At the Manufacturer's discretion and expense, additional testing of individual rolls may be performed to further identify the non-complying rolls and/or to qualify individual rolls.

1.07 PACKING AND LABELING

A. Geocomposite shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers.
B. Geocomposite rolls shall be marked or tagged with the following information:
    1. manufacturer's name;
    2. product identification;
    3. lot or batch number;
    4. roll number; and
    5. roll dimensions.
C. If any special handling is required, it shall be so marked on the Geocomposite itself; e.g., "This Side Up" or "This Side Against Soil to be Retained".

1.08 DELIVERY, STORAGE, AND HANDLING

A. Transportation of the Owner-provided Geocomposite is the responsibility of the Owner.
B. Transportation of the Contractor-provided Geocomposite is the responsibility of the Contractor. The Contractor shall be liable for all damages to the materials incurred prior to and during transportation to the Site.
C. Unloading, handling, storage, and care of the Geocomposite upon delivery, prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damages to the materials incurred prior to final acceptance of the lining system by the Owner.
D. Delivered materials shall be stockpiled, stored, or staged in areas approved by the Owner or CQA Representative in accordance with ASTM D4873.
E. The Geocomposite shall be protected from sunlight, moisture, excessive heat or cold, puncture, or other damaging or deleterious conditions. The Geocomposite shall be protected from mud, dirt and dust. Any additional storage procedures required by the Manufacturer shall be the Contractor's responsibility.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

Proposed materials and source of supply shall be approved by Engineer or CQA Consultant as specified prior to delivery and use in construction.

2.02 GEOCOMPOSITES

A. Material manufacturers must be approved by the Engineer and the Owner.
B. Geocomposite shall meet or exceed the criteria specified in the CQA Plan and the Waste Management Geosynthetic Specification Tables. The Manufacturer shall provide test results for these procedures, as well as a certification that the material properties meet or exceed the specified values.

C. In addition to the applicable property values listed in the CQA Plan and the Waste Management Geosynthetic Specification Tables, the Geocomposite shall retain their structure during handling, placement, and long-term service.
D. The Contractor/Installer or Manufacturer shall supply documentation demonstrating the in-ground durability of the proposed Geocomposite. This documentation shall be submitted to the Engineer at least 7 days prior to the start of installation. Approval of the Geocomposite products based on the documentation is at the discretion of the Engineer.

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any work of this Section, the Contractor/Installer shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section and the CQA Plan.
B. Inspection:
    1. Prior to implementing any work of this Section, the Contractor/Installer shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.
    2. If the Contractor/Installer has concerns regarding the installed work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to installation of the Geocomposite will be construed as Contractor's/Installer's acceptance of the related work of all other Sections.

3.02 HANDLING AND PLACEMENT

A. The Contractor/Installer shall handle all Geocomposite in such a manner as to ensure they are not damaged.
B. The Contractor/Installer shall take the necessary precautions to prevent damage to underlying layers during placement of the Geocomposite.
C. After unwrapping the Geocomposite from its opaque cover, the geotextile shall not be left exposed for a period in excess of 20 days unless a longer exposure period is approved by the CQA Representative, based on a formal demonstration from the Contractor that the Geocomposite is stabilized against U.V. degradation for the proposed period of exposure. The manufacturer may approve in writing an extended period but it must not affect the material warranty.
D. The Contractor/Installer shall take care not to entrap stones, excessive dust, or moisture in the Geocomposite during placement.
E. The Contractor/Installer shall weight all deployed Geocomposite with sandbags, or the equivalent, in the presence of wind. Such sandbags shall be installed during placement and shall remain until replaced with protective soil cover or other components of the liner system.
F. The Contractor/Installer shall examine the entire Geocomposite surface after installation to ensure that no potentially harmful foreign objects are present. The Contractor/Installer shall remove any such foreign objects and shall replace any damaged geotextile.

3.03 SEAMS AND OVERLAPS

A. Geonet overlaps and geotextile seaming shall be constructed in accordance with manufacturer recommendations and as indicated on the Drawings. The Contractor/Installer shall submit proposed seaming procedures to the Engineer for approval prior to installation of the material.
B. Non-woven geotextiles shall be continuously sewn (i.e., spot sewing is not allowed) or as recommended by the manufacturer and approved by the Engineer. Geotextiles shall be overlapped a minimum of 6 inches prior to seaming. No horizontal side seams shall be allowed on slopes steeper than 4 horizontal

to 1 vertical (i.e., seams shall be generally parallel to line of maximum slope). Adjacent rolls of geonet shall be overlapped a minimum of 6 inches and be tied with plastic fasteners at a spacing of not more than every 5 feet. Adjacent seams in the anchor trench and end of roll seams shall be connected by fasteners at a spacing of no less than six inches. End of roll seams shall be connected with ties at least every two feet and seams shall be staggered. Other seaming techniques may be approved by the Owner or the CQA Representative. Additional requirements of the CQA Plan shall be followed.

C. Polymeric thread, with chemical resistance properties equal to or exceeding those of the non-woven geotextile, shall be used for sewing. The seams shall be sewn to provide a flat (prayer) seam, "J" seam, or "butterfly folded" seam and shall be a two thread, double lock stitch or a double row of single thread, chain stitch. Other types of seaming may be allowed if recommended by the material manufacturer and approved by Engineer.

D. When sewing a flat geotextile seam, the stitching shall be approximately 1-1/2 inches (± 1/4") from the outside edge of the fabric (not in the selvage or at the selvage edge). The "J" fold and Butterfly fold seams require a fold 1-1/4 inches to 2 inches from the fabric edge with the stitching approximately 1 inch from the folded edge.

3.04 REPAIR

A. Any holes or tears in the Geocomposite shall be repaired as follows:
   1. On slopes steeper than 5 horizontal to 1 vertical, a patch made from the same Geocomposite shall be double seamed into place (with each fastener 0.5 inch apart and no closer than 2 inches from any edge). Should any tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced with new material.
   2. On slopes flatter than or equal to 5 horizontal to 1 vertical, a patch made from the same Geocomposite shall be spot seamed in place with a minimum of 2 feet overlap in all directions.

B. Care shall be taken to remove any soil or other material which may have penetrated the torn Geocomposite.

3.05 PLACEMENT OF SOIL COVER MATERIALS

The Contractor/Installer shall place all soil materials on top of the Geocomposite, in such a manner as to ensure that:

1. the Geocomposite and underlying materials are not damaged,
2. minimum slippage occurs between the Geocomposite and underlying layers,
3. wrinkle development and progression are limited and within industry standard, and
4. material remains overlapped as specified and excess stresses are not produced in the Geocomposite.

3.06 PRODUCT PROTECTION

A. The Contractor/Installer shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.

B. In the event of damage, the Contractor/Installer shall immediately make all repairs and replacements necessary to the approval of the CQA Representative and at no additional cost to Owner.

- END OF SECTION 31 05 19.26

SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Clearing, grubbing, removal and disposal of vegetation, rocks, roots and debris within the limits of the Work except objects designated on the Drawings to remain.
B. Preservation from injury or defacement all vegetation and objects to remain.
C. Installation of erosion control measures per Section 01 57 13.

1.02 LIMITS OF WORK

A. Ingress and egress rights-of-way established by the Owner.
B. Construction area designated on the Drawings, including the designated contractor staging and employee parking areas bounded by lines five feet outside the designated areas.

1.03 QUALITY ASSURANCE

A. Owner will retain the services of a CQA Consultant to determine conformance of materials and constructed work with the specifications in accordance with Section 01 40 00.
B. If a defective area is discovered in the Site Clearing, the CQA Representative shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Representative shall determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Representative deems appropriate.
C. After determining the extent and nature of a defect, the CQA Representative shall notify the Contractor and schedule appropriate retests when the defective work has been corrected.
D. The Contractor shall correct defective work to the satisfaction of the CQA Representative. The cost of corrective actions shall be borne by the Contractor.
E. All retests recommended by the CQA Representative must verify that the defect has been corrected before any additional work is performed by the Contractor in the area of the deficiency.

1.04 EROSION AND SEDIMENT CONTROLS

A. Prior to beginning Site Clearing, Contractor shall install and establish erosion and sediment controls in accordance with Section 01 57 13.
B. Contractor shall not clear or disturb any areas that are not protected by adequate erosion and sediment controls to prevent sediment discharge from the Site.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the Work falling within this Section and the CQA Plan.
B. Inspection:
    1. Prior to implementing any work of this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.

2. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to performance of the Work will be construed as Contractor's acceptance of the related work of all other Sections.

C. The Contractor shall maintain benchmarks, monuments and other reference points and re-establish at no cost to Owner if disturbed or destroyed. The Contractor shall also furnish all labor, materials, supervision and equipment to complete Site Clearing for the proposed construction.

3.02 CLEARING AND GRUBBING

A. The Contractor shall clear the construction area, borrow area(s), stockpile area(s), roadway area(s), and other construction areas of trees, stumps, roots, vegetation and other deleterious organic materials.
B. Trees and stumps shall be cut to within six inches of the ground surface where embankments are to be constructed provided undercutting or other corrective measures are not stipulated.
C. Trees and stumps outside the construction area and marked by the Owner for removal shall be cut to within six inches of the ground surface.
D. Low hanging, unsound or unsightly branches on trees or shrubs designated to remain shall be removed as directed by the Owner.
E. The construction area shall be grubbed of protruding obstructions except sound undisturbed stumps and roots six inches or less above the ground which will be a minimum of 5 feet below subgrade or embankment slope provided undercutting, topsoil stripping or other corrective measures are not stipulated.
F. The Contractor shall perform Site Clearing well in advance of construction or material removal activities.
G. The Site Clearing contractor shall not cut or injure any trees or other vegetation outside the limits of the areas on which work is to be done without permission therefore, and he shall guard against like action by his employees and sub-contractors. Existing vegetation or landscaping beyond clearing limits shall be protected by orange plastic fencing or other clearly visible approved means.
H. Review with the Owner or CQA Representative the location, limits, and methods to be used prior to commencing the Work under this section.

3.03 DEBRIS REMOVAL

A. All material collected in the course of the Site Clearing shall be disposed of in a manner consistent with applicable State and County regulations. Such disposal shall be carried on after removal of the materials in the Site Clearing operations and shall not be left until the final clean up period.
B. Burning shall be done only with approval of Owner and at approved times and locations. Burning shall be in conformity with all local and state regulations and requirements including those requirements of the governing air pollution control authority and the facilities solid waste permit. The Contractor shall make all necessary arrangements and pay for all necessary permits. The Contractor shall take all precautions necessary to prevent the spread of fire outside the immediate areas where burning is being done. No material shall be transported from off-site locations and burned on the landfill property.
C. Prior to depositing surplus material at any off-site location, the Site Clearing contractor shall obtain a written agreement between himself and the owner of the property on which the disposal is proposed. The agreement shall state that the owner of the property gives permission for the Contractor to enter and deposit the material at no expense to the Owner. A copy of the agreement shall be furnished to the Owner prior to removing any material from the site.

3.04 PRODUCT PROTECTION

A. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.

B. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the CQA Representative and at no additional cost to Owner.

- END OF SECTION 31 10 00 -

SECTION 31 23 13
SUBGRADE PREPARATION FOR GEOSYNTHETICS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

The Contractor shall prepare the earthen subgrade surface over which the geosynthetic liner (geomembrane liner or geosynthetic clay liner) will be deployed to promote "direct and uniform contact" between the Landfill Compacted Soil Liner (Section 31 23 43) and the geosynthetic liner. "Direct and uniform contact" between the composite liner components is directed by 40 CFR Part 258.40.

1.02 REFERENCES

A. Construction Quality Assurance (CQA) Plan.
B. Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.

1.03 QUALITY ASSURANCE

A. Owner will retain the services of a CQA Consultant to determine conformance of materials and constructed work with the specifications in accordance with Section 01 40 00.
B. The construction of the Subgrade Preparation for Geosynthetics shall be monitored as outlined in the Construction Quality Assurance (CQA) Plan.
C. The construction of the Subgrade Preparation for Geosynthetics may also be overseen and require approval by the state regulatory agency or agent. Contractor shall be familiar with any requirements of the state regulatory agency or agent and prepare the subgrade accordingly.
D. The Contractor shall be aware of the activities and requirements outlined in the CQA Plan and shall account for these activities in the construction schedule.
E. The Contractor shall correct defective work to the satisfaction of the CQA Representative. The cost of corrective actions shall be borne by the Contractor.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section and the CQA Plan.
B. Inspection:
    1. Prior to implementing any work of this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.
    2. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to preparation of the Subgrade for Geosynthetics will be construed as Contractor's and/or Installer's acceptance of the related work of all other Sections.

3.02 SUBGRADE PREPARATION

A. The earthen subgrade shall be prepared to the lines and grades as designated on the Contract Drawings.
B. The subgrade shall be moisture conditioned and compacted in accordance with the pertinent earthwork specification.
C. Subgrade surface shall be smooth, flat, firm, and unyielding with no sudden, sharp, or abrupt changes or break in grade.
D. Subgrade surface shall be free of all rocks and stones
E. Sticks, sharp objects, hard nodules, subsurface voids, soft areas, excess silt, protrusions, or debris of any kind shall not be present.
F. Subgrade shall be of adequate bearing strength to support the weight of geosynthetics installation equipment. Equipment shall not deform or rut the soil subgrade excessively. Tire or track deformations beneath the geosynthetic liner should not be greater than 1.0 inches in depth.
G. No standing water, mud, snow, ice, or frozen subgrade conditions shall be present.
H. The subgrade shall not be prepared while frozen and it should not include any frozen material.
I. The subgrade should be protected from desiccation, inundation, and freezing for extended periods. Freezing of the subgrade may require reworking the subgrade at the discretion of the CQA Representative. Desiccated (dry) subgrade should be wetted and may require smooth drum rolling to seal desiccation cracks at the discretion of the CQA Representative.
J. The subgrade surface should be drum smooth rolled or otherwise acceptably smoothed prior to geosynthetic liner installation.
K. Subgrade damaged by construction equipment shall be repaired prior to geosynthetic placement.
L. Contractor may apply loose, relatively dry compacted soil liner soil or granulated bentonite to fill small voids or to help smooth rough areas. Loose soil fill or bentonite should be tamped in place with a hand tamper.
M. Contractor shall comply with any other requirements of the state regulatory agency or agent with regard to subgrade preparation.

3.03 SUBGRADE APPROVAL

A. The subgrade may require approval by the state regulatory agency or agent. The Contractor will coordinate with CQA Representative or Owner to request approvals, as needed, by the state regulatory agency. Contractor shall NOT contact the state regulatory agency directly.
B. The Geosynthetic Installer and CQA Representative shall inspect the surface to be covered with geosynthetic liner prior to each day's deployment operations to verify and document suitability of the subgrade for geosynthetic liner deployment.
C. The Geosynthetic Installer and CQA Representative shall provide daily written acceptance for the subgrade to be covered by the geosynthetic liner on that day's operations.

3.04 PRODUCT PROTECTION

A. The subgrade shall be maintained in a manner, prior to and during geosynthetic liner installation, to ensure subgrade suitability and acceptability.
B. All subgrade damaged by construction equipment and deemed unsuitable for geosynthetic liner deployment shall be repaired prior to placement of the geosynthetic liner. All repairs shall be approved by the CQA Representative and the Geosynthetic Installer.

– END OF SECTION 31 23 13 –

SECTION 31 23 19
DEWATERING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

Contractor shall provide Dewatering as needed to facilitate completion of the Work, if groundwater, seepage, or stormwater infiltration is encountered.

1.02 DESIGN REQUIREMENTS

A. Contractor shall be responsible for the design of all dewatering systems (including construction of dewatering features) required for construction of earthworks and installation of pipes and structures as required to complete the Work.
B. Dewatering systems shall be designed and implemented to provide a working area free of standing water until construction is completed. Water shall be pumped, drained by gravity, or removed by other means and discharged were approved by the Engineer and Owner.
C. The extent of control of water includes, but is not limited to, the following:
    1. Furnishing, installing, an operating all necessary pumps, piping, and accessories.
    2. Design and construction of dewatering and drainage control features such as underdrains, French drains, or well-point networks.
    3. Maintaining dewatering system for as long as needed and removing temporary works and equipment after they have served their purpose.

1.03 SUBMITTALS

A. Submit a Dewatering Plan for control of water to the Engineer for review and approval.
B. The Dewatering Plan shall indicate:
    1. Method(s) of dewatering to be used;
    2. The location of sumps, wells, and pumps as needed; and
    3. How and where water will be discharged.
C. The Contractor shall notify the Owner in writing a minimum of 7 days prior to starting construction of the Dewatering.
D. If work is interrupted for reasons other than inclement weather, the Contractor shall notify the Owner and CQA Representative a minimum of 24 hours prior to the resumption of work.

1.04 PROJECT CONDITIONS

Some subsurface information (including soil borings and groundwater elevations) may be available for review by the Contractor as referenced in the Contract Documents. Contractor is responsible for determining the character of materials, extent of groundwater, seepage or other conditions to be encountered and is responsible for managing groundwater and/or seepage during construction. No warranty, either expressed or implied, is made as to the accuracy of the subsurface information presented by the Owner and/or Engineer.

1.05 COORDINATION

Dewatering work shall be coordinated with other phases of the Work to comply with the approved schedule and to provide required conditions for stability of excavations, control of groundwater during construction, and proper disposal of removed groundwater as specified or directed.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Provide and maintain at all times proper and approved pumping machinery of sufficient capacity to meet the maximum requirements for the removal of water which may be encountered in the excavations or which may enter excavations due to precipitation.
B. Keep on hand, or have immediate access to, additional pumps of sufficient capacity to provide reasonably for any breakdown or for Dewatering the work in case of flooding.
C. Sufficient suction and discharge hose or piping shall be available for adequate disposal of pumped liquid's without causing erosion, sedimentation, or other adverse consequences.

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the Work falling within this Section and the CQA Plan.
B. Inspection:
    1. Prior to implementing any Work of this Section, the Contractor shall carefully inspect the installed Work of all other Sections and verify that all such Work is complete to the point where the installation of this Section may properly commence without adverse impact.
    2. If the Contractor has any concerns regarding the installed Work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to installation of the Dewatering will be construed as Contractor's acceptance of the related Work of all other Sections.

3.02 DEWATERING

A. If required for construction operations, the groundwater surface shall be lowered to a depth of approximately two feet below proposed excavation bottom.
B. Maintain and operate the Dewatering equipment until excavation of materials and placement of the landfill liner and leachate collection system is complete. Only discontinue dewatering or pumping with approval from Engineer.
C. Provide erosion and sedimentation control necessitated by the dewatering discharge operations and coordinate dewatering with Owner and Engineer.

3.03 DISPOSAL OF WATER

A. All non-contact (waste) water removed during the Dewatering operations shall be discharged into areas approved by the Engineer and Owner using approved equipment and methods.

3.04 PRODUCT PROTECTION

A. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.
B. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the CQA Representative and at no additional cost to Owner.

- END OF SECTION 31 23 19 -

SECTION 31 23 23
GENERAL EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, and equipment necessary for the construction of the General Earthwork as specified herein, as shown on the Drawings, and in accordance with the Construction Quality Assurance (CQA) Plan.

B. The Work of this Section shall include, but not necessarily be limited to: excavating, separating, hauling, stockpiling, backfilling, compacting, and grading of soils placed as general grading fill or structural fill, but excludes Landfill Compacted Soil Liner. The Work of this Section may pertain in whole or in part to construction of the following: the landfill cell, perimeter berm, roads, sedimentation basin, leachate tank area, maintenance area, parking areas, fuel station, access bench, temporary anchor trench bench, and other earthworks.

C. The Contractor shall conform General Earthwork to the dimensions, lines, and grades indicated or specified on the Drawings.

D. Excavation shall be considered General Excavation when earthen materials can be removed by the following equipment:

E. General Excavation: A single-tooth ripper drawn by a crawler tractor having a draw bar pull rated at not less than 56,000 pounds (Caterpillar D-8R or equivalent) or a front-end loader with a minimum bucket breakout force of 40,000 pounds (Caterpillar 973 or equivalent).

   1. Trench Excavation: A backhoe having a bucket curling force rated at not less than 53,000 pounds (Caterpillar 330D or equivalent).
   2. Rock Excavation: Excavation and disposal of rock material occurring as boulders or in beds, ledges, unstratified masses, and conglomerate deposits and which cannot be removed by the excavating equipment referenced above without the aid of systematic drilling and blasting and having a minimum volume of one cubic yard. Drilling or blasting in order to increase productivity will not be cause for classification of materials as rock excavation.

F. The Contractor is responsible for stormwater management, controls and dewatering related to the Work area and materials used for the General Earthwork in accordance with Section 01 57 13.

G. The Contractor shall be prepared to construct the General Earthwork in conjunction with other earthwork elements of the Work (i.e. Landfill Compacted Soil Liner) and the installation and construction of the other components of the Project.

H. Notwithstanding the prequalification of any material sources for the General Earthwork, the Contractor shall be entirely responsible for meeting the requirements of this Section.

1.02 DEFINITIONS

The following list of definitions is provided for reference.

A. "Compaction" shall mean the process of increasing the density or unit weight of soil by rolling, tamping, vibrating, or other mechanical means.

B. "In Situ" shall mean in-place.

C. "Moisture Content" shall mean the ratio of weight of water in the soil to the weight of the soil solids (dry soil), expressed in percentage; also referred to as gravimetric water content.

D. “Percent Compaction” shall mean the ratio of the unit weight of the soil to the maximum unit weight of the soil at determined by a laboratory compaction (Proctor) test.

E. "Unit Weight" shall mean the weight of a soil weight per unit volume, usually expressed in lb/ft^3 or kN/m^3; also referred to as density.

1.03 REFERENCES

A. Construction Quality Assurance (CQA) Plan.
B. Latest version of ASTM International (ASTM) standards:
    1. ASTM D422, Standard Method for Particle-Size Analysis of Soils.[withdrawn standard]
    2. ASTM D698, Test Method for Laboratory Compaction of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
    3. ASTM D1140, Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75-mm) Sieve.
    4. ASTM D1556, Standard Test Method for Density of Soil In Place by the Sand-Cone Method.
    5. ASTM D2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.
    6. ASTM D2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
    7. ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
    8. ASTM D2937, Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
    9. ASTM D4220, Standard Practices for Preserving and Transporting Soil Samples.
    10. ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
    11. ASTM D4643, Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating.
    12. ASTM D4718, Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
    13. ASTM D4959, Standard Test Method for Determination of Water Content of Soil by Direct Heating.
    14. ASTM D5080, Standard Test Method for Rapid Determination of Percent Compaction.
    15. ASTM D6913, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
    16. ASTM D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.04 SUBMITTALS

A. The Contractor shall submit the following information and samples to the CQA Representative a minimum of 14 days prior to the start of construction of the General Earthwork, unless otherwise approved by the CQA Representative:
    1. Identification of the proposed material source or sources.
    2. A representative 50-pound sample of each material type and source.
    3. A list of equipment to be used for construction of the Landfill Compacted Soil Liner with make and model of equipment.
    4. Detailed specification cut sheet for soil compactor.
B. The Contractor shall notify the Owner and CQA Consultant in writing a minimum of 7 days prior to starting construction of the General Earthwork. The notice shall state the material to be used, the equipment to be used, the date and time that placement operations will start, and the name of the person in the field who will be in charge of the construction of the General Earthwork.
C. If work is interrupted for reasons other than inclement weather, the Contractor shall notify the Owner and CQA Representative a minimum of 24 hours prior to the resumption of work.

1.05 QUALITY ASSURANCE

A. Owner will retain the services of a CQA Consultant to determine conformance of materials and constructed work with the specifications in accordance with Section 01 40 00.

B. The construction of the General Earthwork shall be performed and monitored as outlined in the Construction Quality Assurance (CQA) Plan or as indicated on the Drawings.
C. The Contractor shall be aware of the activities and requirements outlined in the CQA Plan and shall account for these activities in the construction schedule.
    1. The minimum testing frequencies for CQA are presented in the CQA Plan. Actual test frequencies may vary. CQA testing, or lack thereof, does not relieve the Contractor from its responsibility to complete the Work in accordance with the CQA Plan and Specifications.
    2. Sampling locations shall be selected by the CQA Representative. If necessary, the location of routine in-place moisture content and dry unit weight tests shall be determined using a non-biased sampling plan.
    3. Additional testing may be performed at the CQA Representative's discretion.
D. If a defective area is discovered in the General Earthwork, the CQA Representative shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Representative shall determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Representative deems appropriate.
E. After determining the extent and nature of a defect, the CQA Representative shall notify the Contractor and schedule appropriate retests when the defective work has been corrected.
F. The Contractor shall correct defective work to the satisfaction of the CQA Representative. The cost of corrective actions shall be borne by the Contractor.
G. All retests recommended by the CQA Representative must verify that the defect has been corrected before any additional work is performed by the Contractor in the area of the deficiency.

1.06 DELIVERY, STORAGE, AND HANDLING

A. General Earthwork material shall be stockpiled in areas approved by the Owner or CQA Representative.
B. In order to achieve relative consistency of soil type and performance results of General Earthwork, soil material from different borrow sources shall either be segregated into separate stockpiles or the source of fill material shall be limited to hauling from one borrow source per day.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Proposed materials and source of supply shall be approved by Engineer or CQA Consultant as specified prior to delivery and use in construction.
B. Contactor shall obtain and submit samples of all proposed General Earthwork materials for analysis within fourteen (14) days of planned use to allow for required CQA laboratory testing.
C. Acceptability of the proposed borrow source for General Earthwork material will be evaluated by the CQA Consultant based on the requirements of the CQA Plan or as deemed necessary by the CQA Engineer.
D. Contractor shall notify the CQA Representative prior to any change in source of General Earthwork materials and shall submit samples as required herein to evaluation and approval of source.

2.02 STRUCTURAL FILL SOIL

A. Structural Fill Soils includes soils to be used for grading fill in structurally dependent areas such as cell floor/subgrade, perimeter berms, roadways, and other areas designated on the plans to receive Structural Fill.
B. Laboratory testing to evaluate the suitability or conformance of soil materials for the Structural Fill Soil shall be carried out in accordance with the CQA Plan.
C. The Structural Fill Soil shall consist of relatively homogeneous, natural or amended soils which are free of gypsum, ferrous, calcareous concretions, roots, debris, foreign objects, excess silt, and organics. The soil shall be classified according to the Unified Soil Classification System as SW, SP, SC, ML, or CL

material or shall be other natural or amended material approved by the Engineer or CQA Engineer capable of meeting strength requirements. Regardless of the classification requirements, the material shall meet the requirements of the CQA Plan. The soils selected shall not be organic, organic-laden, gap-graded or susceptible to piping. Substandard materials shall be segregated at the source and will not be permitted at the work area. Any material which is found by the CQA Representative to be substandard shall be removed from the work area by the Contractor as directed by the Owner at no extra cost to Owner.

D. The Structural Fill Soil material shall have a minimum liquid limit and plasticity index as specified in the CQA Plan.

E. For construction quality assurance (CQA) purposes, the Owner shall provide soil testing in accordance with the CQA plan. Costs associated with retesting of failing CQA tests shall be paid for by the Contractor if requested by the Owner. The Contractor may use quality assurance test results to assist him with constructing the Structural Fill Soils in accordance with these Specifications. If the Contractor requires additional testing to control construction quality, such additional testing shall be provided by the Contractor at no additional cost to the Owner.

2.03 GENERAL GRADING SOIL

A. General Grading Soil includes soils to be used for grading fill in non-structurally dependent areas to achieve general grade for stormwater management, general maintenance operations, etc.

B. Laboratory testing to evaluate the suitability or conformance of soil materials for the General Grading Soil shall be carried out in accordance with the CQA Plan.

C. The General Grading Soil shall consist of natural soils which are free of gypsum, ferrous, calcareous concretions, excess roots, excess debris, foreign objects, excess silt, and excess organics. The soils shall not be highly erodible. Substandard materials shall be segregated at the source and will not be permitted at the work area. Any material which is found by the CQA Representative to be substandard shall be removed from the work area by the Contractor as directed by the Owner at no extra cost to Owner.

D. For construction quality assurance (CQA) purposes, the Owner shall provide soil testing in accordance with the CQA plan. Costs associated with retesting of failing CQA tests shall be paid for by the Contractor if requested by the Owner. The Contractor may use quality assurance test results to assist him with constructing the Structural Fill Soils in accordance with these Specifications. If the Contractor requires additional testing to control construction quality, such additional testing shall be provided by the Contractor at no additional cost to the Owner.

2.04 GRADED SOLID ROCK FILL

A. With prior approval from the Owner and Engineer, graded solid rock may be used in place of structural fill to achieve design grades.

B. Graded solid rock shall consist of sound, non-degradable rock with a maximum size of 24 inches. Material that readily breaks down under 3 passes of a 60,000 lbs (27,200 kgs) static tamping foot roller will be considered as degradable. At least 50% of the rock shall be uniformly distributed between 12 inches and 24 inches in diameter, and no greater than 10% shall be less than 2 inches in diameter. The material shall be roughly equidimensional in shape. Thin, plate-like material will not be accepted. Rock fill shall be free of organic materials, debris, waste, frozen materials, vegetation, roots, and any other deleterious materials.

C. Contractor shall be required to process the material with an acceptable mechanical screening process that produces the required gradation. When the material is subjected to five alternations of the Sodium Sulfate Soundness Test (AASHTO T 104), the weighted percentage of loss shall not be more than 12 percent. The material shall be approved by the CQA Engineer prior to use.

D. Rock Fill shall not be dumped into its final position but shall be placed and spread into position in approximately horizontal layers by blading or dozing in a manner that will minimize voids, pockets and

bridging. Each layer shall be leveled the full width of the embankment. Distribute spalls and finer rock fragments to level and smooth each lift. For embankments, the rock shall be placed so that the completed fill shall be graded with the smaller rock fragments placed in the outer portion of the embankment and the larger rock fragments placed on the inner slopes.

E. Rock shall be placed to produce a stable fill that contains no large unfilled spaces caused by bridging of the larger fraction.
F. Rock Fill shall not be placed in the top 5 ft. (1.5 m) of any embankment unless approved by the Engineer. Rock Fill shall not be placed within 5 feet of proposed culverts or piping. Rock Fill shall not be placed within the proposed or future landfill footprint.
G. The outer slopes of the embankment must consist of a minimum of 2 feet of soil structural fill. Where rock fill is utilized within the embankment, the transition from rock fill to structural fill must consist of well graded material to prevent movement of soil into the rock fill. Such transitions shall be inspected by the CQA Engineer.
H. The Engineer may require the use aggregate or geotextile to provide an adequately filtered transition from rock fill to structural fill. Remove any unsuitable materials encountered (e.g. organics, soft/loose soil, protruding cobbles and boulders, etc.) and fill the resulting voids with structural or rock fill appropriately compacted.

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any Work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section and the CQA Plan.
B. Inspection:
    1. Prior to implementing any work of this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.
    2. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to installation of the Compacted Soil Liner will be construed as Contractor's acceptance of the related work of all other Sections.
    3. The Contractor shall verify that the as-built subgrade has been surveyed to sufficient accuracy as approved by the CQA Engineer prior to placement of any General Earthwork material.

3.02 EXCAVATION

A. Excavation shall be performed, at a minimum, to the lines and grades indicated on the Drawings. Additional excavation shall be performed to achieve a stable working base or to "bridge" over weak subgrade materials with Structural Fill Soils. The limits of additional excavation shall be determined by the CQA Representative.
B. Excavated materials shall be transported to stockpile or placement locations, as indicated on the Drawings or as directed by the Owner.

3.03 STOCKPILING

A. Prior to the start of excavation, the Contractor shall present an excavation plan to the CQA Representative for review. The plan shall indicate the areas and sequence of excavation, and the anticipated classification of the excavated material (e.g., topsoil, structural fill, soil liner, general fill). This excavation plan must be reviewed and approved by the Owner or CQA Representative. The Contractor shall take into account that the stockpiling portion of the excavation plan may be modified during construction based on the results of conformance testing of the excavated material.

B. Excavated materials classified as fill shall be stockpiled in designated areas free of incompatible soil, clearing debris, or other objectionable materials. Stockpile areas will be shown on the Drawings or designated by the Owner or CQA Representative.
C. Excavated material classified as spoil shall be segregated from fill and stockpiled or disposed of in the manner shown on the Drawings or as specified by the Owner or CQA Representative.
D. Excavated material classified as topsoil shall be segregated from fill and stockpiled in the manner shown on the Drawings or as specified by the Owner or CQA Representative.
E. Excavated material classified as select fill (structural fill or soil liner material) shall be segregated and stockpiled in a manner shown on the Drawings or as specified by the Owner or CQA Representative.
F. Stockpiles of fill, spoil, or topsoil shall be no steeper than 3:1 (horizontal:vertical) without approval of the CQA Representative, graded to drain, sealed by tracking parallel to the slope with a dozer or other means approved by the CQA Representative, and dressed daily during periods when fill is taken from the stockpile. The Contractor may cover fill stockpiles with plastic sheeting or other material approved by the CQA Representative in order to preserve the moisture content of the fill.
G. Stockpiles that will remain out of active use for a period greater than 14-days shall either be covered as described previously or stabilized by revegetation in accordance with the requirements for revegetation, or in accordance with the applicable construction stormwater permit.

3.04 UNAUTHORIZED EXCAVATIONS

A. All excavation outside or below the proposed lines and grades shown on the Drawings shall be considered unauthorized excavation, unless required by the Owner or CQA Representative. Any unauthorized excavation performed will be performed and properly backfilled at no additional cost to the Owner.
B. The Contractor shall backfill areas of unauthorized excavation with the type material necessary (e.g., soil, rock, or concrete) in accordance with this Section at no cost to the Owner, to insure the stability of the structure or construction involved.

3.05 OBSTRUCTIONS

A. Obstructions shown on the Drawings are for information only and do not guarantee their exact locations nor exclude the presence of other obstructions.
B. The Contractor shall exercise due care in excavating adjacent to existing obstructions and shall not disturb same.
C. In the event obstructions are disturbed, the Contractor shall repair or replace them as quickly as possible to the condition existing prior to their disturbance at no cost to the Owner.
D. If desired by the utility company, the Contractor shall pay for the repair or replacement work performed by the forces of the utility company or other appropriate party.
E. If replacement or repair of disturbed obstructions is not performed after a reasonable period of time, the Owner may have the necessary work done and deduct the cost of same from payments to the Contractor.

3.06 STRUCTURAL FILL SOIL PLACEMENT

A. The Contractor shall construct the Structural Fill Soil to the grades, slopes, and elevations shown on the Drawings and as specified in this Section.
B. The Contractor shall remove all organics from the area to receive Structural Fill Soil in accordance with Section 31 10 00 Site Clearing.
C. The Contractor shall construct the Structural Fill Soil on a firm, non-yielding subgrade with adequate moisture to promote lift bonding and compaction. The Contractor shall moisten the subgrade prior to fill placement as needed to promote lift bonding. The subgrade shall be stable and absent of significant deformation under proof-roll.

D. The subgrade to receive Structural Fill Soil shall be proof-rolled by the Contractor with observation by the CQA Representative. The Contractor shall proof-roll the subgrade utilizing a loaded rubber-tired dump truck or other approved equipment with a minimum weight of 25 tons and maximum 50 tons. The equipment shall make a minimum of two passes over the evaluation area with wheels overlapping approximately ½ vehicle width with each pass. Proof-roll vehicle shall travel between 2 and 6 miles per hour. The subgrade shall not significantly yield by rutting (plastic deformation) or pumping (elastic deformation) under the load of the proof roll.

E. An acceptable firm, non-yielding subgrade is one that exhibits no ruts or pumping in excess of 1-inch for native subgrade and ½-inch for constructed subgrade (fill) under proof-roll loading.

F. If yielding subgrade soils are observed in the proof-roll, the extents of the area shall be identified by the CQA Representative with concurrence by Contractor and reported to the CQA Engineer. The CQA Engineer or Owner shall direct mitigation, if needed.

G. The source of the Structural Fill Soil shall be approved by the CQA Representative prior to construction.

H. The Structural Fill Soil material shall be spread in loose lifts not to exceed 10 inches, or no greater than the length of the compactor cleats plus 2 inches, whichever is less.

I. Prior to compaction, the Contractor shall mix the Structural Fill Soil by disc-harrowing or an approved equivalent method to a homogenous consistency without clods which are not easily broken by the compaction process.

J. Equipment or truck traffic on the surface will not be permitted during the period between scarifying and placement of the following lift.

K. Each lift shall be thoroughly homogenized and compacted to a minimum compaction of 95 percent of the maximum dry unit weight as determined by ASTM D698, within the acceptable range of water contents indicated herein.

L. The moisture content of the Structural Fill Soil material shall be within the range of 3 percent below to 4 percent above the optimum moisture content as established by ASTM D 698 or be within an acceptable range as demonstrated by testing and as approved by the CQA Engineer, during the entire time when the compactor is working the soil. If, in the opinion of the CQA Representative, the soil is too dry for proper compaction, the Contractor shall spray the soil with a sufficient quantity of clean water and mix the water into the soil to bring the soil to a uniform, proper moisture content. If, in the opinion of the CQA Representative, the soil is too wet for proper compaction, the Contractor shall dry the soil by discing or otherwise to bring the soil to a uniform, proper moisture content. The moisture content must be consistent through the full thickness of the compacted lift.

M. At the beginning of each day's work, the previously placed Structural Fill Soil shall be inspected by the CQA Representative. The Owner or CQA Representative may specify compaction, scarification or moisture conditioning of the top surface of soil, as necessary in the judgment of the CQA Representative, to obtain the compaction criteria and provide a suitable surface for the next lift. This work will be performed at no cost to Owner.

N. No Structural Fill Soil shall be placed over a lift which has not been tested and approved by the CQA Representative. Should the field tests indicate that the density of any layer of Structural Fill Soil, or portion thereof, is below the required dry unit weight, the particular layer, or portion thereof, shall be reworked at no extra cost to Owner.

O. Compaction of lifts shall be performed with an appropriately heavy, properly ballasted, penetrating-foot compactor (such as a CAT 815 or alternate approved by CQA Engineer). The minimum operating weight of the compactor should be 26,000 pounds or 2,000 pounds per linear foot of drum length. Compactor teeth or pads shall be a minimum of 4 inches. A minimum of 6 passes will be required on each area of each lift to remold the soil regardless of whether the lift meets compaction specifications. One pass of a double-wheeled roller, such as the CAT 815, will be considered as two passes.

P. The daily work area will extend a distance no greater than necessary to maintain moist soil conditions and continuous operations. Desiccation and crusting of the lift surface will be avoided as much as possible.

Q. If desiccation and crusting of the lift surface occurs before placement of the next lift, this area will be sprinkled with water and then scarified and tested for water content to ensure uniform moisture before placement of a subsequent lift.
R. Lifts shall be scarified (roughened) and moistened immediately prior to placement of a subsequent lift to promote lift bonding.
S. Dozer, haul truck or scraper equipment will not be used for primary compaction efforts.
T. No frozen or thawing Structural Fill Soil material shall be placed, spread or compacted and no Structural Fill Soil material shall be placed, spread, or compacted while the subgrade is frozen or thawing, during unfavorable weather conditions, or during periods of precipitation.
U. Hand compaction at the proper moisture content shall be used in all locations around penetrations, corners, appurtenances, etc., in order to achieve the specified dry unit weight and moisture content. Care shall be taken to protect piping, culverts and other structures. Damage to any materials or work shall be repaired by the Contractor at no additional cost to Owner.
V. The same material and compaction methods as outlined in this Section shall be used to replace unacceptable zones detected by the CQA Representative.
W. The Structural Fill Soil surface shall be made smooth and free from ruts or indentations at the end of every working day when precipitation is forecast and/or at the completion of the compaction operations in that area.
X. The Contractor shall finish each day's work with a smooth roller to create a smooth surface which will promote surface-water runoff and minimize moisture penetration.
Y. The entire area shall be left in a manner to promote runoff at the end of each day.

3.07 GENERAL GRADING SOIL PLACEMENT

A. The Contractor shall construct the General Grading Soil to the grades, slopes, and elevations shown on the Drawings and as specified in this Section.
B. The Contractor shall remove all organics from the area to receive General Grading Soil in accordance with Section 31 10 00 Site Clearing.
C. The source of the soil shall be approved by the CQA Representative prior to construction.
D. The General Grading Soil material shall be spread in loose lifts not to exceed 10 inches.
E. Each lift shall be thoroughly homogenized and compacted to a minimum compaction of 90 percent of the maximum dry unit weight as determined by ASTM D698.
F. The moisture content of the General Grading Soil material shall be adequate to achieve the required compaction. If, in the opinion of the CQA Representative, the soil is too dry for proper compaction, the Contractor shall spray the soil with a sufficient quantity of clean water and mix the water into the soil to bring the soil to a uniform, proper moisture content. If, in the opinion of the CQA Representative, the soil is too wet for proper compaction, the Contractor shall dry the soil by discing or otherwise to bring the soil to a uniform, proper moisture content.
G. No General Grading Soil shall be placed over a lift which has not been tested and approved by the CQA Representative. Should the field tests indicate that the density of any layer of General Grading Soil, or portion thereof, is below the required dry unit weight, the particular layer, or portion thereof, shall be reworked at no extra cost to Owner.
H. Compaction of lifts will be performed with an appropriately heavy, properly ballasted, penetrating-foot compactor (such as a CAT 815 or equivalent) subject to approval from the CQA Representative. The minimum weight of the compactor should be 1,500 pounds per liner foot of drum length. A minimum of 4 passes will be required on each area of each lift to remold the soil regardless of whether the lift meets compaction specifications. One pass of a double-wheeled roller, such as the CAT 815, will be considered as two passes.
I. Lifts shall be scarified (roughened) and moistened immediately prior to placement of a subsequent lift to promote lift bonding.
J. Dozer or scraper equipment will not be used for primary compaction efforts.

K. No frozen or thawing General Grading Soil material shall be placed, spread or compacted and no General Grading Soil material shall be placed, spread, or compacted while the subgrade is frozen or thawing, during unfavorable weather conditions, or during periods of precipitation.
L. The same material and compaction methods as outlined in this Section shall be used to replace unacceptable zones detected by the CQA Representative.
M. The entire area shall be left in a manner to promote runoff at the end of each day.

3.08 FIELD QUALITY CONTROL AND QUALITY ASSURANCE

A. The Contractor is responsible for quality control and construction of the General Earthwork to meet the requirements of the CQA Plan and Specifications.
B. The CQA Consultant shall perform quality testing and quality assurance oversight and evaluation in accordance with this Section and the CQA Plan or as deemed necessary by the CQA Engineer. CQA testing, or lack thereof, does not relieve the Contractor from its responsibility to complete the Work in accordance with the CQA Plan and Specifications.

3.09 PRODUCT PROTECTION

A. The completed General Earthwork shall be final graded and smoothed to promote run-off of stormwater.
B. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.
C. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the CQA Representative and at no additional cost to Owner.

- END OF SECTION 31 23 23 -

SECTION 31 23 33
TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, and equipment necessary for the construction of the Trenching and Backfilling to install pipelines and utilities as specified herein, as shown on the Drawings, and in accordance with the Construction Quality Assurance (CQA) Plan.

B. The Work of this Section shall include, but not necessarily be limited to: excavating, separating, hauling, stockpiling, backfilling, placing and compacting soils as necessary to complete the Trenching and Backfilling. The pipe zone area of the trench is divided into five specific areas:
   1. Foundation: The area beneath the bedding, sometimes also referenced to as trench stabilization.
   2. Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.
   3. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.
   4. Initial Backfill: The area above the haunching material and below a plane 18 inches above the top of the barrel of the pipe. Initial Backfill is soil material place intermittently through the trench to hold the pipe in place during Final Backfill.
   5. Final Backfill: The area above a plane 18 inches above the top of the barrel of the pipe.

C. The Contractor shall conform Trenching and Backfilling to the dimensions, lines, and grades indicated or specified on the Drawings.

D. The Contractor shall be prepared to construct the Trenching and Backfilling in conjunction with other earthwork elements of the Work (i.e. Compacted Soil Liner and General Earthwork) and the installation and construction of the other components of the Project.

E. Notwithstanding the prequalification of any material sources for the Trenching and Backfilling, the Contractor shall be entirely responsible for meeting the requirements of this Section and the requirements of applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction. The choice of method, means, techniques and equipment rests with the Contractor. The Contractor shall select the method and equipment for Trenching and Backfilling depending upon the type of material to be excavated and backfilled, the depth of excavation, the amount of space available for operation of equipment, storage of excavated material, proximity of man made improvements to be protected, available easement or right of way and prevailing practice in the area.

1.02 DEFINITIONS

The following list of definitions is provided for reference.

A. "Compaction" shall mean the process of increasing the density or unit weight of soil by rolling, tamping, vibrating, or other mechanical means.

B. "In Situ" shall mean in-place.

C. "Moisture Content" shall mean the ratio of weight of water in the soil to the weight of the soil solids (dry soil), expressed in percentage; also referred to as gravimetric water content.

D. “Percent Compaction” shall mean the ratio of the unit weight of the soil to the maximum unit weight of the soil at determined by a laboratory compaction (Proctor) test.

E. "Unit Weight" shall mean the weight of a soil weight per unit volume, usually expressed in lb/ft^3 or kN/m^3; also referred to as density.

1.03 REFERENCES

A. Construction Quality Assurance (CQA) Plan.
B. Latest version of ASTM International (ASTM) standards:
    1. ASTM C33, Standard Specification for Concrete Aggregates
    2. ASTM D422, Standard Method for Particle-Size Analysis of Soils.[withdrawn standard]
    3. ASTM D698, Test Method for Laboratory Compaction of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
    4. ASTM D1140, Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75-mm) Sieve.
    5. ASTM D1556, Standard Test Method for Density of Soil In Place by the Sand-Cone Method.
    6. ASTM D2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.
    7. ASTM D2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
    8. ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
    9. ASTM D2937, Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
    10. ASTM D4220, Standard Practices for Preserving and Transporting Soil Samples.
    11. ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
    12. ASTM D4643, Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating.
    13. ASTM D4718, Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.
    14. ASTM D4959, Standard Test Method for Determination of Water Content of Soil by Direct Heating.
    15. ASTM D5080, Standard Test Method for Rapid Determination of Percent Compaction.
    16. ASTM D6913, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
    17. ASTM D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.04 SUBMITTALS

A. The Contractor shall submit the following information and samples to the CQA Representative a minimum of 14 days prior to the start of construction of the Trenching and Backfilling, unless otherwise approved by the CQA Representative:
    1. Identification of the proposed material source or sources.
    2. A representative 50-pound sample of each soil material type and source.
B. The Contractor shall notify the Owner and CQA Consultant in writing a minimum of 7 days prior to starting construction of the Trenching and Backfilling. The notice shall state the material to be used, the equipment to be used, the date and time that placement operations will start, and the name of the person in the field who will be in charge of the construction of the Trenching and Backfilling.
C. If work is interrupted for reasons other than inclement weather, the Contractor shall notify the Owner and CQA Representative a minimum of 24 hours prior to the resumption of work.

1.05 QUALITY ASSURANCE

A. Owner will retain the services of a CQA Consultant to determine conformance of materials and constructed work with the specifications in accordance with Section 01 40 00.
B. The construction of the Trenching and Backfilling shall be performed and monitored as outlined in the Construction Quality Assurance (CQA) Plan or as indicated on the Drawings or in this Specification.

C. The Contractor shall be aware of the activities and requirements outlined in the CQA Plan and shall account for these activities in the construction schedule.
    1. The minimum testing frequencies for CQA are presented in the CQA Plan. Actual test frequencies may vary. CQA testing, or lack thereof, does not relieve the Contractor from its responsibility to complete the Work in accordance with the CQA Plan and Specifications.
    2. Sampling locations shall be selected by the CQA Representative. If necessary, the location of routine in-place moisture content and dry unit weight tests shall be determined using a non-biased sampling plan.
    3. Additional testing may be performed at the CQA Representative's discretion.
D. If a defective area is discovered in the Trenching and Backfilling, the CQA Representative shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Representative shall determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Representative deems appropriate.
E. After determining the extent and nature of a defect, the CQA Representative shall notify the Contractor and schedule appropriate retests when the defective work has been corrected.
F. The Contractor shall correct defective work to the satisfaction of the CQA Representative. The cost of corrective actions shall be borne by the Contractor.
G. All retests recommended by the CQA Representative must verify that the defect has been corrected before any additional work is performed by the Contractor in the area of the deficiency.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Trenching and Backfilling material shall be stockpiled in areas approved by the Owner or CQA Representative.
B. In order to achieve relative consistency of soil type and performance results of Trenching and Backfilling, soil material from different borrow sources shall either be segregated into separate stockpiles or the source of fill material shall be limited to hauling from one borrow source per day.

1.07 SAFETY

Contractor is fully and solely responsible for Safety on the Project. Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91 596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P “Excavation, Trenching & Shoring” as described in OSHA 2226 or later revision thereof.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Proposed materials and source of supply shall be approved by Engineer or CQA Consultant as specified prior to delivery and use in construction.
B. Contactor shall obtain and submit samples of all proposed Trenching and Backfilling materials for analysis within fourteen (14) days of planned use to allow for required CQA laboratory testing.
C. Acceptability of the proposed borrow source for Trenching and Backfilling material will be evaluated by the CQA Consultant based on the requirements of the CQA Plan or as deemed necessary by the CQA Engineer.
D. Contractor shall notify the CQA Representative prior to any change in source of Trenching and Backfilling materials and shall submit samples as required herein to evaluation and approval of source.

2.02 TRENCH FOUNDATION MATERIALS

A. Trench foundation shall be native soil with competent bearing. In the event unsuitable soils are encountered in trench foundations, the CQA Engineer or CQA Representative shall evaluate the foundation soils and make recommendations for mitigation or replacement.
B. Trench backfill of foundation soils I shall consist of Structural Fill Soil placed and compacted in accordance with Section 31 23 23 of these Specifications

2.03 BEDDING AND HAUNCHING MATERIALS

A. Unless specified otherwise, Bedding and Haunching materials shall be crushed stone or sand as specified below.
B. Crushed stone or sand utilized for Bedding and Haunching shall meet the requirements of pipe manufacturer for the size and type of pipe.
C. If manufacturer's recommendations for Bedding and Haunching materials are not available, earth materials utilized for bedding and haunching shall be well graded fine to coarse sands or gravel meeting the gradation requirements of ASTM C 33 for fine aggregates.
    1. Natural materials or artificial mixtures, consisting largely of a mixture of sand and gravel, found in natural deposits in the vicinity may be utilized as long as the material meets the proper proportions and gradation requirements.
    2. The material shall generally pass a 3/8-inch sieve with no more than 10 percent passing a No. 100 sieve, and shall be non-plastic.

2.04 INITIAL BACKFILL

Initial backfill material shall be crushed stone or earth materials as specified for Bedding and Haunching materials or shall be earthen materials as specified for Final Backfill.

2.05 FINAL BACKFILL

A. Earth materials utilized for Final Backfill shall be suitable materials selected from materials excavated from the trench.
B. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials.
C. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction requirements.
D. When necessary, Final Backfill materials shall be moistened to facilitate compaction by tamping.
E. If materials excavated from the trench are not suitable for use as final backfill material, provide select backfill material conforming to the requirements of this Section.

2.06 SELECT BACKFILL

Select backfill shall be materials which meet the requirements as specified for Bedding and Haunching or the requirements of Structural Fill per Section 31 23 23.

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any Work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section and the CQA Plan.
B. Inspection:

1. Prior to implementing any work of this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.
2. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to installation of the Compacted Soil Liner will be construed as Contractor's acceptance of the related work of all other Sections.
3. The Contractor shall verify that the as-built subgrade has been surveyed to sufficient accuracy as approved by the CQA Engineer prior to placement of any Trenching and Backfilling material.

3.02 TRENCH EXCAVATION

A. Topsoil and grass shall be stripped a minimum of 6 inches over the trench excavation site and stockpiled separately for replacement over the finished grading areas.
B. Trenches shall be excavated to the lines and grades (location, depth, width) shown on the Drawings with the centerlines of the trenches on the centerlines of the pipes and to the dimensions which provide the proper support and protection of the pipe and other structures and accessories.
C. Width
    1. The sides of all trenches shall be vertical to a minimum of one foot above the top of the pipe. Unless otherwise indicated on the Drawings, the maximum trench width shall be equal to the sum of the outside diameter of the pipe plus two feet. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material.
    2. Excavate the top portion of the trench to any width within the construction easement or right of way which will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees or private property. Where necessary to accomplish this, provide sheeting and shoring.
    3. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of 9 inches clearance between the rock and any part of the pipe barrel or manhole.
    4. Wherever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher class (load factor) of bedding and haunching for the full trench width as actually cut, at no additional cost to the Owner. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over excavation, intentional over excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over excavation due to the size of the Contractor's excavation equipment, or other reasons beyond the control of the Engineer or Owner.
D. Depth
    1. The trenches shall be excavated to the required depth or elevation which allow for the placement of the pipe and bedding to the thickness shown on the Drawings.
    2. Where rock is encountered in trenches, excavate to the minimum depth which will provide clearance below the pipe barrel of 8 inches for pipe 21 inches in diameter and smaller and 12 inches for larger pipe, valves and manholes. Remove boulders and stones to provide a minimum of 6 inches clearance between the rock and any part of the pipe, manhole or accessory.
E. Excavated Materials
    1. Excavated materials shall be placed adjacent to the work to be used for backfilling as required. Topsoil shall be carefully separated and lastly placed in its original location.
    2. Excavated material shall be placed sufficiently far from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.

3.03 SHEETING, BRACING AND SHORING

A. Sheeting, bracing and shoring shall be performed in the following instances:

1. Where sloping of the trench walls does not adequately protect persons within the trench from slides or cave ins.
2. In caving ground.
3. In wet, saturated, flowing or otherwise unstable materials. The sides of all trenches and excavations shall be adequately sheeted, braced and shored.
4. Where necessary to prevent damage to adjoining buildings, structures, roadways, pavement, utilities, trees or private properties which are required to remain.
5. Where necessary to maintain the top of the trench within the available construction easement or right of way.
6. In any instance where the Contractor's Safety Manager deems sheeting, bracing or shoring necessary to ensure a safe excavation.

B. In all cases, excavation protection shall strictly conform to the requirements of the Occupational Safety and Health Act of 1970, as amended.

C. Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good, serviceable condition. Size and spacing shall be in accordance with OSHA regulations.

D. Steel Sheeting and Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from live loads. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The Contractor shall provide closure and sealing between sheet piling and existing facilities. Sheet piling within three feet of an existing structure or pipeline shall remain in place, unless otherwise directed by the Contractor's Safety Manager.

E. Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the haunching of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield will be raised in 6 inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be "dragged" with the bottom of the shield extending below the top of the pipe.

F. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the Contractor's Safety Manager and Owner it cannot be safely removed. Cut off any sheeting left in place at least two feet below the surface.

3.04 UNAUTHORIZED EXCAVATIONS

A. All excavation outside or below the proposed lines and grades shown on the Drawings shall be considered unauthorized excavation, unless required by the Owner or CQA Representative.

B. The Contractor shall backfill areas of unauthorized excavation with the type material necessary (e.g., soil, rock, or concrete) in accordance with this Section at no cost to the Owner, to insure the stability of the structure or construction involved.

3.05 OBSTRUCTIONS

A. Obstructions shown on the Drawings are for information only and do not guarantee their exact locations nor exclude the presence of other obstructions.

B. The Contractor shall exercise due care in excavating adjacent to existing obstructions and shall not disturb same.

C. In the event obstructions are disturbed, the Contractor shall repair or replace them as quickly as possible to the condition existing prior to their disturbance at no cost to the Owner.

D. If desired by the utility company, the Contractor shall pay for the repair or replacement work performed by the forces of the utility company or other appropriate party.

E. If replacement or repair of disturbed obstructions is not performed after a reasonable period of time, the Owner may have the necessary work done and deduct the cost of same from payments to the Contractor.

3.06 DEWATERING EXCAVATIONS

A. Dewater excavation continuously to maintain a water level two feet below the bottom of the trench.
B. Dewatering should be performed in accordance with Section 31 23 19.

3.07 TRENCH FOUNDATION AND STABILIZATION

A. The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.
B. Should the undisturbed material encountered at the trench bottom constitute, in the opinion of the CQA Representative or Engineer, an unstable foundation for the pipe, the Contractor shall be required to remove such unstable material and fill the trench to the proper subgrade with crushed stone or in accordance with subsection 2.02 herein.

3.08 BEDDING AND HAUNCHING

A. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings, and the pipe shall be placed thereon and brought to grade by tamping the bedding material or by removal of the slight excess amount of the bedding material under the pipe. Adjustment to grade line shall be made by scraping away or filling with bedding material. Wedging or blocking up of pipe shall not be permitted. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except immediately at the joint. All bedding shall extend the full width of the trench bottom. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders or large dirt clods.
B. Bell & Spigot Pipe: At each joint, excavate bell holes of ample depth and width to permit the joint to be assembled properly and to relieve the pipe bell of any load. After the pipe section is properly placed, add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders or dirt clods.
C. Welded or Coupled HDPE Pipe: Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall be carefully placed by hand and compacted to provide full support under and up to 18 inches over the top of the pipe for pipe 42 inches in diameter and larger, and 12 inches over the top of the pipe for pipe 36 inches in diameter and smaller.
D. Manholes: Excavate to a minimum of 12 inches below the planned elevation of the base of the manhole. Place and compact crushed stone bedding material to the required grade before constructing the manhole.
E. Excessive Width and Depth: If the trench is excavated to excessive depth, provide crushed stone to place the bedding at the proper elevation or grade.
F. Compaction: Bedding and haunching materials under pipe, manholes and accessories shall be compacted in accordance with pipe manufacturers recommendations, or to a minimum of 90 percent of the maximum dry density, unless shown or specified otherwise.

3.09 INITIAL BACKFILL

A. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.
B. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least 18 inches above the pipe barrel. Layer depths shall be a maximum of 6 inches for pipe 18 inches in diameter and smaller and a maximum of 12 inches for pipe larger than 18 inches in diameter.
C. Backfill on both sides of the pipe simultaneously to prevent side pressures.
D. Compact each layer thoroughly with suitable hand tools or tamping equipment.
E. Initial backfill shall be compacted to a minimum 90 percent of the maximum dry density (by ASTM D698), unless shown or specified otherwise.
F. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.

3.10 FINAL BACKFILL

A. Backfill carefully to restore the ground surface to its original condition.
B. The top 6 inches shall be topsoil obtained as specified in Article 3.02 of this Section.
C. Excavated material which is unsuitable for backfilling, and excess material, shall be disposed of, at no additional cost to the Owner, in a manner approved by the Engineer. Surplus soil may be stockpiled on the site, if approved by the Owner or Engineer. If such stockpiling is allowed, the site shall be left in a clean and sightly condition and shall not affect pre-construction drainage patterns.
D. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.
E. After Initial Backfill material has been placed and compacted, backfill with Final Backfill material. Place backfill material in uniform layers, compacting each layer thoroughly as follows:
    1. In 6 inch layers, if using light power tamping equipment, such as a “jumping jack”.
    2. In 12 inch layers, if using heavy tamping equipment, such as hammer with tamping feet.
    3. In 24 inch layers, if using a hydra hammer.
F. Settlement: If trench settles, refill and grade the surface to conform to the adjacent surfaces.
G. Final Backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless specified otherwise.

3.11 DETECTION TAPE

Where required, detection tape shall be buried 4 to 10 inches beneath the ground surface directly over the top of the pipe. Should detection tape need to be installed deeper, the Contractor shall provide 3-inch wide tape. In no case shall detection tape be buried greater than 20 inches from the finished grade surface.

3.12 FIELD QUALITY CONTROL AND QUALITY ASSURANCE

A. The Contractor is responsible for quality control and construction of the Trenching and Backfilling to meet the requirements of the CQA Plan and Specifications.
B. The CQA Consultant shall perform quality testing and quality assurance oversight and evaluation in accordance with this Section and the CQA Plan or as deemed necessary by the CQA Engineer.

3.13 PRODUCT PROTECTION

A. The completed Trenching and Backfilling shall be final graded and smoothed to promote run-off of stormwater.
B. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.

C. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the CQA Representative and at no additional cost to Owner.

- END OF SECTION 31 23 33 -

SECTION 31 23 43
LANDFILL COMPACTED SOIL LINER

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, and equipment necessary for the construction of the low permeability Landfill Compacted Soil Liner as specified herein, as shown on the Drawings, and in accordance with the Construction Quality Assurance (CQA) Plan.
B. The Contractor shall be prepared to construct the Landfill Compacted Soil Liner in conjunction with the earthwork and the installation and construction of the other components of the Project.
C. Notwithstanding the prequalification of any material sources for the Landfill Compacted Soil Liner, the Contractor shall be entirely responsible for meeting the requirements of this Section.

1.02 DEFINITIONS

The following list of definitions is provided for reference.

A. "Compaction" shall mean the process of increasing the density or unit weight of soil by rolling, tamping, vibrating, or other mechanical means.
B. "In Situ" shall mean in-place.
C. "Moisture Content" shall mean the ratio of weight of water in the soil to the weight of the soil solids (dry soil), expressed in percentage; also referred to as gravimetric water content.
D. “Percent Compaction” shall mean the ratio of the unit weight of the soil to the maximum unit weight of the soil at determined by a laboratory compaction (Proctor) test.
E. "Unit Weight" shall mean the weight of a soil weight per unit volume, usually expressed in lb/ft^3 or kN/m^3; also referred to as density.

1.03 REFERENCES

A. Construction Quality Assurance (CQA) Plan.
B. Latest version of ASTM International (ASTM) standards:
    1. ASTM D422, Standard Method for Particle-Size Analysis of Soils.
    2. ASTM D698, Test Method for Laboratory Compaction of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
    3. ASTM D1140, Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75-□m) Sieve.
    4. ASTM D1556, Standard Test Method for Density of Soil In Place by the Sand-Cone Method.
    5. ASTM D1587, Standard Practice for Thin-Walled Tube Sampling of Soils.
    6. ASTM D2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.
    7. ASTM D2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
    8. ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
    9. ASTM D2937, Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
    10. ASTM D4220, Standard Practices for Preserving and Transporting Soil Samples.
    11. ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
    12. ASTM D4643, Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating.
    13. ASTM D4718, Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.

14. ASTM D4959, Standard Test Method for Determination of Water Content of Soil by Direct Heating.
15. ASTM D5080, Standard Test Method for Rapid Determination of Percent Compaction.
16. ASTM D5084, Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
17. ASTM D6913, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
18. ASTM D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

C. Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.

1.04 SUBMITTALS

A. The Contractor shall submit the following information and samples to the CQA Representative a minimum of 14 days prior to the start of construction of the Landfill Compacted Soil Liner, unless otherwise approved by the CQA Representative:
   1. Identification of the proposed material source or sources.
   2. A representative 50-pound sample for each source.
   3. A list of equipment to be used for construction of the Landfill Compacted Soil Liner with make and model of equipment.
   4. Detailed specification cut sheet for soil compactor.

B. The Contractor shall notify the Owner and CQA Consultant in writing a minimum of 7 days prior to starting construction of the Landfill Compacted Soil Liner. The notice shall state the material to be used, the equipment to be used, the date and time that placement operations will start, and the name of the person in the field who will be in charge of the construction of the Landfill Compacted Soil Liner.

C. If work is interrupted for reasons other than inclement weather, the Contractor shall notify the Owner and CQA Representative a minimum of 24 hours prior to the resumption of work.

1.05 QUALITY ASSURANCE

A. Owner will retain the services of a CQA Consultant to determine conformance of materials and constructed work with the specifications in accordance with Section 01 40 00.

B. The construction of the Landfill Compacted Soil Liner shall be performed and monitored as outlined in the Construction Quality Assurance (CQA) Plan.

C. The Contractor shall be aware of the activities and requirements outlined in the CQA Plan and shall account for these activities in the construction schedule.
   1. The minimum testing frequencies for CQA are presented in the CQA Plan. Actual test frequencies may vary. CQA testing, or lack thereof, does not relieve the Contractor from its responsibility to complete the Work in accordance with the CQA Plan and Specifications.
   2. Sampling locations shall be selected by the CQA Representative. If necessary, the location of routine in-place moisture content and dry unit weight tests shall be determined using a non-biased sampling plan.
   3. Undisturbed Landfill Compacted Soil Liner material samples for laboratory hydraulic conductivity testing shall be taken in accordance with ASTM D 1587. If requested by the CQA Representative, the Contractor shall provide assistance such that the sample tube is advanced vertically into the Landfill Compacted Soil Liner with a continuous smooth stroke from the construction equipment or other methods used to advance the sampler.
   4. Additional testing may be performed at the CQA Representative's discretion.

D. If a defective area is discovered in the Landfill Compacted Soil Liner, the CQA Representative shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Representative shall determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Representative deems appropriate.

E. After determining the extent and nature of a defect, the CQA Representative shall notify the Contractor and schedule appropriate retests when the defective work has been corrected.
F. The Contractor shall correct defective work to the satisfaction of the CQA Representative. The cost of corrective actions shall be borne by the Contractor. If the defective material has been overlain with additional material or other materials (i.e. geosynthetics), the cost of replacing the materials overlaying the defective material shall also be borne by the Contractor.
G. All retests recommended by the CQA Representative must verify that the defect has been corrected before any additional work is performed by the Contractor in the area of the deficiency.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Landfill Compacted Soil Liner material shall be stockpiled in areas approved by the Owner or CQA Representative.
B. In order to achieve relative consistency of soil type and performance results of Landfill Compacted Soil Liner, soil material from different borrow sources shall either be segregated into separate stockpiles or the source of fill material shall be limited to hauling from one borrow source per day.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Proposed materials and source of supply shall be approved by Engineer or CQA Consultant as specified prior to delivery and use in construction.
B. Contactor shall obtain and submit samples of all proposed Landfill Compacted Soil Liner materials for analysis at least fourteen (14) days before planned use to allow for required CQA laboratory testing.
C. Acceptability of the proposed borrow source for Landfill Compacted Soil Liner material will be evaluated by the CQA Consultant based on the requirements of the CQA Plan or as deemed necessary by the CQA Engineer.
D. Contractor shall notify the CQA Representative prior to any change in source of Compacted Soil Liner materials and shall submit samples as required herein to evaluation and approval of source.

2.02 MATERIAL

A. Laboratory testing to evaluate the suitability or conformance of soil materials for the Landfill Compacted Soil Liner shall be carried out in accordance with the CQA Plan.
B. The Landfill Compacted Soil Liner shall consist of relatively homogeneous, natural or amended soils which are free of gypsum, ferrous, calcareous concretions, roots, debris, foreign objects, excess silt, and organics. The soil shall be classified according to the Unified Soil Classification System as ML, MH, CL or CH material or shall be other natural or amended material approved by the CQA Engineer capable of meeting hydraulic conductivity requirements. Regardless of the classification requirements, the material shall meet the requirements of the CQA Plan. The soils selected shall not be gap-graded or susceptible to piping. Substandard materials shall be segregated at the source and will not be permitted at the work area. Any material which is found by the CQA Representative to be substandard shall be removed from the work area by the Contractor as directed by the Owner at no extra cost to Owner. Contractor is responsible for removing deleterious materials from otherwise suitable soil material.
C. The Landfill Compacted Soil Liner shall have an in situ (i.e., after compaction) hydraulic conductivity less than or equal to 1.0×10^{-5} cm/sec as measured in accordance with ASTM D5084.
D. The Landfill Compacted Soil Liner material shall have a minimum liquid limit and plasticity index as specified in the CQA Plan.
E. Onsite or other materials may be amended to achieve the permeability requirements for the Landfill Compacted Soil Liner material. Amending agents and methods shall be approved by the Owner and the CQA Engineer prior to use.

F. For construction quality assurance (CQA) purposes, the Owner shall provide soil testing in accordance with the CQA plan. Costs associated with retesting of failing CQA tests shall be paid for by the Contractor if requested by the Owner. The Contractor may use quality assurance test results to assist him with constructing the Landfill Compacted Soil Liner in accordance with these Specifications. If the Contractor requires additional testing to control construction quality, such additional testing shall be provided by the Contractor at no additional cost to the Owner.

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the Work falling within this Section and the CQA Plan.
B. Inspection:
   1. Prior to implementing any work of this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.
   2. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to installation of the Landfill Compacted Soil Liner will be construed as Contractor's acceptance of the related work of all other Sections.
   3. The Contractor shall verify that the as-built subgrade has been surveyed to sufficient accuracy as approved by the CQA Engineer prior to placement of any Landfill Compacted Soil Liner material.

3.02 COMPACTED SOIL LINER PLACEMENT

A. The Contractor shall construct the Landfill Compacted Soil Liner to the grades, slopes, and elevations shown on the Drawings and as specified in this Section.
B. The Contractor shall construct the Landfill Compacted Soil Liner on a firm, moist compacted subgrade that meets the requirements of Section 31 23 23 or the requirements of Buffer Soils or Subgrade in the CQA Plan.
C. The source of the soil shall be approved by the CQA Representative prior to construction.
D. The Landfill Compacted Soil Liner material shall be spread and compacted in lifts not to exceed a compacted thickness of 6 inches.
E. Prior to compaction, the Contractor shall mix the Landfill Compacted Soil Liner by disc-harrowing or an approved equivalent method to a homogenous consistency without clods which are not easily broken by the compaction process.
F. Equipment or truck traffic on the surface will not be permitted during the period between scarifying and placement of the following lift.
G. Each lift shall be thoroughly homogenized and compacted to the required minimum dry unit weight, within the acceptable range of water contents, as approved by the Owner or CQA Representative.
H. The Contractor shall make all necessary provisions to manage inclement weather conditions and protect the Landfill Compacted Soil Liner and work area. The Contractor shall be fully responsible for control of stormwater during installation of the liner system and for moisture control and protection of completed construction.
I. At the beginning of each day's work, the previously placed Landfill Compacted Soil Liner shall be inspected by the CQA Representative. The Owner or CQA Representative may specify compaction, scarification or moisture conditioning of the top surface of soil, as necessary in the judgment of the CQA Representative, to obtain the compaction criteria and provide a suitable surface for the next lift. This work will be performed at no cost to Owner.

J. The moisture content of the Landfill Compacted Soil Liner material shall be wet of optimum moisture content as established by ASTM D 698 or be within an acceptable range as demonstrated by testing and as approved by the CQA Representative, during the entire time when the compactor is working the soil. If, in the opinion of the CQA Representative, the soil is too dry for proper compaction, the Contractor shall spray the soil with a sufficient quantity of clean water and mix the water into the full lift of the soil to bring the soil to a uniform, proper moisture content. The compacted lift shall exhibit acceptable moisture content through the full thickness of the lift or additional processing and moisture-conditioning of the lift will be required.

K. No Landfill Compacted Soil Liner shall be placed over a lift which has not been tested and approved by the CQA Representative. Should the field tests indicate that the density of any layer of Landfill Compacted Soil Liner, or portion thereof, is below the required dry unit weight, the particular layer, or portion thereof, shall be reworked at no extra cost to Owner.

L. Compaction of lifts shall be performed with an appropriately heavy, properly ballasted, penetrating-foot compactor (such as a CAT 815 or alternate approved by CQA Engineer). The minimum operating weight of the compactor should be 26,000 pounds or 2,000 pounds per linear foot of drum length. Compactor teeth or pads shall be a minimum of 4 inches. A minimum of 6 passes will be required on each area of each lift to remold the soil regardless of whether the lift meets compaction specifications. One pass of a double-wheeled roller, such as the CAT 815, will be considered as two passes.

M. The daily work area shall extend a distance no greater than necessary to maintain moist soil conditions and continuous operations. Desiccation and crusting of the lift surface shall be avoided as much as possible.

N. If desiccation and crusting of the lift surface occurs before placement of the next lift or subsequent material, this area shall be sprinkled with water and then scarified and tested for water content to ensure uniform moisture before placement of a subsequent lift.

O. Lifts shall be scarified (roughened) and moistened immediately prior to placement of a subsequent lift to promote lift bonding.

P. Transition from full depth liner to beginning of adjacent new section will be accomplished by sloping (cutting back) the end of a full depth section at 5:1 (horizontal to vertical) or flatter for tying in a new lift. Alternatively, each new lift will be benched into the previously constructed liner at 2-ft horizontal intervals.

Q. The transition between the bottom and side slopes will be accomplished by compacting parallel to the slope and by running up and down the slope.

R. Dozer, haul trucks or scraper equipment will not be used for primary compaction efforts.

S. No frozen or thawing Landfill Compacted Soil Liner material shall be placed, spread or compacted and no Landfill Compacted Soil Liner material shall be placed, spread, or compacted while the subgrade is frozen or thawing, during unfavorable weather conditions, or during periods of precipitation.

T. Landfill Compacted Soil Liner material which has been contaminated with clusters of rock or gravel, sand, organic debris or other deleterious material shall be removed and replaced with uncontaminated material by the Contractor at no additional cost to Owner.

U. Hand compaction at the proper moisture content shall be used in all locations around penetrations, corners, appurtenances, etc., in order to achieve the specified dry unit weight and moisture content. Care shall be taken to protect piping, geosynthetics and other structures. Damage to any materials or work shall be repaired by the Contractor at no additional cost to Owner.

V. Tie-in of the Landfill Compacted Soil Liner to previously constructed areas of Landfill Compacted Soil Liner shall be completed by either (i) stair-step method with each step being no more than 6-inches high and no less than 12-inches wide, or (ii) slope method at a slope no steeper than 5(H):1(V).

W. The same material and compaction methods as outlined in this Section shall be used to replace unacceptable zones detected by the CQA Representative.

X. The Landfill Compacted Soil Liner surface shall be made smooth and free from ruts or indentations at the end of every working day when precipitation is forecast and/or at the completion of the compaction operations in that area.

Y. The Contractor shall finish each day's work with a smooth roller to create a smooth surface which will promote surface-water runoff and minimize moisture penetration.
Z. The entire area shall be left in a manner to promote runoff at the end of each day.
AA. Any holes in the Landfill Compacted Soil Liner shall be backfilled with similar soil material or with bentonite. The backfill material shall be compacted in loose lift thicknesses no greater than 6 inches.
BB. All grade stakes or pin flags shall be removed upon the achievement of final grade. Holes remaining after the removal of grade stakes shall be backfilled and compacted as specified herein.
CC. After completion of a segment of Landfill Compacted Soil Liner, but before installation of the geosynthetic liner, the top of the soil will be surveyed to ensure that: (i) the specified thickness of the Landfill Compacted Soil Liner has been achieved; (ii) the top of the soil liner slopes across the cell at the grades specified on the permitted plans; and (iii) the top of the soil liner in the collection sump area is at the grades and elevations specified on the permitted plans. Additionally, the surface of the soil liner shall be worked to provide a smooth surface without loose materials or abrupt ruts, dips, pits or extrusions so as to provide intimate contact between the soil liner and the geomembrane liner or other geosynthetic material.

3.03 FIELD QUALITY CONTROL AND QUALITY ASSURANCE

A. The Contractor is responsible for quality control and construction of the Landfill Compacted Soil Liner to meet the requirements of the CQA Plan and Specifications.
B. The CQA Consultant shall perform quality testing and quality assurance oversight and evaluation in accordance with the CQA Plan or as deemed necessary by the CQA Engineer.

3.04 PRODUCT PROTECTION

A. The completed Landfill Compacted Soil Liner shall be final graded and smoothed to promote run-off of stormwater.
B. Completed lifts and the completed final surface of the Landfill Compacted Soil Liner shall be kept moist to prevent desiccation and crusting of the Landfill Compacted Soil Liner.
C. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.
D. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the CQA Representative and at no additional cost to Owner.

- END OF SECTION 31 23 43 -

SECTION 31 23 55
LANDFILL LEACHATE DRAINAGE AGGREGATES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, and installation equipment necessary for the construction of the leachate collection trench and sump gravel as specified herein, as shown on the Drawings and in accordance with the Construction Quality Assurance (CQA) Plan.
B. The Contractor shall place the Landfill Leachate Drainage Aggregates in conjunction with other components of the leachate collection system.

1.02 REFERENCES

A. Construction Quality Assurance (CQA) Plan.
B. Latest version of ASTM International (ASTM) standards:
    1. ASTM C136, Test Method for Sieve Analysis of Fine and Coarse Aggregates
    2. ASTM D422, Standard Method for Particle-Size Analysis of Soils.
    3. ASTM D1140, Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75-mm) Sieve.
    4. ASTM D2434, Standard Test Method for Permeability of Granular Soils (Constant Head)
    5. ASTM D2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
    6. ASTM D4373, Standard Test Method for Rapid Determination of Carbonate Content of Soils
    7. ASTM D6913, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
C. Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.

1.03 SUBMITTALS

A. The Contractor shall submit the following information and samples to the CQA Representative a minimum of 14 days prior to starting construction of the sump, leachate collection pipe trenches or chimney drains:
    1. The proposed material source.
    2. The results of a particle-size analysis on the proposed material, conducted in accordance with ASTM D6913 or C136.
    3. The results of tests conducted in accordance with ASTM D 2434 to determine permeability of the proposed material.
    4. The results of tests conducted in accordance with ASTM D 4373 to determine calcium carbonate content of the proposed material.
    5. A 50-lb sample of the proposed material.
B. The gravel may be subjected to independent testing at the CQA Engineer's or Engineer's discretion. Any material that does not conform to these specifications shall be rejected and replaced with new material at no cost to Owner.

1.04 QUALITY ASSURANCE

A. Owner will retain the services of a CQA Consultant to determine conformance of materials and constructed work with the specifications in accordance with Section 01 40 00.

B. The construction of the Landfill Leachate Drainage Aggregates shall be monitored as outlined in the Construction Quality Assurance (CQA) Plan.
C. The Contractor shall be aware of the activities and requirements outlined in the CQA Plan and shall account for these activities in the construction schedule.
    1. The minimum testing frequencies for CQA are presented in the CQA Plan. Actual test frequencies may vary. CQA testing, or lack thereof, does not relieve the Contractor from its responsibility to complete the Work in accordance with the CQA Plan and Specifications.
    2. Sampling locations shall be selected by the CQA Representative. If necessary, the location of routine in-place moisture content and dry unit weight tests shall be determined using a non-biased sampling plan.
    3. Additional testing may be performed at the CQA Representative's discretion.
D. If a defective area is discovered in the Landfill Leachate Drainage Aggregates, the CQA Representative shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Representative shall determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Representative deems appropriate.
E. After determining the extent and nature of a defect, the CQA Representative shall notify the Contractor and schedule appropriate retests when the defective work has been corrected.
F. The Contractor shall correct defective work to the satisfaction of the CQA Representative. The cost of corrective actions shall be borne by the Contractor.
G. All retests recommended by the CQA Representative must verify that the defect has been corrected before any additional work is performed by the Contractor in the area of the deficiency.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivered materials shall be stockpiled, stored, or staged in areas approved by the Owner or CQA Representative.
B. Contactor shall take care to prevent or limit contamination of the Landfill Leachate Drainage Aggregate with soil, debris, or other deleterious matter.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

Proposed materials and source of supply shall be approved by Engineer or CQA Consultant as specified prior to delivery and use in construction.

2.02 MATERIAL

A. Material for this work shall consist of a clean, non-calcarious granular material with strong, durable, particles which are free of any metals, roots, trees, stumps, concrete, construction debris, other organic matter, and deleterious materials and coatings.
B. The material shall meet the angularity requirements of the CQA Plan.
C. The material shall meet the gradation requirements of the CQA Plan as determined by ASTM D6319 or C136.
D. The material shall have a minimum permeability as set forth in the CQA Plan and as determined by ASTM D2434.
E. The material shall have a maximum calcium carbonate content as set forth in the CQA Plan and as determined by ASTM D4373.
F. For construction quality assurance (CQA) purposes, the Owner shall provide materials QA testing in accordance with the CQA plan. Costs associated with retesting of failing CQA tests shall be paid for by the Contractor if requested by the Owner. The Contractor may use quality assurance test results to assist him with constructing the Landfill Leachate Drainage Aggregates in accordance with these Specifications.

If the Contractor requires additional testing to control construction quality, such additional testing shall be provided by the Contractor at no additional cost to the Owner.

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section and the CQA Plan.
B. Inspection:
   1. Prior to implementing any work of this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.
   2. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to installation of the Landfill Leachate Drainage Aggregates will be construed as Contractor's acceptance of the related work of all other Sections.

3.02 FIELD QUALITY CONTROL

A. The frequency of quality control testing shall be in accordance with the CQA Plan.
B. The Contractor shall take this testing frequency into account in planning his construction schedule.
C. The frequency of testing shall apply to conformance testing of on-site material or material delivered to the site.

3.03 INSTALLATION

A. The Landfill Leachate Drainage Aggregates shall be placed directly on top of the geotextile, geonet, or geocomposite, as shown on the Drawings. Gravel will not be allowed to free-fall greater than 2 feet.
B. Placement of the Landfill Leachate Drainage Aggregates should be performed using a low ground-pressure dozer or equivalent equipment. The tracked equipment shall operate only over previously placed Landfill Leachate Drainage Aggregates or protective soil cover. The Contractor shall not operate equipment directly on geotextile, geonet, or geocomposite.
C. The equipment used to spread Landfill Leachate Drainage Aggregates shall not exert ground pressures exceeding the following:

Allowable Equipment Ground Pressure (psi)	Thickness of Stone Above Geotextile or Geonet (in.)
< 5	12
< 10	18
< 20	24
> 20	48

D. Within 1 foot of the toe of slopes in the landfill cell, the Landfill Leachate Drainage Aggregates shall be placed by hand. Hand shovels used to place the gravel shall not be allowed to damage the geosynthetics. Any damage created during placement will be repaired to the satisfaction of the Owner at the Contractor's expense.
E. The Landfill Leachate Drainage Aggregates shall be placed to within 0.2 foot of the specified elevations.

F. Geotextiles wrapping Landfill Leachate Drainage Aggregates in the pipe trench shall be mechanically sewn by a method acceptable to the CQA Representative. Alternative means of overlapping and/or bonding of the geotextile may only be acceptable if approved in writing by the CQA Representative.

3.04 PRODUCT PROTECTION

A. After the Landfill Leachate Drainage Aggregates has been placed, the Contractor shall maintain it free of ruts, depressions, and damage resulting from the hauling and handling of any material, equipment, tools, etc., until such time as the overlying geosynthetics or other materials are placed.
B. The Contractor shall maintain the Landfill Leachate Drainage Aggregates free from silt or soil incursion into the. If silt or soil washes into the Landfill Leachate Drainage Aggregates prior to wrapping the gravel in geotextile, the Contractor may be required to remove and replace or clean the gravel.
C. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.
D. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the CQA Representative and at no additional cost to Owner.

- END OF SECTION 31 23 55 -

SECTION 32 15 10
AGGREGATE SURFACING FOR ROADS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

Section includes construction of crushed aggregate surface coarse for all-weather access road.

1.02 REFERENCES

A. Construction Quality Assurance (CQA) Plan.
B. Standard Specifications – ArDOT, 2014, Section 303.
C. Latest version of ASTM International (ASTM) standards:
    1. ASTM D698, Test Method for Laboratory Compaction of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
    2. ASTM D1140, Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75-□m) Sieve.
    3. ASTM D1556, Standard Test Method for Density of Soil In Place by the Sand-Cone Method.
    4. ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
    5. ASTM D2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.
    6. ASTM D2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
    7. ASTM D6913, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
    8. ASTM D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.03 SUBMITTALS

A. Submit documentation, signed by the material producer, indicated that the materials meet or exceed the specified requirements.

1.04 QUALITY ASSURANCE

A. Owner will retain the services of a CQA Consultant to determine conformance of materials and constructed work with the specifications in accordance with Section 01 40 00.
B. The construction of the Aggregate Surfacing for Roads shall be monitored as outlined herein by the CQA Representative.
C. If a defective area is discovered in the Aggregate Surfacing for Roads, the CQA Representative shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Representative shall determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Representative deems appropriate.
D. After determining the extent and nature of a defect, the CQA Representative shall notify the Contractor and schedule appropriate retests when the defective work has been corrected.
E. The Contractor shall correct defective work to the satisfaction of the CQA Representative. The cost of corrective actions shall be borne by the Contractor.
F. All retests recommended by the CQA Representative must verify that the defect has been corrected before any additional work is performed by the Contractor in the area of the deficiency.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivered materials shall be stockpiled, stored, or staged in areas approved by the Owner or CQA Representative.
B. Contactor shall take care to store materials in a manner that prevents contamination of materials with soil, debris, or other deleterious materials.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Proposed materials and source of supply shall be approved by Engineer or CQA Consultant as specified prior to delivery and use in construction.
B. Aggregate shall meet specified gradation prior to placement. All processing shall be completed at the source.
C. Should the aggregate, at any time, deviate from the required gradation, the Contractor shall, at his own expense, correct the inconsistency to the satisfaction of the Engineer.

2.02 MATERIAL

A. Aggregate for surfacing roads shall conform to the requirements of ArDOT, 2014, Section 303, Table 303-1.
B. Gradation shall conform to the following:

Sieve Size	Percent Passing by Weight
1½ inch	100
1 inch	60 – 100
¾ inch	50 – 90
No. 4	25 - 55
No. 40	10 – 30
No. 200	3 - 12

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section and the CQA Plan.
B. Inspection:
    1. Prior to implementing any work of this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.
    2. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to installation of the Aggregate Surfacing for Roads will be construed as Contractor's acceptance of the related work of all other Sections.
C. Contractor shall prepare road subgrade as specified in the appropriate Section.
D. Contractor's surveyor shall verify that grades and elevations of subgrade conform to the elevations indicated on the Drawings, and that subgrade is ready for placement of aggregate.

3.02 FIELD QUALITY CONTROL

A. Quality Control Testing of Aggregate Material:
   1. Moisture-Density Curve (ASTM D 1557): Minimum of one test per source and for each visible change in material
   2. Aggregate Gradation (ASTM D 6913): Minimum of one test per 1,000 cubic yards
B. Tests specified below will be performed by the CQA Consultant during placement and compaction of aggregate:
   1. Compaction/Density (ASTM D 6938 or D 1556) – one test per lift for every 5,000 square feet of material placed, or fraction thereof.
C. Surveying shall be performed by the Contractor's surveyor to monitor construction of aggregate surfacing to the design lines and grades. Surveyor shall set stakes on each side of the road at a minimum spacing of 50 feet for the purpose of confirming the accuracy of the completed aggregate surfacing elevations.
D. Aggregate surfacing thickness, surface elevations and uniformity of surface will be checked and approved by the CQA Consultant during installation.

3.03 PLACING AND COMPACTING

A. Contractor shall take special care to avoid damaging installed stabilization geotextile when placing and compacting the aggregate. Damage to the geotextile shall be repaired at the Contractor's expense and as approved by the Engineer.
B. The aggregate surface course shall be constructed to the total depth indicated on the Drawings. Place in uniform horizontal layers, with each layer having a maximum compacted thickness of 6 inches.
C. Place, spread, shape, and compact the aggregate as continuously as practicable during each day's operations. Place the material in a manner to avoid segregation. Uncontrolled spreading shall not be permitted.
D. Level and contour surfaces to achieve the final grades and cross-section indicated on the Drawings.
E. Each layer shall be compacted to a density of at least 95 percent of the material's maximum dry density as determined by ASTM D1557.
F. Areas of aggregate surface course that do not meet the specified density requirement shall be moisture conditioned as necessary and recompacted and retested.
G. The depth of aggregate shall be carefully controlled, with periodic measurements of the loose and compacted depth.

3.04 THICKNESS AND SURFACE TOLERANCES

A. Acceptable tolerance for depth of aggregate surfacing shall be plus or minus one inch.
B. Based on the results of surveying, areas of the aggregate surfacing that are not constructed with required depth, within the allowed tolerance, shall be adjusted to the proper thickness using methods approved by the Engineer.

3.05 PRODUCT PROTECTION

A. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.
B. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the CQA Representative and at no additional cost to Owner.

- END OF SECTION 32 15 10 -

SECTION 32 92 19
SEEDING AND MULCHING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

This work shall include all labor, materials, tools and equipment necessary for furnishing and applying lime, fertilizer, furnishing and placing grass seed or sod, and mulching in the quantities specified for areas designated on the Drawings or selected by the Company.

1.02 REFERENCES

A. Construction Quality Assurance (CQA) Plan.

1.03 SUBMITTALS

A. Contractor shall submit the following a minimum of 30 days prior to beginning seeding or sodding operations:
   1. Certificates for each grass seed mixture, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed.
   2. Grass seed mix that will be used for the project and application rate.
   3. Binder type.
   4. A plan view drawing that depicts the areas to be seeded with areas measured, if plan alters from Drawings.
   5. Soil test results with recommendations of lime and nutrient needs.

B. Contractor shall submit the following weekly during seeding operations:
   1. Copies of fertilizer and lime invoices, showing grade furnished and total quantity applied.

C. Contractor shall submit the following within one week of completing seeding operations:
   1. A plan view drawing that depicts the areas that were seeded with concurrence from the CQA.

1.04 QUALITY ASSURANCE

A. Owner will retain the services of a CQA Consultant to determine conformance of materials and constructed work with the specifications in accordance with Section 01 40 00.

B. The construction of the Seeding and Mulching shall be monitored as outlined in the Construction Quality Assurance (CQA) Plan or as determined by the CQA Engineer or Engineer.

C. If a defective area is discovered in the Seeding and Mulching, the CQA Representative shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Representative shall determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Representative deems appropriate.

D. After determining the extent and nature of a defect, the CQA Representative shall notify the Contractor and schedule appropriate retests when the defective work has been corrected.

E. The Contractor shall correct defective work to the satisfaction of the CQA Representative. The cost of corrective actions shall be borne by the Contractor.

F. The Owner has the authority to postpone seeding at any time weather or moisture conditions are unfavorable. If there is not enough moisture in the soil to ensure adequate plant growth, water shall be applied until adequate moisture content has been reached. Additional watering will be required during the germination period, and during the growth period until a satisfactory growth has been attained. Water shall not be applied when there is danger of freezing.

1.05 DELIVERY, STORAGE, AND HANDLING

Delivered materials shall be stockpiled, stored, or staged in areas approved by the Owner or CQA Representative.

1.06 HEALTH STAND OF GRASS REQUIRED

It is the intent of this specification that the Contractor is obligated to deliver a satisfactory stand of healthy perennial grass before final acceptance of work. If it is necessary to repeat any or all of the Work, including plowing, fertilizing, watering, seeding, and mulching the Contractor shall repeat these operations, without additional cost to the Owner, until a satisfactory stand is obtained. A satisfactory stand of grass will be considered a full cover over the seeded areas with grass that is alive and growing for a 12-month period of time leaving no bare spots larger than one square yard, the total of all bare spots in any one area not to exceed 10 percent of the area.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

Proposed materials and source of supply shall be approved by Engineer or CQA Consultant as specified prior to delivery and use in construction.

2.02 FERTILIZER

A. Fertilizer shall be uniform in composition, free flowing, and suitable for application with approved equipment. The fertilizer shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to fertilizer laws of the state where work is being performed, and bearing the name, trade name or trademark, and warranty of the producer.
B. Fertilizer shall be commercial grade fertilizer conforming to all state and federal regulations. The analysis shall represent percentages of nitrogen, phosphoric, and potash. A minimum of 30 percent of the nitrogen in the fertilizer used shall be water insoluble (WIN).
C. All fertilizer shall be identified by labels and shall show the following:
    1. Guaranteed analysis.
    2. Name and address of the guarantor of the fertilizer.
    3. Type or brand.
    4. Net weight.
D. Fertilizer shall be 13-13-13 and shall be applied at a rate of 600 lbs/acre, unless alternate composition and rate based on soil analysis is approved by Engineer.

2.02 LIME

Lime shall be agricultural-grade dolomitic limestone ground to pass an 8-mesh sieve with 25 percent passing a 100-mesh sieve and be applied at a rate of 2 tons/acre. Alternatively, the Contractor may provide to the Engineer the results of an agronomic soil test and may apply the recommended rate of lime per the soil test. In addition, the dolomitic limestone shall contain not less than 40 percent magnesium oxide. Coarser materials will be acceptable provided the specified rates of application are increased proportionately, on the basis of quantities passing the 9 and 100-mesh sieves, but no additional payment will be made for the increased quantity.

2.03 MULCH

A. Mulch shall be threshed hay and shall be free of clay, stones, foreign substances, plant parts of Thistle, Johnson Grass, or other weed seeds.

B. Materials that contain objectionable weed seeds or other species that might be detrimental to the planting being established will not be acceptable.

2.04 GRASS SEED

A. Grass seed shall meet all state requirements and shall not include primary noxious weed seeds.
B. Grass seed shall be furnished in fully labeled, standard, sealed containers.
C. Percent germination and purity of the seed and weed seed content shall be clearly stated on the label.
D. Seed shall be subject to the testing provisions of the Association of Official Seed Analysis. The month and year of the test shall be clearly stated on the label.
E. Seed may be tested after it has been delivered to the project.
F. Seed which has become wet, moldy, or otherwise damaged will not be acceptable.
G. Contractor shall use seed mixture having seed proportioned by weight as follows:

Species	Application Rate (lbs/acre)
Bermuda	100
Bahaia	100

2.05 SOD

A. The sod shall consist of live, growing Bermuda grass, San Augustine grass, Bahia grass, or other acceptable sod, (ninety-five percent pure), secured from sources where the soil is fertile and has been fumigated. The sod shall have a healthy virile root system of dense, thickly matted roots throughout. The sod shall be cut from the field so that there is a minimum of one-half inch of soil on the roots of the sod, and so that no roots show on the bottom of the soil. Sod shall be dense, with the grass having been mowed to 1 inch height before lifting from field. Sod shall be in a vigorous condition, dark green in color, free of disease and harmful insects. The contractor shall not use sod from areas where the grass is thinned out, or where the grass roots have been dried out by exposure to the air and sun to such an extent as to damage its ability to grow when transplanted. The sod shall be free from obnoxious weeds or other grasses and shall not contain any matter deleterious to its growth or which might affect its subsistence or hardiness when transplanted. It shall be closely mowed and raked to remove all weeds and longstanding stems.
B. Care shall be taken at all times to retain the native soil on the roots of the sod during the process of excavation, hauling and planting. Sod material shall be kept moist from the time it is dug, until planted. When so directed by the CQA Representative, the sod existing at the source shall be watered to the extent required, prior to excavating. Do not stack sod for more than 36 hours between the time of cutting and the time of installation. The CQA Representative reserves the right to reject any sod deemed unacceptable for installation.
C. All plantings shall be done between the average date of the last freeze in the spring and six weeks prior to the average date for the first freeze in the fall, according to the U.S. Weather Bureau.
D. Fertilizer shall conform to the requirements of the Item, “Fertilizer” except shall be applied at the rate of 480-pounds per acre.

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section and the CQA Plan.
B. Inspection:
   1. Prior to implementing any work of this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.
   2. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to installation of the Seeding and Mulching will be construed as Contractor's acceptance of the related work of all other Sections.
   3. Unless otherwise specified, seeding operations shall be performed at the times approved by the CQA Representative. Seeding operations shall not be performed when the ground is frozen or when soil or weather conditions would prevent proper soil preparation and subsequent operations. The Contractor shall notify the CQA Representative at least 48 hours prior to beginning Seeding and Mulching operations.

3.02 GENERAL REQUIREMENTS FOR SEEDING

In order to prevent unnecessary erosion of excavated areas and unnecessary siltation of drainage ways, the Contractor shall carry out erosion control items of work such as seeding and mulching as soon as he has satisfactorily completed that portion of the project.

3.03 GRADING

Previously established grades shall be maintained on the areas to be treated in a true and even condition; necessary repairs shall be made to previously graded areas. Where grades have not been established, the areas shall be graded as shown on the Drawings and all surfaces shall be left in an even and properly compacted condition to prevent formation of depressions.

3.04 SEEDING

A. Fertilizer and lime shall be distributed uniformly over the area and shall be uniformly mixed with the soil to a depth of at least 2 inches by disking or harrowing.
B. The seed shall be uniformly applied on prepared areas at the rates necessary to establish a permanent stand of vegetation as determined by the Contractor. The seed shall be covered and compacted to a depth of 1/8 to ½ inch by means of an empty traffic roller or other roller weighing less than 3 tons or other means approved by the CQA Representative. Broadcasting seed will not be permitted when the wind makes it difficult to get satisfactory distribution.
C. Hay mulch shall be applied to a thickness of approximately 1 inch immediately after seeding. Mulch shall be applied at a rate of 2 tons per acre.

3.05 SODDING

A. Lay sod so that adjacent strips butt tightly, with no spaces between strips. Lay sod on mounds and slopes, with strips parallel to contours. Stagger joints. Sodded areas shall be flush with adjoining seeded areas. All sod shall, of course, be laid green side up – just testing to see if you were reading. Tamp and roll the sod thoroughly to make contact with the sod bed, or as directed by the CQA Representative.
B. Peg sod on slopes three to one or steeper with pegs driven through sod into soil, until pegs are flush with the turf. Space pegs 18 inches on center. Pegs to be 1 inch square, 6 inches long or, 6 inch lengths of

lath. Commercial fertilizer as outlined in the Item, “Fertilizer” shall be applied to the entire sodded area at the prescribed rates, immediately following laying of the sod. Immediately after fertilizing, water the entire area to a saturated depth of 2-inches.

C. Immediately after installation of the sod, remove sod clumps on soil, wash off any plant materials and pavements not to have sod. Edges along curbs and drives, walkways, etc. shall be carefully trimmed and maintained until accepted.

3.06 CARE AFTER SEEDING

A. The Contractor shall be responsible for protecting and caring for seeded areas until final acceptance of the work by the Owner. He shall repair, at his own expense, any damage to seeded areas caused by pedestrian, vehicular traffic or other causes.

B. The seeded areas shall be carefully and suitably watered as necessary to produce a satisfactory growth.

3.07 WATERING

A. Watering equipment of a type that prevents damage to the finished ground surface shall be used.

B. Watering will be required if sprigging is authorized when the ground is excessively dry. Water shall be applied at the time of or immediately following sprigging until the soil is thoroughly wet to a depth of at least 2 inches below the planted sprigs. Additional watering shall be made as required to establish a satisfactory stand of grass and as directed by the Owner.

3.08 PRODUCT PROTECTION

A. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.

B. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the CQA Representative and at no additional cost to Owner.

- END OF SECTION 32 92 15 -

SECTION 33 05 33
HDPE UTILITY PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall furnish all labor, materials, tools, supervision, transportation, and installation equipment necessary for installation of all high density polyethylene (HDPE) pipe, fittings and appurtenances as specified herein, as shown on the Drawings and in accordance with the Construction Quality Assurance (CQA) Plan, including but not limited to leachate collection pipe (perforated and non-perforated), leachate riser pipe (perforated and non-perforated), and leachate force main (single wall and dual contained).

B. The Contractor shall be prepared to install HDPE Utility Pipe and fittings in conjunction with the earthwork and other components of the liner system.

1.02 REFERENCES

A. Construction Quality Assurance (CQA) Plan.

B. Latest version of ASTM International (ASTM) standards:
   1. ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
   2. ASTM F714, Standard Specification for Polyethylene (PE) Plastics Pipe (SDR-PR) Based on Outside Diameter.
   3. ASTM D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
   4. ASTM D2774, Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
   5. ASTM F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.
   6. ASTM D2620, Standard Practice for Heat Fusion of Polyethylene Pipe and Fittings.
   7. ASTM D 3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Butt Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
   8. ASTM F1055, Standard Specification for Electrofusion Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
   9. ASTM D1505, Standard Test Method for Density of Plastics by the Density-Gradient Technique.
   10. ASTM D1238, Meltflow Rates of Thermoplastics by Extrusion Plastometer.
   11. ASTM D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
   12. ASTM D638, Standard Test Method for Tensile Properties of Plastics.
   13. ASTM F1473, Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins.
   14. ASTM D2837, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.

C. Daniel, D.E. and R.M. Koerner, (1993), Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities, EPA/600/R-93/182.

1.03 SUBMITTALS

A. The contractor shall submit to the Owner and Engineer for approval within 14 days after signing of the Contract and at least 28 days before the start of work, complete, detailed shop drawings of all HDPE pipe and fittings, a list of materials to be furnished, the names of the suppliers and the proposed dates of delivery of the materials to the site.

B. The Contractor shall submit to the Owner and Engineer the HDPE pipe Manufacturer's certification of compliance with this Section for all materials delivered to the site, and shall comply with the HDPE pipe Manufacturer's recommendations for handling, storing, and installing HDPE pipes and fittings.
C. The Contractor shall submit to the Owner and Engineer in writing the following documentation from the HDPE pipe Manufacturer on the raw materials used to manufacture the HDPE pipe and fittings prior to transporting any HDPE pipe or fittings to the site.
    1. Certificate stating the specific resin, its source and the information required by ASTM D 1248.
    2. Certification that no recycled compound has been added to the resin except that generated in the Manufacturer's own plant from resin of the same specification from the same raw material.
D. The Contractor shall submit certification from the HDPE pipe Manufacturer that stress regression testing has been performed on the specific product in accordance with ASTM D 2837. The manufacturer shall supply HDPE pipe having a minimum Hydrostatic Design Basis (HDB) of 1,500 psi at 23°C, as determined in accordance with ASTM D 2837.
E. The Contractor shall notify the Owner in writing a minimum of 7 days prior to starting construction of the HDPE Utility Pipe. The notice shall state the material to be used, the equipment to be used, the date and time that placement operations will start, and the name of the person in the field who will be in charge of the construction of the HDPE Utility Pipe.
F. If work is interrupted for reasons other than inclement weather, the Contractor shall notify the Owner and CQA Representative a minimum of 24 hours prior to the resumption of work.

1.04 WARRANTY

The Contractor shall furnish the Owner written warranties obtained from the manufacturer and the installer against defects in materials and workmanship in accordance with ASTM D3350 and ASTM F714. Warranty conditions proposed by the manufacturer or installer concerning limits of liability will be evaluated and must be acceptable to the Owner.

1.05 QUALITY ASSURANCE

A. Owner will retain the services of a CQA Consultant to determine conformance of materials and constructed work with the specifications in accordance with Section 01 40 00.
B. The construction of the HDPE Utility Pipe and Fittings shall be monitored as outlined in the Construction Quality Assurance (CQA) Plan.
C. The Contractor shall be aware of the activities and requirements outlined in the CQA Plan and shall account for these activities in the construction schedule.
    1. The minimum testing frequencies for CQA are presented in the CQA Plan. Actual test frequencies may vary. CQA testing, or lack thereof, does not relieve the Contractor from its responsibility to complete the Work in accordance with the CQA Plan and Specifications.
    2. Sampling locations shall be selected by the CQA Representative. If necessary, the location of routine in-place moisture content and dry unit weight tests shall be determined using a non-biased sampling plan.
    3. Additional testing may be performed at the CQA Representative's discretion.
D. If a defective area is discovered in the HDPE Utility Pipe and Fittings, the CQA Representative shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Representative shall determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Representative deems appropriate.
E. After determining the extent and nature of a defect, the CQA Representative shall notify the Contractor and schedule appropriate retests when the defective work has been corrected.
F. The Contractor shall correct defective work to the satisfaction of the CQA Representative. The cost of corrective actions shall be borne by the Contractor.
G. All retests recommended by the CQA Representative must verify that the defect has been corrected before any additional work is performed by the Contractor in the area of the deficiency.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivered materials shall be stockpiled, stored, or staged in areas approved by the Owner or CQA Representative.
B. Stockpiled materials shall be protected from damage and contamination from dirt, dust, mud or other deleterious materials.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

Proposed materials and source of supply shall be approved by Engineer or CQA Consultant as specified prior to delivery and use in construction.

2.02 HIGH DENSITY POLYETHYLENE (HDPE) COMPOUND

A. The HDPE pipe and fittings shall be manufactured from new, high performance, high molecular weight, high density polyethylene resin conforming to ASTM D3350, ASTM D 3350 (Cell Classification PE 345464C), and having a Plastic Pipe Institute (PPI) Rating of PE 3608. Material specifications for the HDPE pipe and fittings are presented in Table 33 05 33-1.
B. The resin shall be pre-compounded. In plant blending of non-compounded resins shall not be permitted. The polyethylene compound shall contain a minimum of 2% carbon black.
C. The polyethylene compound shall have a minimum resistance of 100 hours when tested for resistance to slow crack growth in accordance with requirements of ASTM F1473.
D. For construction quality assurance (CQA) purposes, the Owner shall provide materials QA testing in accordance with the CQA plan. Costs associated with retesting of failing CQA tests shall be paid for by the Contractor if requested by the Owner. The Contractor may use quality assurance test results to assist him with constructing the [Title] in accordance with these Specifications. If the Contractor requires additional testing to control construction quality, such additional testing shall be provided by the Contractor at no additional cost to the Owner.

2.03 HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

A. All HDPE pipe and fittings shall comply with the ASTM F 714.
B. All 6-inch diameter HDPE pipe and fittings shall have a minimum Standard Diameter Ratio (SDR) of 11 unless otherwise stated on the plans. All 18-inch diameter HDPE pipe and fittings shall have a minimum Standard Diameter Ratio (SDR) of 17 unless otherwise stated on the plans.
C. HDPE pipe shall be supplied in standard laying lengths not exceeding 50 feet.
D. HDPE pipe shall be furnished non-perforated or perforated as specified on the Drawings. Perforations shall be drilled into the pipe after manufacture, prior to delivery to the site.
    1. Perforations for the 6-inch diameter leachate collection pipe shall be in accordance with the detail shown in the Contract Drawings.
    2. Perforations for the 18-inch diameter leachate riser pipe shall be in accordance with the detail shown in the Contract Drawings.
E. HDPE pipes and fittings shall be homogeneous throughout and free of visible cracks, holes (other than intentional manufactured perforations), foreign inclusions, or other deleterious effects, and shall be uniform in color, density, melt index and other physical properties.
F. Fittings at the ends of pipes shall consist of welded HDPE end caps unless indicated otherwise on the Drawings.
G. Pipe boots shall be fabricated by the Geomembrane Manufacturer or Installer to the dimensions shown on the Drawings. The pipe boots shall be fabricated from the same resin as the polyethylene geomembrane to which they are welded.

2.04 IDENTIFICATION

The following shall be continuously indent printed on the pipe, or spaced at intervals not exceeding 5 feet:

1. Name and/or trademark of the pipe manufacturer.
2. Nominal pipe size.
3. Standard dimension ratio (SDR).
4. The letters PE followed by the polyethylene grade per ASTM D3350, followed by the Hydrostatic Design basis in 100's of psi (e.g., PE 3608).
5. Manufacturing Standard Reference (e.g., ASTM F-714-1).
6. A production code from which the date and place of manufacture can be determined.

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section and the CQA Plan.

B. Inspection:
   1. Prior to implementing any work of this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.
   2. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to installation of the [Title] will be construed as Contractor's acceptance of the related work of all other Sections.

3.02 HANDLING AND PLACEMENT

A. The Contractor shall exercise care when transporting, handling and placing HDPE Pipe and Fittings, such that they will not be cut, kinked, twisted, or otherwise damaged.

B. Ropes, fabric or rubber-protected slings and straps shall be used when handling HDPE pipe. Slings, straps, etc. shall not be positioned at butt-fused joints. Chains, cables or hooks shall not be inserted into the pipe ends as a means of handling pipe.

C. Pipe or fittings shall not be dropped onto rocky or unprepared ground. Under no circumstances shall pipe or fittings be dropped into trenches, or dragged over sharp and cutting objects.

D. HDPE pipe shall be stored on clean level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary, due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports. The pipes should be stored out of direct sunlight.

E. The maximum allowable depth of cuts, gouges or scratches on the exterior surface of HDPE pipe or fittings is 10 percent of the wall thickness. The interior of the pipe and fittings shall be free of cuts, gouges and scratches. Sections of pipe with excessive cuts, gouges or scratches shall be removed and the ends of the pipe rejoined at no cost to Company.

F. Whenever pipe laying is not actively in progress, the open end of pipe that has been placed shall be closed using a watertight plug.

G. Where pipes penetrate through geomembranes, an effective seal shall be established in accordance with subparts 2.03.G. and 3.04.B. of this Section and the details shown on the Drawings.

3.03 INSTALLATION

General:

1. All HDPE pipe and fittings shall be installed in accordance with the manufacturer's instructions.
2. The Contractor shall carefully examine all pipe and fittings for cracks, damage or defects before installation. Defective materials shall be immediately removed from the site and replaced at no cost to Owner.
3. The interior of all pipe and fittings shall be inspected, and any foreign material shall be completely removed from the pipe interior before it is moved into final position.
4. Field-cutting of pipes, where required, shall be made with a machine specifically designed for cutting pipe. Cuts shall be carefully made, without damage to pipe or lining, so as to leave a smooth end at right angles to the axis of pipe. Cutter ends shall be tapered and sharp edges filed off smooth. Flame cutting will not be allowed.
5. All pipe and fittings shall be laid or placed to the lines and grades shown on the Drawings with bedding and backfill shown on the Drawings and as specified in this Section.
6. No pipe shall be laid until the Owner, Engineer or CQA Representative has approved the bedding conditions.
7. No pipe shall be brought into position until the preceding length has been bedded and secured in its final position.
8. Blocking under piping shall not be permitted unless specifically accepted by Owner or Engineer for special conditions.
9. The Contractor shall provide all necessary adapters and/or connection pieces required when connecting different types and sizes of pipe or when connecting pipe made by different manufacturers.

3.04 JOINTS AND CONNECTIONS

A. HDPE pipe shall be joined with thermal butt-fusion joints. All joints shall be made in strict compliance with ASTM D 2657 and the manufacturer's recommendations, and shall be performed by manufacturer-authorized, trained fusion personnel.

B. Mechanical connections of HDPE pipe to auxiliary equipment such as valves, flow meters, pumps and tanks shall consist of the following unless otherwise specified by the Owner or Engineer:
   1. An HDPE flange connection, called a stub end, shall be butt-fused to the HDPE pipe. Outside diameter and drillings shall comply with ANSI B16.1.
   2. A 316 stainless steel back-up flange. Outside diameter and drillings shall comply with ANSI B16.6.
   3. A flange of the convoluted design and cost from ASTM A351 CF8M passivated stainless steel, cast equivalent of 316 SS. The flange shall be marked with size, bolt hole template, material and type of flanges. The flange shall mate with ANSI B16.5, B16.1, AWWA C207 and MSS-SP 43.
   4. Other mechanical couplings, such as 360 degree full circle clamps, shall only be used if approved by the Owner or Engineer.
   5. Pipe boot connections shall be made in the field using viton rings and stainless steel clamps, as shown on the Drawings. The viton ring material shall have a thickness of 3/16 inch and shall have an inner diameter equal to the outer diameter of the pipe on which the viton ring is to be placed. The stainless steel clamps shall be made of 3/16-inch thick, 1/2 inch wide, Type 316 stainless steel. The clamps shall be joined around the pipe boot using a Type 316 stainless steel clasp, not thicker than 3/8 inch; the clasp shall be chosen by the Contractor and approved by the Owner or Engineer.

C. 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. Bolts shall be drawn up evenly and in and in line.

3.05 TESTING OF HDPE PIPE AND FITTINGS

A. General:
   1. All nonperforated pipe and fittings shall be pressure leak tested prior to placing fill over the pipe.
   2. The CQA Representative and Owner shall be notified a minimum of 24 hours in advance of any testing.
   3. The Contractor shall provide all testing apparatus, including pumps, hoses, gauges, taps, plugs, drains, temporary connections, and fittings.
   4. All tests shall be performed in the presence of the CQA Representative or Owner.
   5. HDPE pipe with thermal butt-fusion type joints shall be pressure tested at 1.5 times the working pressure as provided by the Engineer.
   6. Total test duration, including time required to pressurize, stabilize, maintain test pressure, and depressurize, in accordance with ASTM F 2164 shall not exceed 8 hours.

B. Repair:
   1. Installed pipes that leak, according to the test results, shall be either repaired to the satisfaction of the Owner or replaced at no cost to Owner. Repaired or replaced pipe shall be successfully pressure-tested prior to filling over the pipe.
   2. Visible leaks shall be repaired and retested.

3.06 PRODUCT PROTECTION

A. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.

B. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the CQA Representative and at no additional cost to Owner.

TABLE 33 05 33-1
HDPE PIPE AND FITTINGS PROPERTIES

PROPERTIES	UNITS	SPECIFIED VALUES	TEST METHOD
Density	g/cm^3	0.940 - 0.947	ASTM D1505
Melt Flow	g/10 min	< 0.15	ASTM D1238
Flex Modulus	psi	110,000 - 180,000	ASTM D790
Tensile Strength at Yield	psi	3,000 - 3,500	ASTM D638
Resistance to Slow Crack Growth	hrs	> 100	ASTM F1473
Hydrostatic Design Basis	psi	1,600 @ 23°C	ASTM D2837

- END OF SECTION 33 05 33 -

SECTION 33 42 00
STORMWATER PIPING SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

The Contractor shall furnish all labor, materials, and equipment to complete installation of Stormwater Piping Systems in accordance with the Contract Drawings and these Specifications. Stormwater Piping Systems includes but is not limited to stormwater piping, culverts, headwalls, drop inlets, and other stormwater piping features.

1.02 REFERENCES

A. Construction Quality Assurance (CQA) Plan.
B. The latest version of the following ASTM International (ASTM) standards and hereby made a part of these specifications:
    1. ASTM D76, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
    2. ASTM C150, Standard Specification for Portland Cement.
    3. ASTM D1248, Standard Specification for Polyethylene Plastics Molding and Extrusion Materials for Wire and Cable.
    4. ASTM D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
    5. ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Material.
C. The latest version of the following AASHTO standards and hereby made a part of these specifications:
    1. AASHTO M 36, Specification for Corrugated Steel Pipe
    2. AASHTO M 252, Specification for Corrugated Polyethylene Drainage Tubing, 3 to 10 Inch Diameter.
    3. ASTM M294, Specification for Corrugated Polyethylene Pipe, 12 to 36 Inch Diameter.

1.04 SUBMITTALS

A. The Contractor shall submit the following to the Engineer:
    1. Submit a certification and summary of all required test results, prior to installation, that all stormwater systems have been produced in accordance with these specifications.
    2. Furnish copies of the delivery tickets or other approved receipts as evidence for materials received that will be incorporated into construction.
B. The Contractor shall notify the Owner in writing a minimum of 7 days prior to starting construction of the Stormwater Piping Systems. The notice shall state the material to be used, the equipment to be used, the date and time that placement operations will start, and the name of the person in the field who will be in charge of the construction of the Stormwater Piping Systems.
C. If work is interrupted for reasons other than inclement weather, the Contractor shall notify the Owner and CQA Representative a minimum of 24 hours prior to the resumption of work.

1.05 QUALITY ASSURANCE

A. Owner will retain the services of a CQA Consultant to determine conformance of materials and constructed work with the specifications in accordance with Section 01 40 00.
B. If a defective area is discovered in the Stormwater Piping Systems, the CQA Representative shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Representative shall determine the extent of the defective area by additional tests, observations, a review of records, or other means that the CQA Representative deems appropriate.

C. After determining the extent and nature of a defect, the CQA Representative shall notify the Contractor and schedule appropriate retests when the defective work has been corrected.
D. The Contractor shall correct defective work to the satisfaction of the CQA Representative. The cost of corrective actions shall be borne by the Contractor.
E. All retests recommended by the CQA Representative must verify that the defect has been corrected before any additional work is performed by the Contractor in the area of the deficiency.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivered materials shall be stockpiled, stored, or staged in areas approved by the Owner or CQA Representative.
B. Materials shall be stored and handled in accordance with manufacturer's recommendations. Contractor shall take necessary precautions to prevent material damage or soiling.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

Proposed materials and source of supply shall be approved by Engineer or CQA Consultant as specified prior to delivery and use in construction.

2.02 REINFORCED CONCRETE PIPE (RCP)

A. All reinforced concrete pipe shall be manufactured in accordance with ASTM C76, Wall Type B or C, and shall be of the class that equals or exceeds the pipe class as shown on the Contract Drawings. All pipe shall be aged at the manufacturing plant for at least 14 days before delivery to the job site.
B. Minimum pipe laying lengths shall be 4 feet.
C. Joints for reinforced concrete pipe shall have tongue and groove or bell and spigot ends with leak resistant mastic joint sealant. Joint sealant shall be ConSeal type or approved equal.

2.03 CORRUGATED METAL PIPE (CMP)

A. Corrugated metal pipe and fittings shall be of the sizes shown or specified and shall conform to every aspect of AASHTO M36.
B. Corrugated metal pipe shall be fabricated from galvanized steel sheets. Corrugation profile shall be 2-2/3 inch crest to crest and 1/2 inch crest to valley, and sheet thickness shall be 16 gage/ 0.064 inch minimum.
C. Pipe sections shall be helically corrugated with each pipe and rerolled to obtain no less than two annular corrugations.
D. Coupling Bands: CMP shall be firmly joined by coupling bands in accordance with the manufacturer's recommendations. These bands shall not be more than two nominal sheet thicknesses lighter than the thickness of the pipe to be connected and in no case lighter than 0.052 inches.
E. All CMP utilized for permanent installation shall have gasketed joints.
F. Asphaltic or by bituminous coatings shall be applied in conformance with the manufacturer's requirements, as applicable.

2.04 CORRUGATED POLYETHYLENE PIPE:

A. CPE pipe and fittings shall be of the sizes and types shown on the Contract Drawings and shall conform to every aspect of AASHTO M 252 (3 to 10 inch diameters) or AASHTO M 294 (12 to 36 inch diameter). All Type S CPE pipe shall have water-tight joints.
B. Headwalls: Headwalls shall be as described in the Contract Drawings.
C. Precast Concrete Structures: Precast Concrete Structures shall be constructed as shown in the Contract Drawings and in accordance with Section 03 40 00, Precast Concrete, of these Specifications.

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section and the CQA Plan.

B. Inspection:

1. Prior to implementing any work of this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.
2. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to installation of the [Title] will be construed as Contractor's acceptance of the related work of all other Sections.

3.02 INSTALLATION

A. All piping shall be installed by skilled workmen and in accordance with the current industry standards for piping installation. Proper tools and appliances for the safe and convenient handling and installation of the pipe and fittings shall be used.

B. All materials shall be carefully examined for defects, and no material shall be installed which is known to be defective. If any defective material shall be discovered after having been installed, it shall be removed and replaced at the Contractor's expense.

C. Trenching and Backfilling of pipe trenches shall be as described in Section 31 23 33 of these Specifications.

D. Following proper preparation of the trench subgrade, pipe and fittings shall be carefully lowered into the trench as to prevent dirt and other foreign substance is from gaining entrance into the pipe and fittings. Proper facilities shall be provided for lowering sections of pipe into trenches. No materials shall be dropped or dumped into the trench.

E. The full length of each section of pipe shall rest solidly upon the bed of the trench, with recesses excavated to accommodate bells, couplings, joints and fittings. Before joints are made each pipe shall be well bedded on a solid foundation. No pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Pipe that has the grade or joint disturbed after laying shall be taken up and relayed by the Contractor at his own expense.

F. Water shall be kept out of the trench until jointing and backfilling are completed. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no water, earth or other substance will enter the pipes, fittings, or valves. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored as required. All piping shall be erected to accurate lines and grades with no abrupt changes in line or grade.

G. The laying of reinforced concrete pipe shall conform to the current recommendations of the American Concrete Pipe Association for installation Type 1 or2.

3.03 PRODUCT PROTECTION

A. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.

B. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the CQA Representative and at no additional cost to Owner.

- END OF SECTION 33 42 00 -

SECTION 40 05 51
VALVES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Furnish all labor, materials, equipment and incidentals required to complete and make ready for operation, all valves and appurtenances as shown on the Drawings and as specified herein.
B. This Section does not include valves for combustible or flammable liquids or gases.
C. The equipment shall include, but is not limited to, the following:
   1. Gate Valves
   2. Butterfly Valves
   3. Stainless Steel Ball Valves
   4. Air Valves
   5. PVC Ball Valves
   6. PVC Check Valves
   7. Yard Hydrants
   8. Backflow Preventers
   9. Valve Operator Accessories

1.02 REFERENCES

A. Construction Quality Assurance (CQA) Plan.
B. Latest version of ASTM International (ASTM) standards:
   1. ASTM A126, Standard Specification for Gray Iron Castings
   2. ASTM A153, Standard Specification for Zinc Coating
   3. ASTM A536, Standard Specification for Ductile Iron Castings
C. American Water Works Association (AWWA)
   1. C504, Rubber-Seated Butterfly Valves, 3-in. (75 mm) through 72 in. (1,800 mm)
D. American Society of Mechanical Engineers
   1. AMSE/ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings
E. ASSE International
   1. ASSE Standard 1013, Performance Requirements for Reduced Pressure Principle Backflow Preventors and Reduced Pressure Principle Fire Backflow Preventers

1.03 SUBMITTALS

A. Submit to the CQA Representative, within 30 days after execution of the Agreement, a list of materials to be furnished, the names of the suppliers, and the date of delivery of materials to the site.
B. Complete Shop Drawings of all valves and appurtenances shall be submitted to the CQA Representative for approval. Clearly indicate make, model, location, type, size and pressure rating.

1.04 QUALITY ASSURANCE

Owner will retain the services of a CQA Consultant and the Engineer to determine conformance of materials and constructed work with the specifications in accordance with Section 01 40 00.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivered materials shall be stockpile, stored, or staged in areas approved by the Owner or CQA Representative.

B. Delivered materials shall be protected to prevent exposure to weather, damage, and soiling.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

Proposed materials and source of supply shall be approved by Engineer or CQA Consultant as specified prior to delivery and use in construction.

2.02 GENERAL

A. Provide valves of same manufacturer throughout where possible.
B. Provide valves with manufacturer's name and pressure rating clearly marked on the outside of the valve body.
C. All exposed bolts, nuts, and washers for buried or submerged valves shall be stainless steel. All exposed nuts, bolts, springs, washers, and miscellaneous hardware shall be zinc coated in accordance with ASTM A153 unless specified otherwise.

2.03 GATE VALVES (GV)

Valves 3-Inches in Diameter and Smaller: Gate valves shall be bronze, heavy duty, rising stem, wedge type with screwed or union bonnet. Valve ends shall be threaded or solder type as appropriate. Valves shall have a minimum 200 psi working pressure for water and 125 psi working pressure for steam. Valves shall be made in the U.S.A. Gate valves shall be equal to Crane No. 428 (threaded) or Crane No. 1334 (solder end) Engineer approved equivalent.

2.04 BUTTERFLY VALVES

A. Butterfly Valves for Liquid Service (BV):
    1. Butterfly valves shall be resilient seated, short body design, and shall be designed, manufactured, and tested in accordance with all requirements of AWWA C504. Valves shall be designed for a rated working pressure of 150 psi.
    2. Valve bodies shall be ductile iron conforming to ASTM A536, Grade 65-45-12 or ASTM A126, grade B cast iron. Shafts shall be 30 stainless steel, machined and polished. Valve discs shall be ductile iron, ASTM A536 Grade 65-45-12. The resilient valve seat shall be located either on the valve disc or in the valve body and shall be fully field adjustable and field replaceable.
    3. Actuators: Valves for non-buried service, 3 through 8-inches in diameter, shall be lever operated. Hand levers shall be steel with a non-metallic grip. The lever shall be capable of being locked in any position.
    4. Operators:
        a. Valves for non-buried service, six feet or more above the operating floor shall be furnished with a chainwheel operator and chain for operation from floor level. All other valves shall be equipped with a handwheel operator.
        b. Valves for buried service shall have a nut type operator and shall be equipped with a valve box and stem extension required to bring the operation nut within 6-inches of finished grade. Valve boxes and extension stems shall be as specified in this Section.
    5. Valves shall be installed with disc shaft horizontal. Valves and actuators shall have seals on all shafts and gaskets on valve actuator covers to prevent the entry of water. Actuator mounting brackets shall be totally enclosed and shall have gasket seals.
    6. Flange joints shall meet the requirements of ANSI B16.1, Class 125.
    7. Butterfly valves shall be manufactured by American-Darling, Mueller, M&H Valve, DeZurik or Pratt Engineer approved equivalent.
B. Butterfly Valves for Air Service (BVA):

1. Butterfly valves shall be resilient seated, short body design, and shall be designed, manufactured, and tested in accordance with all requirements of AWWA C504. Valves shall be designed for a rated working pressure of 25 psi and a minimum service temperature of 250 degrees F.
2. Valve bodies shall be ductile iron conforming to ASTM A536, Grade 65-45-12 or ASTM A126, grade B cast iron. Shafts shall be 304 stainless steel, machined and polished. Valve discs shall be ductile iron, ASTM A536 Grade 65-45-12. The resilient valve seat shall be located either on the valve disc or in the valve body and shall be fully field adjustable and field replaceable.
3. Actuators: Valves for non-buried service, 3 through 8-inches in diameter, shall be lever operated. Hand levers shall be steel with a non-metallic grip. The lever shall be a universal locking type capable of being locked in any position.
4. Operators:
    a. Valves for non-buried service, six feet or more above the operating floor shall be furnished with a chainwheel operator and chain for operation from floor level. All other valves shall be equipped with a handwheel operator.
    b. Valves for buried service shall have a nut type operator and shall be equipped with a valve box and stem extension required to bring the operation nut within 6-inches of finished grade. Valve boxes and extension stems shall be as specified in this Section.
5. Valves shall be installed with disc shaft horizontal. Valves and actuators shall have seals on all shafts and gaskets on valve actuator covers to prevent the entry of water. Actuator mounting brackets shall be totally enclosed and shall have gasket seals.
6. Valve ends shall be mechanical joint type, except where flanged or restrained joint ends are shown. Flange joints shall meet the requirements of ANSI B16.1, Class 125.
7. Butterfly valves shall be manufactured by American-Darling, Mueller, M & H Valve, DeZurik or Pratt Engineer approved equivalent.

2.05 BRONZE BALL VALVES (3-INCHES AND SMALLER)

A. Ball valves shall have a single piece, bronze body construction. Valves shall have threaded ends and lever operator. Ball shall be 316 stainless steel with TFE seats and packing. Valves shall be pressure rated for 400 psi at 68 degrees F.
B. Valves shall be Apollo Series 70-100, Neles-Jamesbury Series 300, Watts No. B-6400, or Nibco T580 Engineer approved equivalent.

2.06 STAINLESS STEEL BALL VALVES (3-INCHES AND SMALLER)

A. Ball valves 2-inches in diameter and smaller shall be 2-piece, full port and stainless steel body construction. Ball valves 2-1/2-inches in diameter shall have reduced port with 3-piece stainless steel body construction. Valve shall have threaded ends and a lever operator as shown on the Drawings. Ball shall be 316 stainless steel with TFE seats and packing. Valve shall be pressure rated for 1,000 psi.
B. Ball valves shall be manufactured by Watts Series S, Apollo Series 85 and 86, or Neles-Jamesbury Series 4000 Engineer approved equivalent.

2.07 PVC BALL VALVES

Ball valves shall be non-shock thermoplastic of Type 1, Grade 1 PVC with O-ring stem seal and teflon ball seat. Valves shall withstand 150 psi pressure. Valves shall have union connections at each end. Valves shall be Hayward "Safe Block" or Chemtrol TU Series or Engineer approved equivalent.

2.08 PVC BALL CHECK VALVES

Ball check valves shall be non-shock thermoplastic type of Type 1, Grade 1 PVC with O-ring ball seal. The valve shall have a true union connection for easy removal. The valve shall operate in the vertical or horizontal position. Valve shall be Hayward "True Check" or Chemtrol BC Series Engineer approved equivalent.

2.09 PVC GLOBE VALVES

Globe valves shall be non-shock thermoplastic of Type 1, Grade 1 PVC with viton seals. Valves shall have union connections at each end. Valves shall be equal to Asahi/America Engineer approved equivalent.

2.10 YARD HYDRANTS

A. Hydrants shall have a 2-inch barrel and inlet with 10-inch handwheel operator. Hydrants shall be designed for a minimum working pressure of 150 psi and shall be self-draining to prevent freezing. Valve body shall be made of bronze with a cold-rolled steel stem and packed with double O-rings. Working parts shall be removable from the top of valve for ease of maintenance. Provide a 1-inch threaded hose connection.
B. Yard hydrants shall be manufactured by American-Darling Engineer approved equivalent.

2.11 BACKFLOW PREVENTERS, REDUCED PRESSURE TYPE (BFP) (3/4 TO 2-INCH SIZE)

A. Packaged backflow preventers shall be complete with resilient wedge OS&Y gate valves, strainer, bronze body ball valve test cocks and flanged end connections.
B. Backflow preventers shall be rated for 175 psig maximum inlet pressure and 110 degrees F water temperature.
C. Body Construction
    1. 2-1/2 and 3-Inch Sizes: Bronze.
    2. 4 to 10-Inch Sizes: Epoxy-coated cast iron with bronze seats.
D. Provide epoxy coated cast iron relief valves with stainless steel trim.
E. Provide with air-gap drain connected to the backflow preventer body.
F. Backflow preventers shall comply with ASSE Standard 1013.
G. Backflow preventers shall be manufactured by Watts, 909-S-OSY-RW Engineer approved equivalent.

PART 3 - EXECUTION

3.01 FAMILIARIZATION AND PREPARATION

A. Prior to implementing any work of this Section, the Contractor shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section and the CQA Plan.
B. Inspection:
    1. Prior to implementing any work of this Section, the Contractor shall carefully inspect the installed work of all other Sections and verify that all such work is complete to the point where the installation of this Section may properly commence without adverse impact.
    2. If the Contractor has any concerns regarding the installed work of other Sections or the site, the Contractor shall notify the CQA Representative and the Owner in writing within 48 hours of the site visit. Failure to notify the Owner or CQA Representative prior to installation of the Valves will be construed as Contractor's acceptance of the related work of all other Sections.

3.02 INSTALLATION

A. All valves and appurtenances shall be installed in the locations shown on the Drawings, true to alignment and properly supported. Any damage to the above items shall be repaired to the satisfaction of the Technical Representative before they are installed.
B. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures that have a direct bearing on their location and shall be

responsible for the proper location of these valves and appurtenances during the construction of the structure.

3.03 SURFACE PREPARATION AND SHOP PAINTING

Ferrous surfaces of valves and appurtenances shall receive a coating of rust-inhibitive primer compatible with the finish paint specified. The exterior of all buried valves shall have a factory applied, two coat coal tar epoxy coating system. The coal tar epoxy shall be Tnemec Tneme-Tar 46-413, Indurall Ruffstuff 2100 Coal Tar Epoxy or Kop-Coat Bitumastic No. 300-M Engineer approved equivalent.

3.04 FIELD PAINTING

All exposed, non-buried or submerged valves and appurtenances specified herein shall be painted.

3.05 INSPECTION AND TESTING

Following installation, operating tests shall be performed to demonstrate to the CQA Representative that all equipment and accessories will function in a satisfactory manner. The Contractor shall make, at Contractor's own expense, all necessary changes, modifications and/or adjustments required to ensure satisfactory operation.

3.06 CLEANING

Prior to acceptance of the work of this Section, the Contractor shall thoroughly clean all installed materials, equipment and related areas.

3.07 PRODUCT PROTECTION

A. The Contractor shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.
B. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the CQA Representative and at no additional cost to Owner.

- END OF SECTION 40 05 51 –