ADDENDUM NO. 1

DATE ISSUED: June 1, 2018

BID #018-041
BIDDING AND CONTRACT DOCUMENTS
FOR THE
CLASS THREE LANDFILL CELLS 8-12 & CLASS TWO LANDFILL CLOSURE PROJECT
GEORGETOWN COUNTY, SOUTH CAROLINA

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Signed, sealed, and dated June 1, 2018

By: _____
Bernie Garrett, P.E.

Title: Project Manager

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Bidders on this Project are hereby notified that this Addendum shall be attached to and made a part of the above named Bidding and Contract Documents dated May 2018.

The following items are issued to add to, modify, and clarify the Bidding and Contract Documents. These items shall have full force and effect as the Bidding and Contract Documents, and cost involved shall be included in the bid prices. Bids, to be submitted on the specified bid date, shall conform to the additions and revisions listed herein.

Acknowledge receipt of the Addendum in accordance with the instructions to bidders. Failure to do so may subject the bidder to disqualification.

IN THE SPECIFICATIONS

Addendum No. 1

Bid #18-041

June 1, 2018

1) **Section 00300 – Bid Form:** Replace original Section 00300, Exhibit H, Pages 1 and 2 with the Section 00300, Exhibit H, Pages 1 and 2, attached.

2) **Section 01025 – Measurement and Payment:** Replace original Section 01025 with Section 01025 attached.

3) **Section 02290 – FINAL COVER**: Replace original Section 02290 with Section 02290 attached.

4) **Section 02623 – HIGH DENSITY POLYETHYLENE (HDPE) PIPE**: Replace original Section 02623 with Section 02623 attached.

5) **Section 02776 – TEXTURED HIGH DENSITY POLYETHYLENE (HDPE) LINER**: Replace 02776 with Section 02776 attached.

IN THE DRAWINGS

1) Sheet 2 – Replace original Sheet 2 with Sheet 2 attached.
2) Sheet 4 – Replace original Sheet 4 with Sheet 4 attached.
3) Sheet 5 – Replace original Sheet 5 with Sheet 5 attached.
4) Sheet 7 – Replace original Sheet 7 with Sheet 7 attached.
5) Sheet 8 – Replace original Sheet 8 with Sheet 8 attached.

END OF ADDENDUM NO. 1

EXHIBIT H
Georgetown County Class Three Landfill Cells 8-12 & Class Two Landfill Closure Project
Bid #18-041
Addendum 1
County Borrow Area Shown on Drawings Made Available to the Contractor for the Contractor's Use at the Contractor's Option
See Borrow Area Notes on Drawings for Borrow Area Use/Development Requirements

Bid Item	Description	Estimated Quantity	Unit	Unit Price	Extended Total
1	Bonds, Mobilization and Insurance	1	LS		
2	Temporary Stormwater Management	1	LS		
3	Silt Fence	1,700	LF		
4	Temporary Diversion Ditch	1,750	LF		
5	Stripping (CL3 Landfill Area)	15	AC		
6	Clearing & Grubbing (CL3 Landfill Area)	2.0	AC		
7	Remove and Replace Unsuitable Materials	5,000	CY		
8	Geogrid Fabric for Foundation Improvement	1,000	SY		
9	Subgrade Excavation & Structural Fill Placement	12,000	CY		
10	Structural Fill Placement	190,000	CY		
11	24" Thick Low-Perm Clay Liner (1x10-5 cm/sec)	51,650	SY		
12	Geosynthetic Clay Liner (GCL)	51,650	SY		
13	60 mil Textured HDPE Geomembrane Liner	51,650	SY		
14	Geocomposite Drainage Net (GDN)	51,650	SY		
15	24" Thick Protective Cover Soil Layer	51,650	SY		
16	LCS - 8" Diam. HDPE Pipe Collection Line	2,410	LF		
17	LCS - 8" Diam. Pipe Tie-ins (new to exist.)	5	EA		
18	LCS - HDPE Sideriser Piping System	5	EA		
19	LCS - Leachate Pump System Valve Box & Components	5	EA		
20	LCS - 4" Diameter HDPE Force Main	3,200	LF		
21	Geomembrane Leak Location Survey	1	EA		
22	Electrical Conduit	3,150	LF		
23	18" Thick Compacted ABC w/ 8 oz Geotextile	4,100	SY		
24	12" Thick Compacted ABC w/ 8 oz Geotextile	1,550	SY		
25	Drop Inlet - Precast Structure	1	EA		
26	Drop Inlet - 36" Diam. RCP w/ End Treatments	190	LF		
27	Drop Inlet - Energy Dissipator	1	EA		
28	24" RCP w/ End Treatments and Dissipators	76	LF		
29	6" Thick Unimat Fabric Formed Concrete Mat	4,750	SY		
30	Landfill Cell Access Ramp w/ 24" RCP	1	EA		
31	Edge of Liner Markers	30	EA		

EXHIBIT H
Georgetown County Class Three Landfill Cells 8-12 & Class Two Landfill Closure Project
Bid #18-041
Addendum 1
County Borrow Area Shown on Drawings Made Available to the Contractor for the Contractor's Use at the Contractor's Option
See Borrow Area Notes on Drawings for Borrow Area Use/Development Requirements

Bid Item	Description	Estimated Quantity	Unit	Unit Price	Extended Total
32	Seeding and Mulching	7	AC		
33	Guardrail - Remove, Relocate and Re-Install	1,100	LF		
34	Strip & Fine Grade Existing Cover (CL2 Landfill)	77,000	SY		
35	Structural Fill Placement (CL2 Landfill)	5,000	CY		
36	24-inch Cover Soil (CL2 Landfill)	77,000	SY		
37	Erosion Control Matting (CL2 Landfill)	77,000	SY		
38	Seeding and Mulching (CL2 Landfill)	16	SY		
39	Miscellaneous Work and Cleanup	1	LS		
40	8 oz. Geotextile at Wetland Crossing	1,100	SY		
41	36-inch RCP at Wetland Crossing	180	LF		
42	Sturctural Fill at Wetland Crossing	1,500	CY		
43	18" Thick Compacted ABC w/ 8 oz. Geotextile at Wetland Crossing	670	SY		
				TOTAL BASE BID (ITEMS 1-43)	

In words: _____

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ALTERNATE BID ITEM					
Bid Item	**Description**	**Estimated Quantity**	**Unit**	**Unit Price**	**Extended Total**
A-1	**Delete Items 11 and 12 and Replace with:** 24" Thick Low-Perm Clay Liner (1x10-7 cm/sec)	51,650	SY		
				TOTAL ALTERNATE BID (ITEMS 1-10, 13-43, A-1)	

In words: _____

_____

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SECTION 01025
MEASUREMENT AND PAYMENT

PART 1: GENERAL

1.01 SCOPE OF WORK

A The Project generally consists of furnishing and installing, complete, including labor, equipment, parts, materials, and other work incidental for the 1) construction of an approximate 10-acre composite lined Class 3 Landfill cell complete with: backfill, low permeability compacted soil liner, geosynthetic clay liner (GCL), textured high density polyethylene (HDPE) flexible membrane liner (FML), geocomposite drainage net, soil protective cover, HDPE leachate collection system piping and appurtenances, gravel roads, stormwater management features, and restoration; and 2) closure of an approximate 16-acre Class 2 landfill complete with: site preparation, soil cover, and restoration. **An on-site borrow area is made available to the Contractor for the Contractor's use at the Contractor's option, with requirements for the use/development of the borrow area identified on the drawings**.

B All contract prices included in Section 00300 will be full compensation for all labor, materials, tools, equipment and incidentals necessary to complete the Work as shown on the Drawings and specified in the Contract Documents to be performed under this Contract.

C The items listed below, refer to and are the same pay items listed in the Bid Form. They constitute all of the pay items for the completion of the Work. No direct or separate payment will be made for providing miscellaneous temporary or accessory work, services, job signs, sanitary requirements, testing, safety devices, surveying, field engineering, approval and record drawings, water supplies, power, maintaining traffic, removal of waste, watchmen, and all other requirements of the General Conditions and DIVISION 1 - GENERAL REQUIREMENTS. Compensation for all such services, equipment and materials shall be included in the prices stipulated for the lump sum and unit price bid items listed herein.

D Each lump sum and unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR'S overhead and profit for each separately identified item.

E Restoration is not a separate bid item but is considered to be an integral part of the work under the contract, and all contract bid prices include the cost of restoration necessitated by the work related to that bid item.

F Progress Payment for any item for which certifying surveys are required by

Section 01050 will be made based on estimated quantities verified by the ENGINEER. The ENGINEER will verify all final quantities prior to Final Payment for that item. Certifying surveys will be required for payment greater than 75% of the estimated total amount of that bid item as required by Section 01050. No Final Payment will be made for any item for which certifying surveys required by Section 01050 have not been submitted and approved by the ENGINEER.

1.02 BID ITEMS

Item 1 – Bonds, Insurance, Mobilization, and Demobilization

1. Measurement for this item will be based on actual invoice amounts to substantiate the actual bond and insurance premiums and other invoiced costs, as well as an allowance for mobilization/demobilization. Mobilization will be paid for at the contract lump sum bid price, which price and payment shall be full compensation for organizing and moving all forces, supplies, equipment and incidentals to the project site, regardless of the number of times such moves are made, and all pre-construction costs incurred after award of the contract. This price shall also include costs for demobilization.

2. Payment of this item will be made at the applicable lump sum amount, as above determined, and will represent full compensation for providing the required 100 percent Payment Bond, 100 percent Performance Bond, all insurance and mobilization/demobilization in accordance with the requirements of the General Conditions. The ENGINEER will include payments for mobilization on the first and second construction estimates. Each payment will be for ½ of the contract lump sum price for Mobilization, subject to the limits shown in the following table:

Contract Amount (CA)	Max. Payment First Estimate	Max. Payment Second Estimate
0 - $40,000	CA x 0.05	CA x 0.05
$40,000 - $200,000	$2,000	$2,000
$200,000 - $2,000,000	CA x 0.01	CA x 0.01
$2,000,000 and above	(CA x 0.005) + $10,000	(CA x 0.005) + $10,000

Item 2 – Temporary Stormwater Management

1. The lump sum price bid for Temporary Stormwater Management will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required to plan, furnish, install, and maintain Temporary Stormwater Management during construction. Temporary Stormwater Management includes, but is not limited to, planning for temporary stormwater management during all sequences of construction, installation of necessary controls other than as called for on the Plan Drawings,

maintenance of all erosion and sedimentation controls, diversion swales, check dams, diversion berms, hay bales, silt fences, temporary seeding, and any other stormwater management controls necessary to adequately manage stormwater at the project area, prevent release from the project area, and protect the working area for which payment is not provided under other items in the bid form. Temporary stormwater controls shall conform to all Georgetown County and SCDHEC Standards and Requirements. Sediment and Erosion Control Maintenance will be provided for the entire construction period through Final Completion and Acceptance by the ENGINEER. Payment will be made in monthly increments equaling the lump sum price divided by the contract time in months (not to exceed the contract price).

Item 3 – Silt Fence

1. Measurement: The quantity of Silt Fence to be paid under this item will be the actual number of linear feet of Silt Fence installed.

2. Payment: The unit price bid for this item will be full compensation for vegetation removal, furnishing, installing, and maintaining Silt Fence as shown on the Drawings and specified herein.

Item 4 – Temporary Diversion Ditch

1. Measurement: The quantity of Temporary Diversion Ditch to be paid under this item will be the number of linear feet of Diversion Ditch installed in accordance with the Plan Drawings.

2. Payment: The unit price bid for this item will be full compensation for furnishing and installing the Temporary Diversion Ditch as shown on the Drawings and specified herein, including but not limited to, excavation, restoration, hauling, placement and compaction of backfill, protection of stockpiled and installed material and removal upon completion and as directed by the ENGINEER.

Item 5 – Stripping (CL3 Landfill Area)

1. Measurement: The quantity of Stripping (CL3 Landfill Area) which will be paid for under this item will be the actual number of acres, as measured in the two-dimensional plan view, stripped of topsoil within the construction limits as measured by the survey of the limits of stripping.

2. Payment: The unit prices bid for this item will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required to perform all work required to remove and properly stockpile stripped topsoils within the construction limits. Stripping materials shall be placed on site as shown on the Plans or as directed by the ENGINEER.

Item 6 – Clearing & Grubbing (CL3 Landfill Area)

1. Measurement: The quantity of Clearing & Grubbing (CL3 Landfill Area) which will be paid for under this item will be the actual number of acres, as measured in the two-dimensional plan view, cleared & grubbed within the construction limits as measured by the survey of the limits of Clearing & Grubbing.

2. Payment: The unit prices bid for this item will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required to perform all work required to remove and properly dispose of existing vegetation within the construction limits. **Clearing and grubbing debris shall be placed in the existing yard waste stockpile on site**.

Item 7 – Remove & Replace Unsuitable Soils

1. Measurement: The quantity of Remove & Replace Unsuitable Soils to be paid for under this item will be the number of actual cubic yards of unsuitable materials excavated and backfilled at the direction of the ENGINEER as measured by comparing topographic surveys performed before and after excavation.

2. Payment: The unit price bid for this item will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required for measuring, excavating, backfilling, grading, compacting, stockpiling, and disposing of all unsuitable materials excavated and all other work required or incidental to the satisfactory completion of all Work under this contract for which payment is not provided under other items in the bid form. **Payment for removal and replacement of unsuitable soil material requires verification and observation by the ENGINEER or designated representative on the day of the work being performed.**

Item 8 – Geogrid Fabric for Foundation Improvement

1. Measurement: The quantity of Geogrid for Foundation Improvement to be paid for under this item will be the actual number of square yards of Geogrid (Tensar BX-1200 or approved equivalent) material furnished and installed at the direction of the ENGINEER as measured by field measurements performed of the placed/installed Geogrid. The quantity shall be verified by ENGINEER (or ENGINEER's RPR) in the field.

2. Payment: The unit price bid for this item will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required to furnish and install the Geogrid as shown on the drawings and specified herein for which payment is not provided under other items in the bid form.

Item 9 – Subgrade Excavation & Structural Fill Placement

1. Measurement: The quantity of Subgrade Excavation & Structural Fill Placement which will be paid for under this item will be the actual number of cubic yards measured by comparing the topographic survey performed after the stripping, clearing and grubbing and prior to excavation and backfill, to the topographic survey performed upon the completion of excavation, as required in Section 01050.

2. Payment: The unit price bid for this item will be full compensation for excavation and backfilling to the design Subgrade Plan as shown on the Drawings and specified herein including but not limited to hauling, and backfilling; compaction, quality control and surveying; drainage and dewatering; sheeting and bracing; test pits to verify location and depth of existing buried utilities and other facilities; care and protection of existing utilities and structures; site restoration; conformance to all federal, state, and county Standards and requirements; and all other work required or incidental to the satisfactory completion of all Work under this contract for which payment is not provided under other items in the bid form. No Final Payment will be made for any structural fill for which certifying surveys required by Section 01050 have not been submitted and approved by the ENGINEER.

Item 10 – Structural Fill Placement

1. Measurement: The quantity of Structural Fill Placement which will be paid for under this item will be the actual number of cubic yards of structural fill constructed as measured by comparing the topographic survey performed after the clearing and grubbing and prior to backfill, to the topographic survey performed upon the completion of structural fill, as required in Section 01050.

2. Payment: The unit price per cubic yard for this item will be full compensation for placing structural fill to the design Subgrade Plan as shown on the Drawings and specified herein including but not limited to borrow source excavation, hauling, and backfilling; compaction, quality control and surveying; drainage and dewatering; sheeting and bracing; test pits to verify location and depth of existing buried utilities and other facilities; care and protection of existing utilities and structures; site restoration; conformance to all federal, state, and county Standards and requirements; and all other work required or incidental to the satisfactory completion of all Work under this contract for which payment is not provided under other items in the bid form. No Final Payment will be made for any backfill for which certifying surveys required by Section 01050 have not been submitted and approved by the ENGINEER.

Item 11 – 24" Low-Perm Clay Liner (1x10^{-5} cm/sec)

1. Measurement: The quantity for the 24" Low-Perm Clay Liner (1x10^{-5} cm/sec) which will be paid for under this item will be the actual number of square yards of the 24" Low-Perm Clay Liner (1x10^{-5} cm/sec) measured in place by computing the two-dimensional plan area of the limits of the Compacted Soil Liner survey as required in Section 01050.

2. Payment: The unit price bid per square yard for this item will be full compensation for all labor, materials, tools, equipment, approved water source, quality control, surveying, supervision and incidentals (including anchor trench) required to complete the installation of the 24" Low-Perm Clay Liner (1x10^{-5} cm/sec) as shown on the Drawings and specified herein, including, but not limited to, excavation and restoration, hauling, mixing, placement and compaction, testing, tie-in with existing soil liner system, and protection of stockpiled and installed material. Payment will only be made for areas that have reached the required thickness, compaction, and permeability requirements and approved by the ENGINEER.

Item 12 – Geosynthetic Clay Liner (GCL)

1. Measurement: The quantity of Geosynthetic Clay Liner (GCL) which will be paid for under this item will be the actual number of square yards as measured in the two-dimensional plan view and excluding the anchor trench of installed Geosynthetic Clay Liner (GCL) measured in place.

2. Payment: The unit price bid per square yard for this item will be full compensation for all labor, materials, tools, equipment, certification of surveying, testing equipment, supervision, and incidentals (including anchor trench) required to install the Geosynthetic Clay Liner (GCL) as shown on the Drawings and specified herein.

Item 13 – 60-mil Textured HDPE Liner

1. Measurement: The quantity of 60-mil Textured HDPE Liner which will be paid for under this item will be the actual number of square yards as measured in the two-dimensional plan view and excluding the anchor trench of installed 60 mil Textured HDPE Liner measured in place.

2. Payment: The unit price bid per square yard for this item will be full compensation for all labor, materials, tools, equipment, quality control, surveying, testing equipment, cleaning the tie-in area to existing and performing the tie-in with the existing liner, supervision, and incidentals (including anchor trench) required to furnish approved materials and install the 60 mil Textured HDPE Liner as shown on the Drawings and

specified herein.

Items 14 – Geocomposite Drainage Net (GDN)

1. Measurement: The quantity of Geocomposite Drainage Net which will be paid for under this item will be the number of square yards as measured in the two-dimensional plan view and excluding the anchor trench of Geocomposite Drainage Net measured in place.

2. The unit price bid per square yard for this item will be full compensation for all labor, materials, tools, equipment, cleaning the tie-in area to existing and performing the tie-in with the existing GDN, quality control, surveying, testing equipment, supervision, and incidentals (including anchor trench) required to furnish approved materials and install the Geocomposite Drainage Net (GDN) as shown on the Drawings and specified herein.

Item 15 – 24-inch Thick Protective Cover Soil Layer

1. Measurement: The quantity for the Protective Cover Layer which will be paid for under this item will be the number of square yards of Protective Cover Layer measured in place by computing the two-dimensional plan area of the limits of the Protective Cover Layer installed.

2. Payment: The unit price bid per square yard for this item will be full compensation to furnish and install the Protective Cover Layer as shown on the Drawings and specified herein including, but not limited to, borrow excavation and restoration, hauling, placement and compaction, testing, cleaning the tie-in area to existing and tie-in with existing protective cover, protection of stockpiled and installed material. Payment will only be made for areas which have reached the required minimum thickness, gradation, permeability requirements, and approved by the ENGINEER.

Items 16 – LCS - 8" Diam. HDPE Pipe Collection Line

1. Measurement: The quantity of LCS - 8" Diam. HDPE Pipe Collection Line to be paid for under these items will be the actual number of linear feet of pipe in place measured horizontally along the centerline of the installed pipes.

2. Payment: The unit price bids per linear foot for this items will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required for furnishing and installing the designated pipe as shown on the Drawings and specified herein, including but not limited to furnishing and installing all pipe, fittings, flanges, bolts, tee sections, pipe supports, crosses, wye laterals, couplings, #57 stone, #789 stone, C-33 sand, 28 oz. non-woven fabric cushion, minimum 40-mil thick HDPE flap,

trench excavation and backfilling, cleaning, testing, certifying surveying, and all other appurtenances

Item 17 – LCS - 8" Diam. Pipe Tie-ins (new to existing)

1. Measurement: The quantity of LCS - 8" Diam. Pipe Tie-ins (new to existing) which will be paid for under these items will be the actual number of Pipe Tie-ins constructed.

2. Payment: The unit price per each for this item will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required for furnishing and constructing the tie-ins to existing pipes shown on the Drawings and specified herein, including but not limited to furnishing and installing all pipe and materials, fusion-welding equipment, excavation and backfilling, cleaning, testing, surveying, and all other appurtenances.

Items 18 – LCS - HDPE Sideriser Piping System

1. Measurement: The quantity of LCS - HDPE Sloperiser Piping System which will be paid for under this item will be the number of LCS - HDPE Sloperiser Piping Systems installed to the completion and approval of the ENGINEER.

2. Payment: The unit price per linear foot for this item will be full compensation for all labor, materials, tools, equipment, supervision, and incidentals required to complete the installation of the LCS - HDPE Sloperiser Piping System as shown on the Drawings and specified herein including, but not limited to, furnishing and installing 24-inch HDPE pipe; fittings; bolted HDPE flange, coupling, cleaning; testing; and all other work required for or incidental to the satisfactory completion of all Work under this contract for which payment is not provided under other items in the bid form.

Item 19 – LCS - Leachate Pump System Valve Box and Components

1. The lump sum price for LCS - Leachate Pump System Valve Box and Components shall be full compensation for all labor, materials, tools, equipment, supervision and incidentals required for furnishing and installing the LCS - Leachate Pump System Valve Box and Components as shown in the Drawings and specified herein, including but not limited to, HDPE valve box (flowmeter, pressure gauge, flanges, couplings, gate and check valves, tees, pipe support, bends, 4” diameter HDPE pipe, connections to force main, excavation and backfill, and any other work not specifically included for payment under any other item but obviously necessary to complete the Contract.

Item 20 – 4" Diameter HDPE Force Main

1. Measurement: The quantity of 4" Diameter HDPE Force Main to be paid under these items will be the actual number of linear feet of force main pipe installed as measured horizontally along the centerline of the installed pipe.

2. Payment: The unit price per linear foot for these items will be full compensation for furnishing all labor, materials, tools, equipment, supervision and incidentals required for installing the force main as shown on the Drawings and specified herein, including but not limited to furnishing and installing approved pipe, fittings, caps, plugs, connections to existing pipelines, connections to valve vault assembly, flex restraints/thrust anchors as specified, trench excavation and backfilling, miscellaneous appurtenances, bedding material, as-built alignment marking devices, surveying, cleaning, and testing.

Item 21 – Geomembrane Leak Location Survey

1. The lump sum price bid for this item will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required to provide the Geomembrane Leak Location Survey of all lined areas by the appropriate method, to be performed after completion and approval of the protective cover layer installation. Work associated with the Geomembrane Leak Location Survey includes, but is not limited to, site preparation, perimeter trenching, planning and sequencing of work to enable successful leak location surveying, scheduling, testing, and reporting for which payment is not provided under other items in the bid form. **Payment in full for this item is conditioned upon submittal and acceptance of an administratively complete and successful Geomembrane Leak Location Survey Report**.

Item 22 – Electrical Conduit

1. Measurement: The quantity of Electrical Conduit to be paid under these items will be the actual number of linear feet of conduit installed as measured horizontally along the centerline of the installed pipe.

2. Payment: The unit price per linear foot for these items will be full compensation for furnishing all labor, materials, tools, equipment, supervision and incidentals required for installing the electrical conduit as shown on the Drawings and specified herein, including but not limited to furnishing and installing conduit pipe, fittings, caps, plugs, connections, trench excavation and backfilling, miscellaneous appurtenances, bedding material, as-built alignment marking devices, surveying and cleaning.

Item 23 – 18" Thick Compacted ABC w/8 oz Geotextile

1. Measurement: The quantity of 18" Thick Compacted ABC w/8 oz Geotextile to be paid for under this item will be the actual number of square yards of 18-inch thick SCDOT GABC stone road paving installed as shown on the Drawings and at the direction of the ENGINEER. The payment area shall be as determined by the limits of Road Paving Survey required by Section 01050.

2. Payment: The unit price per square yard shall be full compensation for all labor, materials, tools, equipment, supervision and incidentals required for furnishing and installing the 18” compacted ABC stone road including sub-base preparation, furnishing and installing 8-oz. geotextile, 18-inch ABC stone section placement, compaction, quality control and testing, surveying and incidentals as shown on the Drawings and specified herein.

Item 24 – 12" Thick Compacted ABC w/8 oz Geotextile

1. Measurement: The quantity of 12" Thick Compacted ABC w/8 oz Geotextile to be paid for under this item will be the actual number of square yards of 12-inch thick SCDOT GABC stone road paving installed as shown on the Drawings and at the direction of the ENGINEER. The payment area shall be as determined by the limits of Road Paving Survey required by Section 01050.

2. Payment: The unit price per square yard shall be full compensation for all labor, materials, tools, equipment, supervision and incidentals required for furnishing and installing the 12” compacted ABC stone road including sub-base preparation, furnishing and installing 8-oz. geotextile, 12-inch ABC stone section placement, compaction, quality control and testing, surveying and incidentals as shown on the Drawings and specified herein.

Item 25 - Precast Drop Inlet – Pre-cast Structure

1. Measurement: The unit price bid for each Precast Drop Inlet – Pre-cast Structure to be paid for under this item will be the actual number of Precast Drop Inlet – Pre-cast Structure installed as shown on the Drawings to facilitate onsite borrow activities and accepted by the ENGINEER.

2. The unit price for the Precast Drop Inlet – Pre-cast Structure shall be full compensation for all labor, materials, tools, equipment, supervision, and incidentals required to furnish and install the Precast Drop Inlet – Pre-cast Structure as shown in the Drawings and specified herein, including but not limited to, excavation, geotextile, bedding material, maintenance, and other appurtenances for which payment is not provided under other items

in the bid form.

Items 26 – Drop Inlet - 36" Diam. RCP w/End Treatments

1. Measurement: The quantity of Drop Inlet - 36" Diam. RCP w/End Treatments to be paid under this item will be the actual number of linear feet of 36-Inch Diameter RCP pipe installed as measured horizontally along the centerline of the installed pipe.

2. Payment: The unit price per linear foot for this item will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required for furnishing and installing the 36-Inch Diameter RCP pipe as shown on the drawings and specified herein, including, but not limited to, furnishing and installing pipe, flared end sections (FES), fittings, gaskets and all other appurtenances.

Items 27 – Drop Inlet - Energy Dissipaters

1. Measurement: The quantity of Drop Inlet - Energy Dissipaters which will be paid for under this item will be the actual number of Energy Dissipaters installed and accepted by the ENGINEER.

2. Payment: The unit price bid for this item will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required to furnish and install stone and filter fabric as shown on the drawings and specified herein for which payment is not provided under other items in the bid form.

Items 28 – 24" Diameter RCP Culvert w/End Treatments & Dissipaters

1. Measurement: The quantity of Drop Inlet - 24" Diameter RCP w/End Treatments and energy dissipaters to be paid under this item will be the actual number of linear feet of 24” Diameter RCP pipe installed as measured horizontally along the centerline of the installed pipe.

2. Payment: The unit price per linear foot for this item will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required for furnishing and installing the 24” Diameter RCP pipe as shown on the drawings and specified herein, including, but not limited to, furnishing and installing pipe, flared end sections (FES), fittings, gaskets and all other appurtenances.

Item 29 – 6" Thick Unimat Fabric Formed Concrete Mat

1. Measurement: The quantity of 6" Thick Unimat Fabric Formed Concrete Mat which will be paid for under this Item will be the actual number of square yards as measured in the two-dimensional plan view and

excluding the anchor trench of Fabric-Formed Concrete Mat measured in place.

2. Payment: The unit price bid per square yard for this item will be full compensation for all labor, materials, tools, equipment, certification of surveying, testing equipment, supervision, and incidentals (including anchor trench) required to furnish approved materials and construct the Fabric-Formed Concrete as shown on the Drawings and specified herein.

Items 30 – Landfill Cell Access Ramp w/24" RCP

1. Measurement: The quantity of Landfill Cell Access Ramp w/24" RCP to be paid for under this time will be the actual number of complete landfill access ramps installed as shown on the Drawings and accepted by the ENGINEER.

2. Payment: The unit price for the Landfill Cell Access Ramp w/24" RCP shall be full compensation for all labor, materials, tools, equipment, supervision, and incidentals required to furnish and install the access ramp with 24-Inch RCP as shown in the Drawings and specified herein, including but not limited to, excavation and backfill, pipe, aggregate, geotextile and other appurtenances.

Item 31 – Edge of Liner Markers

1. Measurement: The unit price bid for each of the Edge of Liner Markers to be paid for under this item will be the actual number of complete Edge of Liner Markers installed at a maximum of 100-feet horizontal spacing and at all change in directions at the direction of the ENGINEER. Markers posts shall be Reinforced Composite Dual Sided Marker (CIB30) as manufactured by Carsonite, or ENGINEER approved equivalent.

2. The unit price for the Edge of Closure Markers shall be full compensation for all labor, materials, tools, equipment, supervision, and incidentals required to fabricate, furnish and install the Edge of Liner Markers as shown in the Drawings and specified herein, including but not limited to the dual-sided marker, decals, decal layout, surveying, marker installation and other appurtenances for which payment is not provided under other items in the bid form. *The unit price shall include supply (only) of four (4) additional decaled markers*.

Item 32 – Seeding and Mulching

1. Measurement: The quantity of Seeding and Mulching which will be paid for under this item will be the actual number of acres Seeded and Mulched as measured in place by computing the two-dimensional plan area of the limits of the Seeding and Mulching performed.

2. Payment: The unit price bid for this item will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required to complete the seeding and mulching work for disturbed areas as shown on the Drawings and specified herein, and the establishment of a sufficient growth of grass as examined and accepted by the ENGINEER.

Items 33 – Guardrail – Remove, Relocate and Reinstall

1. Measurement: The quantity of Guardrail – Remove, Relocate and Reinstall which will be paid for under this item will be the number of linear feet as measured and accepted by the ENGINEER.

2. Payment: The unit price bid for this item will be full compensation for all labor, materials, tools, equipment, supervision, and incidentals to remove and reinstall the guardrail as shown on the Drawings.

Item 34 – Strip & Fine Grade Existing Cover (CL2 Landfill Area)

1. Measurement: The quantity of Strip & Fine Grade Existing Cover (CL2 Landfill Area) which will be paid for under this item will be the actual number of square yards, as measured in the two- dimensional plan view, stripped and fine-graded within the construction limits as measured by the survey of the limits of stripping.

2. Payment: The unit prices bid for this item will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required to perform all work required to remove existing vegetation within the construction limits. Stripped material shall be placed in the existing yard waste stockpile on site or as otherwise directed by the ENGINEER.

Item 35 –Structural Fill Placement (CL2 Landfill Area)

1. Measurement: The quantity of Structural Fill Placement which will be paid for under this item will be the actual number of cubic yards of structural fill constructed as measured by comparing the topographic survey performed after stripping and fine-grading and prior to backfill, to the topographic survey performed upon the completion of structural fill, as required in Section 01050.

2. Payment: The unit price per cubic yard for this item will be full compensation for placing structural fill to the design Subgrade Plan as shown on the Drawings and specified herein including but not limited to borrow source excavation, hauling, and backfilling; compaction, quality control and surveying; drainage and dewatering; sheeting and bracing; care and protection of existing utilities and structures; site restoration; conformance to all federal, state, and county Standards and requirements; and all other work required or incidental to the satisfactory

completion of all Work under this contract for which payment is not provided under other items in the bid form. No Final Payment will be made for any structural fill for which certifying surveys required by Section 01050 have not been submitted and approved by the ENGINEER.

Item 36 – 24-inch Cover Soil (CL2 Landfill)

1. Measurement: The quantity of 24" Soil Cover which will be paid for under this item will be the number of square yards of 24" thick Soil Cover installed over the accepted fine-graded subgrade measured in place by computing the volume from the survey as required in Section 01050.

2. Payment: The unit prices bid per square yard for this item will be full compensation to complete the installation of 24" soil cover as specified herein, including, but not limited to, surveying and quality control, borrow excavation, hauling, placement and compaction, and protection of installed material. No Final Payment will be made for any 24" soil cover for which certifying surveys required by Section 01050 have not been submitted and approved by the ENGINEER

Item 37 – Erosion Control Matting (CL2 Landfill)

1. Measurement: The quantity of Erosion Control Matting (CL2 Landfill) which will be paid for under this item will be the actual number of square yards of Erosion Control Matting as measured in the two-dimensional plan view installed.

2. Payment: The unit price bid for this item will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required to furnish and install the Erosion Control Matting as shown on the drawings and specified herein for which payment is not provided under other items in the bid form.

Item 38 – Seeding and Mulching (CL2 Landfill)

1. Measurement: The quantity of Seeding and Mulching (CL2 Landfill) which will be paid for under this item will be the actual number of acres of Seeding and Mulching as measured in place by computing the two-dimensional plan area of the limits of the Seeded and Mulched performed.

2. Payment: The unit price bid for this item will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required to complete the installation of the seeding and mulching work for disturbed areas as shown on the Drawings and specified herein, and the establishment of a sufficient growth of grass as examined and approved by the ENGINEER.

Item 39 – Miscellaneous Work and Clean-up

1. The lump sum price for this item shall be full compensation for all labor, materials, and equipment required to perform the work specified in Section 02901 of the Specifications and as shown on the Drawings, and any other work not specifically included for payment under any other item but obviously necessary to complete the Contract.

Item 40 – 8 oz Geotextile at Wetland Crossing

1. Measurement: The quantity of 8 oz Geotextile to be paid for under this item will be the actual number of square yards of 8 oz geotextile installed as shown on the Drawings and at the direction of the ENGINEER. The payment area shall be as determined by the limits of a Survey required by Section 01050.

2. Payment: The unit price per square yard shall be full compensation for all labor, materials, tools, equipment, supervision and incidentals required for furnishing and installing the 8-oz. geotextile, quality control and testing, surveying and incidentals as shown on the Drawings and specified herein.

Items 41 – 36" Diam. RCP at Wetland Crossing

1. Measurement: The quantity of 36" Diam. RCP to be paid under this item will be the actual number of linear feet of 36-Inch Diameter RCP pipe installed as measured horizontally along the centerline of the installed pipe.

2. Payment: The unit price per linear foot for this item will be full compensation for all labor, materials, tools, equipment, supervision and incidentals required for furnishing and installing the 36-Inch Diameter RCP pipe as shown on the drawings and specified herein, including, but not limited to, furnishing and installing pipe, fittings, gaskets and all other appurtenances.

Item 42 – Structural Fill at Wetland Crossing

1. Measurement: The quantity of Structural Fill Placement which will be paid for under this item will be the actual number of cubic yards of structural fill constructed as measured by comparing the topographic survey performed after the clearing and grubbing and prior to backfill, to the topographic survey performed upon the completion of structural fill, as required in Section 01050.

2. Payment: The unit price per cubic yard for this item will be full compensation for placing structural fill to the design Subgrade Plan as shown on the Drawings and specified herein including but not limited to

borrow source excavation, hauling, and backfilling; compaction, quality control and surveying; drainage and dewatering; sheeting and bracing; test pits to verify location and depth of existing buried utilities and other facilities; care and protection of existing utilities and structures; site restoration; conformance to all federal, state, and county Standards and requirements; and all other work required or incidental to the satisfactory completion of all Work under this contract for which payment is not provided under other items in the bid form. No Final Payment will be made for any backfill for which certifying surveys required by Section 01050 have not been submitted and approved by the ENGINEER.

Item 43 – 18" Thick Compacted ABC w/8 oz Geotextile at Wetland Crossing

1. Measurement: The quantity of 18" Thick Compacted ABC w/8 oz Geotextile to be paid for under this item will be the actual number of square yards of 12-inch thick SCDOT GABC stone road paving installed as shown on the Drawings and at the direction of the ENGINEER. The payment area shall be as determined by the limits of Road Paving Survey required by Section 01050.

2. Payment: The unit price per square yard shall be full compensation for all labor, materials, tools, equipment, supervision and incidentals required for furnishing and installing the 12” compacted ABC stone road including sub-base preparation, furnishing and installing 8-oz. geotextile, 12-inch ABC stone section placement, compaction, quality control and testing, surveying and incidentals as shown on the Drawings and specified herein.

1.03 Alternate Bid Item

Item A-1 – Delete Items 11 and 12 and Replace with: 24" Thick Low-Perm Clay Liner ($1x10^{-7}$ cm/sec)

1. Measurement: The quantity for the 24" Low-Perm Clay Liner ($1x10^{-7}$ cm/sec) which will be paid for under this item will be the actual number of square yards of the 24" Low-Perm Clay Liner ($1x10^{-7}$ cm/sec) measured in place by computing the two-dimensional plan area of the limits of the Compacted Soil Liner survey as required in Section 01050.

2. Payment: The unit price bid per square yard for this item will be full compensation for all labor, materials, tools, equipment, approved water source, quality control, surveying, supervision and incidentals (including anchor trench) required to complete the installation of the 24" Low-Perm Clay Liner ($1x10^{-7}$ cm/sec) as shown on the Drawings and specified herein, including, but not limited to, excavation and restoration, hauling, mixing, placement and compaction, testing, tie-in with existing soil liner system, and protection of stockpiled and installed material. Payment will

only be made for areas that have reached the required thickness, compaction, and permeability requirements and approved by the ENGINEER.

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END OF SECTION

SECTION 02290

FINAL COVER

PART 1: GENERAL

1.01 SCOPE OF WORK

A Furnish all labor, materials, equipment and incidentals required to install the Final Cover of 24-inch minimum thickness as shown on the Drawings and as specified herein. Associated work includes quality control testing, borrow source excavation, hauling, placement, compaction, and grading of Final Cover and surveying.

1.02 RELATED WORK

A. Section 01050: Field Engineering

B. Section 01340: Shop Drawings, Product Data, Working Drawings, and Samples

C. Section 01040: CQA Plan

D. Section 02200: Excavation, Backfill, and Compaction

E. Section 02985: Stabilization

1.03 SUBMITTALS

A Identification of the Final Cover soil source.

B A signed certification letter, with copies of all applicable permits, stating that the source of the proposed material is in full compliance with State, County, and local laws and regulations.

C The CONTRACTOR shall furnish a representative sample of proposed Final Cover soil weighing approximately 75 pounds to the CQA ENGINEER for approval at least 14 calendar days prior to the date of anticipated use of such material.

1.04 REFERENCE STANDARDS

A ASTM - American Society for Testing and Materials:

1. ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils.

2. ASTM D698 - Standard Test Method for Moisture-Density Relations of Soil and Soil Aggregate Mixtures Using 5.5-lb (2.49 kg) Hammer and 12-in (305 mm) Drop.

3. ASTM D854 - Standard Test Method for Specific Gravity of Soils.

4. ASTM D1140 - Standard Test Method for Amount of Material in Soils Finer Than the Number 200 (75 micrometer) Sieve.

5. ASTM D1556 - Standard Test Methods for Density and Unit Weight of Soil In Place by Sand-Cone Method.

6 . ASTM D2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.

7. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes.

8. ASTM D2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedures).

9. ASTM D2922 - Density of Soil in Place by Nuclear Methods (Shallow Depth).

10. ASTM D3017 - Standard Test Method for Water Content of Soil in Place by Nuclear Methods (Shallow Depth).

11. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

12. ASTM D5268 - Standard Specifications for Topsoil Used for Landscaping Purposes

13. ASTM D2974 - Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

B Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A Quality Assurance shall consist of laboratory conformance testing of samples supplied from each soil source, quality control and quality assurance sampling and testing of the placed Final Cover.

B Conformance testing requirements are specified in Paragraph 1.07; quality control testing requirements area specified in paragraph 3.02.

1.06 PROTECTION

A The CONTRACTOR is solely responsible for protection of the work. Completed work that is damaged by weather or other means shall be repaired by the CONTRACTOR at no additional cost to the OWNER.

1.07 SOIL TESTING

A Prior to the placement of the Final Cover and during such placement, the CQA ENGINEER shall select areas within the limits of the work for testing. The CONTRACTOR shall cooperate fully in obtaining the information desired.

B The CONTRACTOR'S CQC OFFICER shall perform the following laboratory soil testing in accordance with the standards listed in paragraph 1.04.

1. Perform particle size distribution test (ASTM D422), Atterberg limits (ASTM D4318), and Standard Proctor compaction test (5 point curve, ASTM D 698) for each soil type proposed for use as Final Cover soil and for every 10,000 cubic yards (or change in material) of Final Cover material installed.

2. Organic Content (loss on ignition, ASTM D2974) tests shall be performed for soil to be used in the top 6 inches at a frequency of 1 test per 4,000 cubic yards.

C FINAL COVER SOIL ANALYSIS**:** CONTRACTOR shall furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil. The Soil Analysis report shall discuss the suitability of Final Cover for lawn growth, and state recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory growth layer.

1.08 DELIVERY, STORAGE AND HANDLING

A Stockpiled materials shall be located at designated areas within the limits of construction. At the end of each day, the material shall be sloped, tracked and secured to minimize erosional impact on the stockpile. Removal of stockpile material shall be done in a manner to minimize intrusion of soils adjacent to and beneath the stockpile. Stockpiles shall be temporarily seeded per the erosion and sedimentation plan notes.

PART 2: PRODUCTS

2.01 MATERIALS

A Materials for use as Final Cover soils shall be as described below. The CONTRACTOR shall notify the ENGINEER of the source of each material.

B The soil used to construct the Final Cover shall be capable of maintaining vegetation and conform to the following criteria:

1. 100% passing the 3-inch sieve
2. Minimum 80% passing #4 sieve
3. Minimum 15% passing # 200 sieve
4. Organic content of at least 4% (top 6-inch lift only)
5. Maximum Liquid Limit is 50%
6. Maximum Plasticity Index is 25%
7. pH range: 5.5 to 7
8. Free of extraneous materials harmful to plant growth

2.02 SOIL AMENDMENTS

A. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 (2.36 mm) sieve and a minimum 75 percent passing a No. 60 (250 micrometer) sieve. Provide lime in the form of dolomitic limestone.

B. Aluminum Sulfate: Commercial grade, unadulterated.

C. Sand: Clean, washed, natural or manufactured sand, free of toxic materials.

D. Perlite: Horticultural perlite, soil amendment grade.

E. Peat Humus: Finely divided or granular texture, with a pH range of 6 to 7.5, composed of partially decomposed moss peat (other than sphagnum), peat humus, or reed-sedge peat.

F. Sawdust or Ground-Bark Humus: Decomposed, nitrogen-treated, of uniform texture, free of chips, stones, sticks, soil, or toxic materials. When site treated, mix with at least 0.15 lb of ammonium nitrate or 0.25 lb of ammonium sulfate per cu. ft. of loose sawdust or ground bark.

G. Manure: Well-rotted, unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

H. Herbicides: EPA registered and approved, of type recommended by manufacturer.

I. Water shall be obtained from an ENGINEER approved source only

PART 3: EXECUTION

3.01 FINAL COVER PLACEMENT

A. Prior to placement of the Final Cover, the exposed intermediate cover soil layer shall be stripped of organics and fine graded. Vegetative strippings from the intermediate cover soil layer are anticipated to include trace comingled waste scraps and shall not be re-used in the Final Cover layer. Strippings from the intermediate cover soil layer shall be stockpiled at a location approved by the ENGINEER.

B. Placement of the Final Cover shall not be started until all required testing and surveying of the intermediate cover soil layer is completed and accepted

C Placement of the Final Cover shall be performed in manner that prevents damage to the underlying soil cover layer. Rutting, desiccation, or other damage to the soil cover resulting from Final Cover installation shall be repaired to the satisfaction of the CQA ENGINEER at no additional cost to the OWNER.

D Soil for Final Cover shall be placed and compacted in lifts. The maximum loose lift thickness shall be 8-inches. Soil for the Final Cover shall be compacted to at least 92% of its maximum dry density as determined by ASTM D698. The CONTRACTOR may install the Final Cover in thicker lift(s) provided an adequate demonstration, as determined by the OWNER, is provided by the CONTRACTOR's CQC Firm demonstrating that adequate compaction is achieved throughout the entire lift thickness.

E The surfaces of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the grading plan and no soft spots or uncompacted areas will be allowed in the work.

F No compacting shall be done when the material is too wet either from precipitation, surface water runoff, or from excess application of water. At such times, work shall be suspended until the previously placed and new materials have dried sufficiently to permit proper compaction.

G The CONTRACTOR shall utilize water as required to guarantee constructability and protection of the in-place and stored soil. Water used in construction shall be of suitable quality from an approved source only.

H During construction, the CONTRACTOR shall make all necessary provisions to deal with inclement weather conditions. The CONTRACTOR shall be fully responsible for control of stormwater during installation of the Final Cover.

I No material shall be placed, spread, or compacted while the ground or the soil material is frozen/thawing, saturated, desiccated, during unfavorable weather conditions or periods of precipitation. The Final Cover surfaces must be made smooth and free from ruts or indentations at the end of any working day when significant precipitation is forecast and/or at the completion of the compaction operations in that area in order to prevent saturation of the material. Any re-grading due to the above conditions or final preparation shall require retesting at those locations for thickness and density and shall be at the cost of the CONTRACTOR.

J Prior to seeding and mulching the CONTRACTOR shall scarify the finished surface of the Final Cover to a depth of 3 inches. The surface shall be mechanically or hand raked to remove any loose roots or rocks.

3.02 FIELD QUALITY CONTROL AND QUALITY ASSURANCE

A. CQA Plan: Inspection and testing will be a joint effort between the CONTRACTOR's CQC Firm and the OWNER's CQA Firm.

B. Coordination: CONTRACTOR shall be responsible for coordination of field services with the CONTRACTOR's CQC' Firm and with the OWNER's CQA Firm.

C. Initial Observation: Final Cover layer placement operations shall be performed after the surface has been properly prepared and has been observed and approved by CQA OFFICER. No Final Cover layer materials shall be placed unless the CQA OFFICER approves the operation. Any fills placed without CQA OFFICER's observation and prior approval shall be removed in a manner to avoid damage or disturbance to the existing approved work, and the excavation shall be filled as specified herein, at no additional cost to OWNER.

D. Field Quality Control**:** The minimum testing frequencies for field tests to be performed are provided in the following table

TEST METHOD	METHOD	FREQUECY	
		CQC	CQA
Density[1]	ASTM D2937 ASTM D2922 ASTM D1556	2/acre/lift	*discretionary*
Moisture Content[1]	ASTM D2216 ASTM D3017 ASTM D1556	2/acre/lift @ density test location	*discretionary*

Note[1]: A nuclear density test gauge can be used to provide the required density testing. However, the in-situ density shall be determined using the sand

cone method (ASTM D 1556) and/or the drive cylinder method (ASTM D 2937) of a minimum of one test per ten nuclear density tests or one per day, whichever is greater. The sand cone and/or drive cylinder test should be performed at the same location as a nuclear density test. The sand cone and/or drive cylinder tests shall be continued until a correlation between the density and moisture contents obtained by the nuclear density gauge and the sand cone and/or drive cylinder tests has been demonstrated.

E One-point compaction tests shall be performed to interpolate between laboratory compaction (ASTM D 698) curves for at least every 5 in-place density tests. The one-point compaction tests shall be performed on either the field density test sample or soil from a location immediately adjacent to the field density test sample, using the ASTM D 698 procedure. The results of the one-point tests shall then be compared with the full compaction curves of similar soils to estimate the maximum dry density applicable to the field density test sample.

F. The CONTRACTOR's CQC Officer shall provide a final Construction Quality Control Report for the Final Cover at the end of the project. The report shall certify that Work, as associated with Final Cover was performed in accordance with the Contract Documents and shall be prepared and sealed by a Professional Engineer registered in the State of South Carolina. The report shall include a narrative describing construction methods and QC procedures employed, summary tables of all laboratory and field test results, including location and notations regarding any re-work performed, identification of failed tests, and discussions and documentation of re-worked areas with passing tests, as appropriate.

G. The CONTRACTOR shall submit a survey plan with final elevation of top of Final Cover Layer for CQA Officer's approval in accordance with Section 01050.

H. Submittal and acceptance of an administratively complete Construction Quality Control Report and Certification Survey of the completed Final cover shall be required for the Work to be considered Complete.

3.03 DISPOSAL OF SURPLUS MATERIAL

A No excavated materials shall be removed from the site of the work or disposed of by the CONTRACTOR except as specified by the ENGINEER. Materials shall be neatly stockpiled on-site at locations directed by the ENGINEER until used or otherwise disposed of as specified below.

B Surplus Final Cover soil shall become the property of the OWNER if desired and accepted; surplus material shall be stockpiled and stabilized with vegetation as directed by the ENGINEER at no expense of the OWNER.

3.12 GRADING

A Grading shall be performed at all places that are indicated on the Drawings, to the lines, grades and elevations shown and otherwise as directed by the ENGINEER. During the process of grading, the subgrade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the performance or condition of the work.

B If at the time of grading it is not possible to pace material in its final location, it shall be stockpiled for later use in areas approved by the ENGINEER. Stockpiled material shall be smooth rolled at the end of each day to promote runoff of stormwater. No extra payment will be made for the stockpiling or double handling of excavated material.

C The ENGINEER reserves the right to make minor adjustments or revisions in lines or grades if found necessary as the work progresses, in order to obtain satisfactory construction.

D Upon successful installation of the Final Cover to include all required surveys and QC/QA requirements, the Final Cover shall be stabilized with seeding and mulching per the requirements herein and Section 02985 – Stabilization. Stabilization of the Final Cover using sod is not allowed.

END OF SECTION

SECTION 02623

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1: GENERAL

1.01 SCOPE OF WORK

A Furnish all labor, materials, equipment and incidentals required and install high density polyethylene leachate pipe, fittings and appurtenances as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A Section 02777: Linear Low Density Polyethylene (LLDPE) Liner

B Section 02200: Excavation, Backfill, and Compaction

1.03 SUBMITTALS

A Within 30 days following the Effective Date of the Agreement, submit the following information in accordance with Section 01340:

1. List of materials to be furnished, the names of the suppliers and the scheduled date of delivery of materials to the site.

2. The origin of the resin to be used in the manufacturing of the pipe including the suppliers name and production plant, as well as brand name and number.

3. Documentation from the resin's manufacturer showing results of tests for resin identification, including:

   a. Melt Flow Index ASTM D1238

   b. Density ASTM D1505

4. Manufacturer quality control manual describing implementation of quality control procedures during pipe manufacturing process.

5. Pipe Manufacturer's Certification of compliance with these Specifications.

6. Complete, detailed shop drawings of all polyethylene pipe and appurtenances, including the location of all fittings, joints and connections to structures.

7. Manufacturer's recommendations for handling, storing and installing pipe and fittings.

8. For each shipment of pipe a manufacturer's certification that the pipe was manufactured from the same resin identified in Paragraph 1.03.A1.

9. Certification demonstrating that the joining technician was trained by the pipe manufacturer and is qualified to perform heat fusion welding.

1.04 REFERENCE STANDARDS

A American Society for Testing and Materials (ASTM)

1. ASTM D1238 - Standard Test Method for Flow Rates Thermoplastics by Extrusion Plastometer.

2. ASTM D1248 - Standard Specification for Polyethylene Plastic Molding and Extrusion Materials.

3. ASTM D1505 - Standard Test Method for Density of Plastic by the Density Gradient Technique.

4. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

5. ASTM D3350 - Specification for Polyethylene Plastic Pipe and Fitting Materials.

6. ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

B Where reference is made to one of the above standards, the revision in effect at the time of construction shall apply.

1.05 QUALITY ASSURANCE

A Resin Evaluation

1. All incoming resin shall be sampled for conformance testing against test results supplied by the resin manufacturer. Samples shall be taken from the top and bottom of each compartment from every hopper car

received. The following conformance tests shall be performed on the sample:

a. Melt Flow Index ASTM D1238

b. Density ASTM D1505

The results of these tests shall become part of the manufacturer's permanent quality control records.

B Finished Product Evaluation

1. Each length of pipe produced shall be checked by production staff for the items listed below. The results of all measurements shall be recorded on production sheets which become part of the manufacturer's permanent records.

a. Pipe in process shall be checked visually, inside and out for cosmetic defects (grooves, pits, hollows, etc).

b. Pipe outside diameter shall be measured using a suitable periphery tape to ensure conformance with ASTM F714.

c. Pipe wall thickness shall be measured at 12 equally spaced locations around the circumference at both ends of the pipe to ensure conformance with ASTM F714.

d. Pipe length shall be measured.

e. Pipe marking shall be examined and checked for accuracy.

f. Pipe ends shall be checked to ensure they are cut square and clean.

g. Subject inside surface to a "reverse bend test" to ensure the pipe is free of oxidation (brittleness).

C Stress Regression Testing

1. The polyethylene pipe manufacturer shall provide certification that stress regression testing has been performed on the specific polyethylene resin being utilized in the manufacture of this product. This stress regression testing shall have been done in accordance with ASTM D2837 and the manufacturer shall provide a product supplying a

minimum Hydrostatic Design Basis (HDB) of 1,600 psi as determined in accordance with ASTM D2837.

1.06 WARRANTY

A The pipe material manufacturer shall provide an unconditional extended warranty for the pipe covering the cost of materials for repair or replacement plus installation manpower should the pipe fail within the warranty period. The manufacturer's extended warranty shall be for ten years after the final acceptance of the project by the OWNER. The manufacturer shall guarantee that the pipe furnished is suitable for the purpose intended and free from defects of material and workmanship for the duration of the extended warranty. In the event the pipe fails to perform as specified, the pipe manufacturer shall promptly replace defective pipe without any cost to the OWNER.

PART 2: PRODUCT

2.01 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

A The pipe supplied shall be high density, high molecular weight, polyethylene (HDPE) pipe. The pipe shall conform to ASTM D3350 with a minimum cell classification value of 345434C.

B All fittings shall be made from polyethylene resin which meets this same specification as in 2.01A.

C HDPE pipe shall be of size as identified on the Drawings and Standard Dimension Ratio (SDR) 17.0

D All polyethylene pipes shall meet the requirements of ASTM F714.

E Pipe shall be furnished in standard laying lengths not exceeding 50 feet.

2.02 PIPE IDENTIFICATION

A The following shall be continuously printed on the pipe or spaced at intervals not exceeding 5-ft:

1. Name and/or trademark of the pipe manufacturer.

2. Nominal pipe size.

3. Dimension ratio.

4. The letters PE followed by the polyethylene grade in accordance with ASTM D1248, followed by the hydrostatic design basis in 100's of psi, e.g., PE 3408, PE 4710.

5. Manufacturing standard reference, e.g., ASTM F714.

6. A production code from which the date and place of manufacture can be determined.

2.03 PERFORATIONS

A PERFORATED PIPE: locations for perforated pipe, perforation sizes and hole patterns are detailed in the Contract Drawings.

B For accuracy and uniformity, the pipe shall be drilled to design specifications by machines designed for perforating pipe.

PART 3: EXECUTION

3.01 INSTALLATION

A High Density Polyethylene (HDPE) Pipe shall be installed in accordance with the instruction of the manufacturer, as shown on the Drawings and as specified herein. All heat fusion joints shall be done by a qualified joining technician as designated by the pipe manufacturer.

B Pipe shall be laid to lines and grade shown on the Drawings with bedding and backfill as shown on the Drawings.

C PERFORATED PIPE: Tape covering perforations shall be removed during installation. The pipe shall be installed such that perforations face the bottom of trench. The perforations of pipe sections shall be aligned when connected. The pipe shall be joined by butt fusion or by a method of coupling as approved by the ENGINEER.

D When installation is not in progress, including breaks in work, the open ends of the pipe shall be closed by fabricated plugs, or by other approved means.

E HANDLING OF PIPE: Pipe shall be stored on clean level ground to prevent undue scratching or gouging. The handling of the pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp or rough objects and/or areas. The maximum allowable depth of cuts, scratches or gouges on the exterior of the pipe is 10 percent of wall thickness. The interior pipe surface shall be free of cuts, gouges or scratches.

F REPAIR OF PIPE: Sections of pipe with cuts, scratches or gouges deeper than allowed shall be removed completely and the undamaged sections of the pipe re-joined.

G JOINING: The pipe shall be joined by the method of thermal butt fusion, as outlined in ASTM D2657. All joints shall be made in strict compliance with the manufacturer's recommendations. In locations where butt fusion cannot be achieved (ex. tie-in to bootless pipe penetration), a thermal coupling such as electro-fusion connections may be used as approved by the ENGINEER. Hot air welding is not permitted.

H MECHANICAL CONNECTIONS: Flange adaptors shall be used to connect pipe to auxiliary equipment such as valves, pumps and tanks, and shall consist of the following:

1. A stainless steel back-up, polyethylene flange shall be thermally buttfused to the stub end of the pipe.

2. A 316 stainless steel back up ring on both sides of the connection shall be used as approved by the ENGINEER.

3. Flange connections shall be provided with a full face neoprene gasket.

I Fused segments of the pipe shall be handled so as to avoid damage to the pipe. Chains or cable type chokers must be avoided when lifting fused sections of pipe. Nylon slings are preferred. Spreader bars are recommended when lifting long fused sections.

J BACKFILLING: All HDPE pipe must be at the temperature of the surrounding soil at the time of backfilling and compaction. Marking tape shall be installed in the backfill of all piping installed outside the lined areas, i.e. force main.

K Installation of pipe shall be observed and accepted by the CQA Officer prior to backfilling.

3.02 TESTING

A All non-perforated pipe shall be field tested (with the exception of nonperforated cleanouts). The CONTRACTOR shall supply all labor, equipment, material, gages, pumps, meters and incidentals required for testing.

B All non-perforated pipe shall be tested at a pressure of 130 psi. The test pressure shall be measured at the highest point along the test section by a recording type pressure gage and a copy of the readout shall be submitted

to the ENGINEER upon completion of the test. All testing shall be conducted in the presence of the ENGINEER or the RPR.

C Testing shall be conducted after backfilling has been completed and before placement of permanent surface.

D Testing procedure shall be as follows:

1. Fill line slowly with water; maintain flow velocity less than two feet per second.

2. Expel air completely from the line during filling and again before applying test pressure.

3. Apply initial test pressure and allow to stand without makeup pressure for three hours, to allow for diametric expansion or pipe stretching to stabilize.

4. After this equilibrium period, apply the specified test pressure and turn the pump off. The final test pressure shall be held for three hours.

5. Upon completion of the test, the pressure shall be bled off from a location other than the point where the pressure is monitored. The pressure drop shall be witnessed by the RPR. The point where the pressure is being monitored shall show on the recorded pressure readout submitted to the ENGINEER.

E Allowable amount of makeup water for expansion during the pressure test shall conform to Table 5, Allowance for Expansion Under Test Pressure, Technical Report TR 31/88, published by the Plastic Pipe Institute (PPI). If there are no visual leaks or significant pressure drops during the final test period, the installed pipe passes the test.

F If any test of pipe laid disclosed leakage or significant pressure drop greater than that allowed, the CONTRACTOR shall, at his/her own expense, locate and repair the cause of leakage and retest the line.

G All visible leaks are to be repaired by an approved method, regardless of the amount of leakage.

3.03 CLEANING

A At the conclusion of the work, thoroughly clean all of the new pipelines to remove all dirt, stones, and pieces of wood or other material that may have entered during the construction period. Debris cleaned from the lines shall

be removed from the job site. If, after this cleaning, any obstructions remain, they shall be removed.

B Special attention shall be given to clean free and remove HDPE shavings and particles resultant of fusion welding activities. Any area where these activities occurred shall be inspected by the CQA Representative and Contractor prior to acceptance of the Work; this includes sump areas, header line areas and low points of drainage.

3.04 VIDEO INSPECTION

A. Prior to Substantial Completion, all proposed leachate collection and header pipes shall be subject to video camera inspection by the Contractor under the observation of the Owner and Engineer. It is the intent to video leachate pipes to locate pipe defects, deviations to gradient, and clogs. When this inspection is performed, the Contractor shall be responsible for preparing the pipes for inspection and furnishing labor as required at no expense to the Owner. Video inspections of the leachate collection and header pipes shall be conducted by a qualified contractor experienced in working within landfill environments. DVD recordings of the completed leachate pipes shall be provided to the Owner and Engineer as a permanent record. Each DVD recording shall have an audio and written log of that video tape's contents.

B. Video camera system shall be capable of accessing the leachate collection and header lines from the proposed cleanouts or sump risers. Video camera equipment utilized to inspect the leachate pipes must comply with the requirements of Class 1, Division 1 Groups C&D of the National Electrical Code Section NFPA 70.

C. The recordings shall be properly exposed and the camera shall be in proper focus so that good, clear recordings showing detail are produced. Recordings shall be identified by audio recordings noting the leachate pipe, any leaks, cracks, or pipe defects. DVDs (original and one copy) of the completed leachate pipes shall be delivered to the Engineer. The Contractor shall provide any assistance required by the Engineer to assist the Engineer with visual inspections.

END OF SECTION

SECTION 02776

TEXTURED HIGH DENSITY POLYETHYLENE (HDPE) LINER

PART 1: GENERAL

1.01 SCOPE OF WORK

A Furnish all labor, materials, equipment and incidentals required to manufacture, supply and install Textured High Density Polyethylene (HDPE) liner as shown on the Drawings and as specified herein. This specification sets forth a set of minimum, physical, mechanical and chemical properties that must be met, or exceeded by the geomembrane being manufactured.

1.02 RELATED WORK

A Section 02275: Compacted Soil Liner

B Section 02274: Geocomposite Drainage Net

C Section 02700: Protective Cover

D Section 02589: Geomembrane Leak Location Survey

1.03 SUBMITTALS

A At least 60 calendar days prior to HDPE liner installation, submit the following information:

1. Submittals relating to liner manufacturer and liner

    a. Corporate Background

    b. Manufacturing capabilities:

        (1) Information on factory size, equipment, personnel, number of shifts per day and production capacity per shift.

        (2) List of material properties and samples of liner with attached certified test results.

        (3) Manufacturer's quality control program and manual including description of laboratory facilities.

        (4) A list of ten completed facilities totaling a minimum of three million square feet, for which the manufacturer has manufactured a textured HDPE liner. The following information shall be provided for each facility.

            # Name and purpose of facility, its location and date of installation

- # Name of Owner, project manager, design engineer and installer.
- # Liner thickness and surface area
- # Information on performance of the facility

c. The origin of the resin to be used in the manufacturing of liner including the supplier's name and production plant, as well as brand name and number.

d. A fingerprint of the manufacturer's resin properties as listed in Appendix A, Table A1. The purpose of these tests is to identify the manufacturer's liner product. The results of these tests shall be submitted to the Engineer for approval of the product. Once the product is approved, all HDPE liner to be supplied for the Project shall be manufactured using the same resin type identified through fingerprinting tests.

e. Certification that all resin used in the manufacture of textured HDPE liner for this Project meets the approved fingerprinting protocol.

f. Copy of quality control certificates in conformance with Paragraphs 2.01 and 2.02.

g. Certification that the textured HDPE liner and extrudate produced for this project has the same properties.

2. Submittals relating to installation Contractor

a. Background Information

b. Installation capabilities:

(1) Information on equipment (including tensiometer certification) and personnel.

(2) Anticipated average daily production (Complete including QC measures).

(3) A minimum of three field seam samples and a list of minimum values for seam properties.

c. A list of five completed facilities totaling two million square feet for which the installer has installed textured HDPE liner. The following information shall be provided for each facility:

(1) Name and purpose of facility, its location and date of installation.

(2) Name of Owner, design engineer, manufacturer and name and telephone number of contact at the facility who can discuss the project.

(3) Thickness of liner and surface area of the installed liner.

(4) Type of seaming, patching and tacking equipment.

(5) A copy of the manufacturer's certification or approval letter.

(6) And, prior to installation, provide resume(s) of the qualifications of the Installation Supervisor and Master Seamer, and Quality Control personnel to be assigned to this project.

d. Shop drawings, including:

(1) Proposed panel layout showing the installation layout identifying field seams as well as any variance or additional details which deviate from the Drawings.

(2) Details of seaming the liner, anchoring, connections, penetrations and other construction details.

e. Installation schedule

f. A quality control manual that specifically defines the quality assurance program during installation. The manual shall include daily procedures, welding techniques, field testing procedures, lab testing procedures, specific steps that are to be taken in the event of a failure or defect, personnel requirements, levels of authority and all other information necessary to ensure a high quality liner installation.

1.04 REFERENCE STANDARDS

A American Society for Testing and Materials (ASTM)

1. ASTM D792 – Specific Standard Test Method for Tensile Properties of Plastics by Displacement.

2. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.

3. ASTM D751 - Standard Test Methods for Testing Coated Fabrics.

4. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

5. ASTM D1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.

6. ASTM D1204 - Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.

7. ASTM D1238 - Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.

8. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique.

9. ASTM D1603 - Standard Test Method for Carbon Black in Olefin Plastics.

10. ASTM D5397 – Procedure to perform single point notched constant tneil load – Appendix (SP-NCTL)

11. ASTM D1898 – Sampling of Plastics

12. ASTM D4833 – Index puncture resistance of geotextiles, gemembranes and related products

13. ASTM D5596 – Test method for microscopic evaluation of the dispersion of carbon black in polyolefin geosynthetics

14. ASTM D3895 - Standard Test Method for Oxidative Induction Time of Polyolefins by Thermal Analysis.

15. ASTM D4437 - Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes.

16. ASTM D7466 – Test method for measuring the asperity height of textured geomembranes

17. GRI Test Method GM13 - Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes

18. GRI Test Method GM19 - Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes

D Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A Quality Assurance activities are performed to provide assurance that the materials were constructed as specified in the contract specifications and may include manufacturing facility inspections, verifications, audits and evaluation of raw materials and geosynthetic products to assess the quality of the manufactured materials.

B In addition to manufacturer and installer requirements for qualifications and certification specified in Paragraph 1.03, the Quality Assurance Plan consists of conformance testing of the material manufactured for the project and delivered to the site, and field quality control during installation.

C Conformance testing requirements are specified in Paragraph 2.03. The purpose of conformance testing is to assure that the supplied material is constructed as specified in the contract specifications and to the manufacturer's quality control certificates.

D Field quality control requirements are specified in Paragraph 3.06. The purpose of field quality control procedures is to assure that the liner has been installed in accordance with the specifications and manufacturer's recommendations.

E Quality Control Plan

1. The forms in Appendix C for liner quality control documentation shall be used for field installation documentation. Alternative forms, which provide the same level of detail, may be used for documentation as approved by the Engineer.

F Geomembrane Quality Control Documentation

1. Pre-deployment Conference

a. Prior to commencing work, a pre-deployment conference shall be held and the following project personnel shall be identified by name and recorded in the project files:

Contractor
Contractor's Representative
CQA Engineer
Resident Project Representative (RPR)
Installation Supervisor / Quality Control Personnel
Installer
CQC Personnel

b. Two duplicate project files shall be maintained. One shall be maintained by the CQA Representative or Resident Project Representative (RPR) and the other shall be maintained by the Installation Supervisor. At the end of each work week the files shall be updated and checked to assure that copies of all pertinent project information is included in each file.

c. Blank copies of the following nine project forms shall be available on-site throughout the duration of the project:

FORM ID	**TITLE**
CQC - 100	LINER PROJECT QC LOG
CQC - 101	SUBGRADE SURFACE ACCEPTANCE
CQC - 102	RECEIVING QC LOG
CQC - 103	PERSONNEL QC LOG
CQC - 104	DAILY QC REPORT - PRE-WELD TESTING
CQC - 105	DAILY SEAMING QC LOG
CQC - 106	NON-DESTRUCTIVE TESTING LOG
CQC - 107	DAMAGE AND FAILURE LOG

G Record Drawings

1. The Contractor shall furnish record drawings showing changes, if any, from the approved installation drawings which are to include all destructive sample locations (if performed), any patches used to repair liner defects, all panels and panel seams and patch identifications assigned in the field; and a copy of complete documentation for final installation of the liner.

1.06 QUALIFICATIONS

A Manufacturer

1. The manufacturer of the lining material described hereunder shall have previously demonstrated their capability to produce this liner by having at least ten years continuous experience in the manufacture of textured HDPE liner and successfully manufactured a minimum of 50 million square feet of similar liner material for hydraulic lining installations.

B Installer

The installer shall be the manufacturer or an approved installer trained and certified to install the manufacturer's liner. Installation shall be performed under the constant direction of a single installation supervisor who shall remain on site and be in responsible charge, through the liner installation, for liner layout, seaming, patching, testing, repairs and all other activities required by the installer. The installation supervisor shall have installed or supervised the installation and seaming of a minimum of two million square feet of textured HDPE liner. The Installation contractor must be a manufacturer' approved installer for the product.

1.07 PACKAGING, DELIVERY, STORAGE AND HANDLING

A The geomembrane shall be rolled onto a substantial core held firm by dedicated straps, slings or other suitable means approved by the Engineer. The liner rolls shall be packaged and shipped by appropriate means to prevent damage of the liner rolls. Off-loading and storage of the liner is the responsibility of the Contractor. The liner rolls shall be unloaded in the presence of the CQA Officer or his designated CQA representative. The Contractor shall be responsible for replacing any damaged or unacceptable material at no cost to the Owner.

B Damage during off-loading shall be documented by the CQA Officer or CQA representative. Any damaged rolls must be separated from the undamaged rolls until the proper disposition of that material has been determined by the Engineer.

C The liner rolls shall be stored so as to be protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions and excessive heat that may damage the liner material. The rolls shall be stored on a prepared surface (not wooden pallets) and shall not be stacked more than two rolls high.

1.08 MATERIAL WARRANTY

A A warranty for the textured HDPE liner manufacturer shall be provided by the manufacturer. It shall include on a pro-rated basis, warranty against manufacturing defects and material degradation under outdoor exposure for a period of five years from the date of installation. The manufacturer shall replace at no expense, any material which fails from the above causes within the warranty period. The manufacturer shall furnish a written warranty covering the requirements of this Paragraph.

1.09 GUARANTEE

A The Contractor shall guarantee the textured HDPE liner against defects in installation and workmanship for the period of two years commencing with the date of final acceptance. The guarantee shall include the services of qualified service technicians and all materials required for the repairs at no expense to the Owner.

1.10 DEFINITIONS AND RESPONSIBILITIES

A Contractor

1. The Contractor is the firm or corporation with whom the Owner has entered into agreement to construct the project. The Contractor is responsible for scheduling and coordination of the required work with the Engineer, manufacturer and the installer to complete the project. The Contractor is responsible for furnishing as built drawings and a copy of the complete documentation of the liner system. The Contractor is also responsible for daily updating of the design drawings onsite and for any and all deviations from these drawings. The Contractor is responsible for all submittals by the manufacturer and installer as required by the Specifications.

B Manufacturer

1. The manufacturer is the firm or corporation responsible for production of the liner material to be used in the project. The manufacturer shall produce a consistent product meeting the project specifications, and shall provide quality control documentation for the product specified herein. A Manufacturer's Certification that the material was manufactured and tested in accordance with this specification, together with a report of the test results shall be furnished prior to shipment.

C Installer

1. The installer is the firm responsible for installation of the liner. The installer shall be the manufacturer or an approved installer trained and certified to install the manufacturer's geomembrane. The Installer shall be responsible for field handling, storing, placing, seaming, field testing and all other aspects of the liner installation.

PART 2: PRODUCTS

2.01 MATERIALS

A General

1. The liner shall be manufactured of new, prime first-quality products designed and manufactured specifically for the purpose of liquid containment in hydraulic structures and chemically resistant to leachate. Product shall be *Agru America High Density Polyethylene Micro Spike® Liner* or equivalent.

2. The liner material shall be so produced as to be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter. The Engineer may reject all or portions of units (rolls) of geomembrane if significant quantities of production flaws are observed.

3. The sheets shall be manufactured to a minimum 22-ft seamless width. Labels on each roll shall be legible and identify the information listed in Part 2.02, A.4

4. The textured sheet must not delaminate during tensile testing (i.e., textured layers and "particles" of texture must not separate). It shall be free from agglomerated texturing material and such defects that would affect the specified properties of the geomembrane.

B Properties

1. The geomembrane liner rolls shall meet the minimum properties listed in Appendix B, Table B1.

C Other Materials

1. Extrudate welding rods shall be of the same compound as the liner and supplied by the manufacturer and shall be delivered in original sealed containers. Each container shall have a label bearing the brand name, manufacturer's lot number and complete directions as to proper storage. Manufacturer shall provide welding rod in an adequate quantity to complete the project.

2. When applicable, Nominal 40-mil flexible membrane liner (FML) leachate collection stone rain cover shall have minimum properties required by GRI Test Method GM13 (latest revision).

2.02 QUALITY CONTROL DOCUMENTATION

A Prior to shipment and installation of any liner material, the Manufacturer shall provide the following information certified by the manufacturer for the delivered liner.

1. Origin, identification and production of the resin (supplier's name, brand name and production plant).

2. Copies of quality control certificates issued by the resin supplier.

3. Each roll delivered to the project site shall have the following identification information:

a) Serial number
b) Lot number
c) Roll number
d) Resin type
e) Roll length
f) Material width
g) Weight
h) Thickness
i) Inspection identification

4. Quality control certificates, signed by the manufacturer's quality assurance manager. Each certificate shall have roll identification number, sampling procedures, frequency, and test results. At a minimum the following test results shall be provided in accordance with test requirements specified in Appendix B:

Thickness
Density
Tensile properties
Tear resistance
Carbon black content
Carbon black dispersion

2.03 CONFORMANCE TESTING

A Conformance testing shall be performed by the CQA Officer and an independent Quality Assurance Laboratory (QAL) as approved by the Owner. Engineer shall obtain samples from the delivered material, mark the machine direction and identification number. One sample shall be taken per 100,000 square feet, or one sample per lot, whichever results in the greater number of conformance tests. A Lot number will be defined as a continuous production process without changes to raw material or manufacturing methods. This sampling frequency may be increased as deemed necessary by the Engineer. The Owner shall pay for conformance testing at the frequency of one test per 100,000 square feet. For every change in Lot number, the Manufacturer shall pay for conformance testing on the initial roll at the Manufacturer's expense. The Engineer shall obtain the samples from the roll, and mark the machine direction and identification number. The following conformance tests shall be conducted at the laboratory:

Thickness
Density
Tensile properties
Tear resistance
Carbon black content
Carbon Black Dispersion

B These conformance tests shall be performed in accordance with Appendix B. All costs for the initial conformance testing will be paid by the Owner.

C All conformance test results shall be reviewed by Engineer and accepted or rejected, prior to the delivery and placement of the liner. All test results shall meet, or exceed, the property values listed in Appendix B. In case of failing test results, the manufacturer may request that another sample be retested by the independent laboratory with manufacturer's technical representative present during the testing procedures. This retesting shall be paid for by the manufacturer. The manufacturer may also have the sample retested at two different laboratories approved by the Owner. If both laboratories report passing results the material shall be accepted. If both laboratories do not report passing results, all liner material from the lot representing the failing sample will be considered out of specification and rejected.

PART 3: EXECUTION

3.01 COMPACTED SOIL LINER PREPARATION

A Preparation of the compacted soil liner surface shall be as specified in Section 02275.

B The surface of the compacted soil liner shall be smooth, uniform, and free from sudden changes in grade (such as vehicular ruts), rocks, stones, debris and deleterious materials. The moisture content of the compacted soil liner must be maintained within the project specifications until the synthetic liner has been installed. If excessive drying occurs, the contractor shall re-hydrate and compact the affected area to the Engineer's satisfaction. During actual placing and seaming of the liner, the compacted soil liner surface shall be kept free of all standing water. If the compacted soil liner surface below the liner becomes wet and unstable, it shall be dried and re-compacted to the Engineer's satisfaction. If drying and re-compacting the material is insufficient, the unstable material must be removed and replaced with approved material.

C Prior to liner installation, the Contractor and installer shall verify in writing and submit to the CQA Officer:

1. Lines and grades are in conformance with the Drawings and Specifications.

2. The surface area to be lined has been rolled and compacted, free of irregularities and abrupt changes in grade.

D The Contractor shall not proceed with liner installation until a complete report on the compacted soil liner thickness and hydraulic conductivity tests has been submitted and approved by the CQA Officer.

3.02 ANCHOR TRENCH

A The anchor trench shall be constructed as shown on the Drawings and as specified herein.

B Slightly rounded corners shall be provided in the trench to avoid sharp bends in the liner.

C The anchor trench shall be adequately drained to prevent water ponding and softening to adjacent soils. The anchor trench shall be backfilled with local fill material and compacted to 92 percent standard proctor density, ASTM D698 as specified in Section 02200.

D If the anchor trench is located in a clayey material susceptible to desiccation, the amount of trench open at any time shall be limited to one day of liner installation capacity.

3.03 LINER PLACEMENT

A Weather Conditions

1. Liner placement shall not proceed at an ambient temperature below 40 degrees F or above 104 degrees F unless otherwise authorized, in writing, by the CQA Officer or his/her field representative. Liner placement shall not be performed during precipitation, excessive moisture, in an area of ponded water, or excessive winds.

B Method of Placement

1. Each Liner panel shall be layed out in accordance with the approved shop drawings prepared by the Manufacturer. The layout shall be designed to keep field joining of the textured HDPE liner to a minimum and consistent with proper methods of textured HDPE liner installation.

2. Each liner panel shall be identified by panel number, roll number and date of deployment. The liner panel number shall be placed on the ends of each panel and in the middle.

3. For liner placed on 4 to 1 or steeper slopes, the seams shall be oriented in the direction of the slope. Horizontal seams on 4 to 1 slopes or steeper shall not be allowed except for cases in which it is unavoidable. In these instances, a cap strip shall be placed over the seam.

4. The equipment used to deploy the liner shall not cause rutting of the compacted soil liner surface. If rutting occurs, the Contractor shall suspend all liner placement activities and repair the ruts and immediately employ an alternative method for liner deployment. Liner rolls shall be placed using spreader and rolling bars with cloth slings. If a sheet must be relocated a distance greater than its width, a slip sheet shall be used.

5. The RPR shall inspect each panel, after placement and prior to seaming, for damage and/or defects. Defective or damaged panels shall be replaced or repaired, as approved by the CQA Officer.

6. The installer shall not drag the liner panels over the compacted soil liner.

7. All liner shall be anchored as shown on the Drawings and consistent with manufacturer's recommendations. Sufficient liner shall be installed within the anchor trench to ensure proper installation prior to backfilling the trench.

8. Personnel working on the liner shall not smoke, wear damaging shoes or involve themselves in any activity that may damage the liner.

9. The liner shall be properly weighted with sand bags to avoid uplift due to wind.

10. Vehicular traffic across the liner shall not be allowed.

11. All damage shall be recorded and located on the record drawings.

12. When tying into existing liner, all excavation of previously installed liner shall be performed by hand to prevent damage.

13. The liner shall be kept free of debris, unnecessary tools and materials. In general, the liner area shall remain uncluttered in appearance. Any generators in use while on the liner shall have "drop" sheets place underneath.

14. Fuel shall not be stored on the liner.

15. To prevent a "trampoline effect" from forming, the Contractor shall place sufficient sand bags on the liner along the toe of slopes to ensure full contact of the geomembrane liner with the compacted soil liner surface. In addition, the horizontal seams nearest the toe of slope shall remain unwelded until all other

seams in the area are completed. The final seam shall be welded when the liner is cool and fully contracted. Care shall be taken to ensure that the liner contacts the subgrade in all locations before completing the seam.

3.04 FIELD SEAMS

A Individual panels of liner shall be laid out and overlapped by a minimum of 4-in prior to welding. The area to be welded shall be cleaned and prepared in accordance with the installer's quality control welding procedures.

B Double track hot wedge fusion welder shall be used for straight welds.

C Extrusion welder shall be used for cross seam tees, patches, repairs, penetration boots and detailed work.

D The welding equipment used shall be capable of continuously monitoring and controlling the temperature speed, and pressure in the zone of contact where the machine is actually fusing the liner material so as to ensure that changes in environmental conditions will not affect the integrity of the weld.

E No "fish mouths" will be allowed within the seam area. Where "fish mouths" occur, the material shall be cut, overlapped and a patch fusion weld shall be applied. All welds upon completion of the work shall be tightly bonded. Any liner area showing injury due to excessive scuffing, puncture, or distress from any cause shall be replaced or repaired with an additional piece of liner. The number of patches per 100-ft length shall not exceed five. If more than five patches per 100-ft length are necessary, then the entire 100-ft length of seam shall be removed. Further welding will cease at this time and the CQA Officer shall be notified.

F All seams shall have a seam number that corresponds with the panel layout numbers. The numbering system shall be used in the development of the record drawings. Seam numbers shall be derived from the combination of the two panel numbers that are to be welded together.

G All fusion welded "T" seams (i.e., the result of the liner panels placed perpendicular to each other) shall be double welded where possible. The extrusion process shall be used for the second weld.

H All extrudate shall be free of dirt, dry and protected from damage.

I If an extrusion welder is stopped for longer than one minute, it shall be purged to remove heat-degraded extrudate. All purged extradite shall be placed on a sacrificial sheet and disposed of.

J All seams constructed on sloped surfaces shall be vertical seams. Where horizontal seams can't be avoided (due to compounded slopes) on sideslope surfaces, a 18" wide cap strip of the same synthetic material shall be placed on top of the horizontal seam and welded to the adjacent panels to provide additional structural integrity. All cap strip seams shall be non-destructively tested.

K All vertical panels placed on sloped surfaces shall extend 5-ft inward from the toe of slope or edge of trench.

L All end seams shall be staggered a minimum of 5-ft in length between contiguous panels.

M To prevent moisture buildup during fusion welding, it may be necessary to place a movable protective layer of plastic directly below each overlap of liner that is to be seamed.

N If required, a firm substrate shall be provided by using a flat board or similar hard surface directly under the seam overlap to achieve proper support.

O All seams shall extend to the full extent into the anchor trench.

P All factory seams, field seams and repair welds shall meet seam strength requirements specified in Appendix B, Table B2.

3.05 SEAMING WEATHER CONDITIONS

A Normal Weather Conditions

1. The normal required weather conditions for seaming are:

   a. Ambient temperature higher than 40 degrees F and lower than 104 degrees F.

   b. No precipitation or other excessive moisture, such as fog or dew.

   c. No excessive winds.

2. These weather conditions shall be fulfilled during seaming process.

B Cold Weather Conditions

1. If the ambient temperature is below 40 degrees F, the following conditions shall be met to ensure quality seaming process:

   a. Preheating the surface of the liner to achieve normal temperature range.

b. Preheating may be waived by the CQA Officer or the RPR if the installer demonstrates that satisfactory welds of equivalent quality may be obtained without preheating at the expected temperature of installation.

c. Preheating devices shall be approved by the manufacturer.

d. Care shall be taken to assure that surface temperatures are not lowered below the minimum required surface temperature for welding due to winds.

e. Additional destructive tests samples shall be taken at the discretion of the CQA Officer.

f. Test seams, as described in Paragraph 3.06A, shall be performed under the same ambient temperature conditions as the actual seams.

C Warm Weather Conditions

1. If the ambient temperature is above 104 degrees F, no seaming of liner shall be permitted unless the installer can demonstrate to the satisfaction of the Engineer that liner seam quality is not adversely impacted.

2. Test seams shall be performed under the same ambient temperature conditions as the actual seams.

3. Additional destructive tests shall be taken at the discretion of the CQA Officer.

3.06 FIELD QUALITY CONTROL

A Pre-Weld Testing

1. A test weld 3-ft long from each welding machine shall be run upon the beginning of each shift and every four hours thereafter, under the same conditions as exist for the liner welding. The test weld shall be marked with date, ambient temperature and welder's name, temperature and speed, welding machine number. A tensiometer shall be required to be on-site before and during liner installation for the purpose of testing samples. Six specimens of welds 1-in wide shall be cut from the test weld and tested on site with the presence of the RPR for shear and peel strength (3 each) in accordance with Appendix B, Table B-2. No welder may start work until the sample weld has been approved by the RPR.

2. Test seams shall be performed under the same conditions as the actual seams and shall be at least 3-ft long, 1-ft wide after seaming. Test seam for welding shall be cut out of the liner rolls.

B Non-destructive Seam Testing

1. The installer shall perform nondestructive test on all field seams over their full length. The purpose of this test is to assure continuity and integrity of the seams. Vacuum and air pressure tests shall be used for nondestructive testing. The vacuum test shall be used for extrusion welds and single track hot wedge welds. The air pressure test shall be used for double track hot wedge welds.

If the CQA Officer at any time during the installation believes the seaming process may not be performing adequately, he may, to avoid destructive sampling of the actual liner system, request additional test seams. This shall be done by the Installer at no additional cost to the Owner.

2. Vacuum Testing

a. Equipment for testing single wedge fusion seams and extrusion seams shall be comprised of the following:

(1) A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft rubber gasket attached to the bottom, port hole or valve assembly and a vacuum gage.

(2) A vacuum tank and pump assembly equipped with a pressure controller and pipe connections.

(3) A rubber pressure/vacuum hose with fittings and connections.

(4) A plastic bucket and wide paint brush.

(5) A soapy solution.

b. The following procedures shall be followed by the installer:

(1) Excess sheet overlap shall be trimmed away.

(2) Clean the window, gasket surfaces and check for leaks.

(3) Energize the vacuum pump and reduce the tank pressure to approximately 5 psi.

(4) Wet a strip of liner approximately 12-in by 48-in (length of box) with the soapy solution.

(5) Place the box over the wetted area and compress.

(6) Close the bleed valve and open the vacuum valve.

(7) Ensure that a leak-tight seal is created.

(8) For a minimum period of ten seconds, examine the liner through the viewing window for the presence of soap bubbles.

(9) If no bubbles appear after ten seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum of 3-in overlap and repeat the process.

10) All areas where soap bubbles appear shall be marked and repaired and then re-tested.

11) All test locations which have passed vacuum testing shall be marked with the test date and individual performing the test.

c. If the seam cannot be tested prior to final installation, the seaming operations shall be observed by the RPR for uniformity and completeness.

3. Air Pressure Testing.

a. The following procedures are applicable to those processes which produce a double seam with an enclosed space.

b. Equipment for testing double fusion seams shall be comprised of the following:

(1) An air pump equipped with pressure gage capable of generating and sustaining a pressure between 25 and 30 psi and mounted on a cushion to protect the liner.

(2) A manometer equipped with a sharp hollow needle, or other approved pressure feed device.

c. The following procedures shall be followed by the installer.

(1) Seal both ends of the seam to be tested.

(2) Insert needle or other approved pressure feed device into the tunnel created by the double wedge fusion weld.

(3) Energize the air pump to a pressure between 27 and 40 psi, close valve and sustain pressure for at least five minutes.

(4) If loss of pressure exceeds 3 psi, or pressure does not stabilize, locate faulty area, repair and re-test.

(5) If the faulty area cannot be isolated and repaired, the length of seam which cannot be tested shall be capped with liner strip, extrusion welded and vacuum tested. The seam shall be documented as a failed seam indicating the corrective measure.

(6) If loss of pressure is 3 psi or less, release air pressure at the opposite end of where the pressure is applied to verify that the full seam was pressurized and that there was no blockage in the air channel.

(7) Remove needle or other approved pressure feed device and seal.

(8) All test locations which have passed air pressure testing shall be marked with the test date and individual performing the test.

C Destructive Seam Testing

1. At the discretion of the CQA Engineer and/or RPR, destructive seam testing shall be performed on samples of the installed liner.

   a. At any given sampling location, two types of samples shall be taken by the Installer at the request of the CQA Engineer and/or RPR.

   b. First, two specimens for field testing shall be taken. Each of these specimens will be 12 in. by 12 in. long (minimum), with the seam centered parallel to the width. If both specimens pass on-site field test for peel and shear in accordance with Appendix B, Table B-2, a sample for laboratory testing may be taken.

   c. The sample for laboratory testing shall be located between the two specimens for the peel and shear field testing. The destructive sample will be 12 in. wide by 42 in. long of the liner Installer requests a sample; otherwise, the destructive sample will be 30 inches with the seam centered lengthwise. The sample shall be cut into three parts and distributed as follows:

      - One portion to the Installer for laboratory testing, if so requested, 12 in. x 12 in.;
      - One portion to the Owner for archive storage, 12 in. x 12 in.; and
      - One portion for CQA Laboratory testing, 12 in. x 18 in.

   d. Destructive testing will include peel and shear testing. At least 5 specimens will be tested for each test method. A maximum of one non-FTB (Film Tear Bond) failure is acceptable provided that strength requirements are met on that sample.

   e. The following procedures apply whenever a sample fails a destructive test, weather that test is conducted by the CQA Laboratory, the Installers laboratory, or by field tensiometer. The Installer has two options:

      (1) The Installer can reconstruct the seam between any two passed destructive seam test locations, or

      (2) The Installer can trace the seaming path to an intermediate location (at least 10 ft from the point of the failed test in each location) and take a small sample for an additional field test at each location. If these additional samples pass the field tensiometer testing, then full destructive laboratory samples are taken. If these destructive laboratory samples pass the tests, then the seam is reconstructed between these locations by capping for extrusion or fusion welds, at the direction of the Engineer. If either the field tensiometer or the laboratory sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

3.07 ELECTRIC CONDUCTIVITY TESTING

Following installation of the drainage layer, electric conductivity testing may be performed to ensure no puncturing of the liner occurred during installation. The Contractor will fully cooperate with the testing including providing survey service and laborers to establish testing points and vacating areas designated by the testers. The laborers will also perform excavation of sand and removal of fabric at locations of investigation. Repair of damaged liner and replacement of fabric and sand will be performed by the contractor at no additional cost to the Owner.

3.08 DISPOSAL OF WASTE MATERIAL

A Upon completion of installation, the Contractor shall dispose of all trash, waste material and equipment used in connection with the performed work and shall leave the premises in a neat and acceptable condition.

APPENDIX A

TABLE A1

PROPERTIES and TEST METHODS FOR TEXTURED HIGH DENSITY

POLYETHYLENE (textured HDPE) LINER

PROPERTY	TEST METHOD
Density	ASTM D792 or ASTM D1505
Melt Index	ASTM D1238
Carbon Black Content	ASTM D1603
Oxidative Induction Time	ASTM 3895

The above tests shall be performed by the manufacturer of the textured HDPE liner for identification of the manufacturer's product. Test results shall be submitted to the Engineer for approval of the product. Properties shall meet listed test values of GRI-GM13 or its latest version.

APPENDIX B

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TABLE B1

MATERIAL PROPERTIES
TEXTURED HIGH DENSITY POLYETHYLENE (HDPE) LINER

PROPERTY	UNIT	LIMIT	TEST METHOD	VALUE
Thickness[1]	mils	minimum	ASTM D5994	60
Density	g/cc	minimum	ASTM D1505; or ASTM D792	0.940
Tensile Properties (Each Direction)			ASTM D6693	
Yield Strength	lb/in	min. ave		126
Break Strength	lb/in	min. ave.		90
Elongation at Yield	%	min. ave.		12
Elongation at Break	%	min. ave.		100
Tear Resistance	lb.	min. ave.	ASTM D1004	42
Puncture Resistance	lb.	min. ave.	ASTM D4833	90
Carbon Black Content	%	Range	ASTM D1603; or ASTM D4218	2.0 to 3.0

1. Value represents lowest individual value

TABLE B2

FACTORY AND FIELD SEAMS PROPERTIES
TEXTURED HIGH DENSITY POLYETHYLENE (HDPE) LINER

Property (ASTM D6392)	Units	Value
Hot Wedge Seams [1]		
- shear strength [2]	lb/in	120
- shear elongation at break [3]	%	50
- peel strength [2]	lb/in	91
- peel separation	%	25
Extrusion Fillet Seams		
- shear strength [2]	lb/in	120
- shear elongation at break [3]	%	50
- peel strength [2]	lb/in	78
- peel separation	%	25

Notes for Table B2:
1. Also for hot air and ultrasonic methods
2. Value listed for shear and peel strengths are 4 of 5 specimens; the 5th can be as low as 80% listed values
3. Elongation measurements should be omitted for field testing

APPENDIX C

GEOMEMBRANE QUALITY CONTROL or
QUALITY ASSURANCE DOCUMENTATION FORMS

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The following forms are included and shall be completed by the responsible party as shown on the forms, unless otherwise approved by the Engineer:

FORM ID	TITLE
CQC - 100	LINER PROJECT QC LOG
CQC - 101	SUBGRADE SURFACE ACCEPTANCE
CQC - 102	RECEIVING QC LOG
CQC - 103	PERSONNEL QC LOG
CQC - 104	DAILY QC REPORT - PRE-WELD TESTING
CQC - 105	DAILY SEAMING QC LOG
CQC - 106	NON-DESTRUCTIVE TESTING LOG
CQC - 107	DAMAGE AND FAILURE LOG

FORM CQC - 100
LINER PROJECT QC LOG
(one sheet per project)

PROJECT NAME: _____

PROJECT NUMBER: _____ INSTALLATION DATE: _____

PROJECT LOCATION: _____

PROJECT OWNER: _____

ADDRESS: _____

CONTACT: _____ PHONE: _____

ENGINEERING FIRM: _____

ADDRESS: _____

CONTACT: _____ PHONE: _____

GENERAL CONTRACTOR: _____

ADDRESS: _____

CONTACT: _____ PHONE: _____

SPECIFIED LINER MATERIALS: _____ THICKNESS & TYPE: _____

SUPPLIER OF LINER MATERIALS: _____

ADDRESS: _____

CONTACT: _____ PHONE: _____

MATERIAL CERTIFICATION RECEIVED: _____

DATE: _____ ACCEPTED: _____

FABRICATOR OF MATERIAL: _____

INSTALLER OF MATERIAL: _____

QC INSPECTION FIRM: _____

ADDRESS: _____

CONTACT: _____ PHONE: _____

LINER TESTING LABORATORY: _____

ADDRESS: _____

CONTACT: _____ PHONE: _____

FORM CQC - 101
SUBGRADE SURFACE ACCEPTANCE
(one sheet per Day of Liner Deployment)

PROJECT NAME: _____ DATE: _____ PROJECT NUMBER: _____

EARTH CONTRACTOR: _____

ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

SUPERINTENDENT OF PROJECT: _____ PHONE: _____

GEOMEMBRANE INSTALLER: _____

ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

SUPERINTENDENT OF PROJECT: _____ PHONE: _____

CERTIFICATE OF ACCEPTANCE
OF SUBGRADE SOIL BY INSTALLER

I the undersigned, duly authorized representative of _____do hereby accept the soil surface as being acceptable for the placement of a geomembrane liner.

_____	_____	_____	_____
Name	Signature	Title	Date

Certificate Accepted by Inspector - Company: _____

_____	_____	_____	_____
Name	Signature	Title	Date

QC INSPECTOR: _____

SITE SUPERVISOR: _____

INSTALLING SUPERVISOR: _____

Use back for comments.

FORM CQC - 102
RECEIVING QC LOG
(one sheet per truck)

PROJECT NAME: _____

DATE: _____ TIME: _____ PROJECT NUMBER: _____

TRUCKERS ID: _____

NO. OF PIECES ON BOARD: _____ AGREE WITH PACKING LIST? _____

CONDITION OF PACKAGING: _____

VERIFY PROPER MATERIALS: _____ VERIFY PROPER THICKNESS: _____

IDENTIFY PANEL NUMBERS: _____

_____

IDENTIFY ACCESSORIES *(adhesive, battens, boots, etc.)*: _____

_____

IDENTIFY DAMAGED ITEMS: _____

_____

TYPE OF UNLOADING EQUIPMENT USED: _____

CONDITION: _____

OPERATOR: _____

COMMENTS: _____

_____

STORAGE AREA

CONDITION *(surface)*: _____

LOCATION TO PLACEMENT AREA: _____

MATERIAL PROPERLY COVERED: _____

WEATHER

CONDITIONS: _____ TEMP: _____

QC INSPECTOR: _____

SITE SUPERVISOR: _____

Use back for other comments.

FORM CQC - 103
PERSONNEL QC LOG
(installation & field seaming personnel)
(one sheet per mobilization or change of personnel)

PROJECT NAME: _____

DATE: _____ PROJECT NUMBER: _____

SAFETY MEETING CONDUCTED ON MATERIALS HANDLING: _____

GIVEN BY: _____ DATE: _____

SUPERINTENDENT OF INSTALLATION: _____

SEAMING CREW PERSONNEL

#1 CREW LEADER: _____ HELPER: _____

#2 CREW LEADER: _____ HELPER: _____

#3 CREW LEADER: _____ HELPER: _____

#4 CREW LEADER: _____ HELPER: _____

#5 CREW LEADER: _____ HELPER: _____

#6 CREW LEADER: _____ HELPER: _____

#7 CREW LEADER: _____ HELPER: _____

#8 CREW LEADER: _____ HELPER: _____

OTHER CREW MEMBERS

NAME: _____ NAME: _____

NAME: _____ NAME: _____

NAME: _____ NAME: _____

SIGNED: _____

QC Inspector

FORM CQC – 104
DAILY QC REPORT
PRE-WELD TESTING
(field seam test sample, one per day)

DATE _____ JOB NAME _____ JOB NO. _____ MATERIAL _____

TIME	AMBIENT TEMP.	WEATHER	WIND	SEAM TECH INIT.	MACHINE			DESTRUCTIVE TEST						PASS /FAIL	INSP. INITIALS
					ID NO.	TEMP	SPEED	PEEL			SHEAR				

FORM CQC – 105
PANEL PLACEMENT AND SEAMING LOG

DAILY TOTALS: Liner _____Sq. ft., Length Seamed _____ Ft., No. Destructs Marked _____, Anchor Trench: Dug _____
Accepted _____

DATE _____ JOB NAME _____ JOB NO. _____ MATERIAL _____

				SEAMS									
TIME	PANEL NO.	ROLL NO.	LENGTH	SEAM NO.	LENGH	TIME	SEAMER TECH.	MACHINE ID NO.	TEMP	SPEED	AMBIENT TEMP.	WIND	WEATHER

COMMENTS: _____

FORM CQC – 106
NON-DESTRUCTIVE TESTING

DATE _____ JOB NAME _____ JOB NO. _____ MATERIAL _____

DATE	TECH.	PANEL NO.	SEAM NO.	START FOOTAGE	END FOOTAGE	AIR TEST			AIR LANCE OR VACUUM TEST PASS/FAIL
						START PSI	FINISH PSI	DROP IN PSI OVER 5 MIN.	

FORM CQC – 107
DAMAGE AND FAILURE REPORT

DATE _____ JOB NAME _____ JOB NO. _____ PAGE _____

PANEL NO.	SEAM NO.	LOCATION OF REPAIR OR DAMAGE	TYPE OF DAMAGE	INSPECTION DATE	MFSM INITIALS	EFR INITIALS

COMMENTS: _____

END OF SECTION