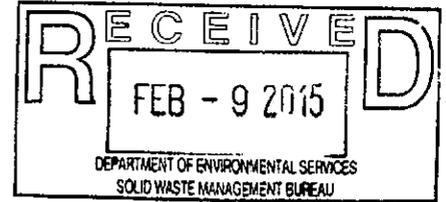


**DES Waste Management Division
29 Hazen Drive; PO Box 95
Concord, NH 03302-0095**



**NCES Stage V Contract Documents and
Technical Specifications – Addenda Transmittal
North Country Environmental Services Landfill
581 Trudeau Road
Bethlehem, NH 03574**

**NHDES Site #: 198704033
Project Type: SW-LNDFILL
Project Number: 0000393**

**Prepared For:
North Country Environmental Services
220 Avenue B
Williston, VT 05495
Phone Number (802) 651-5454
RP Contact Name: John Gay
RP Contact Email: john.gay@casella.com**

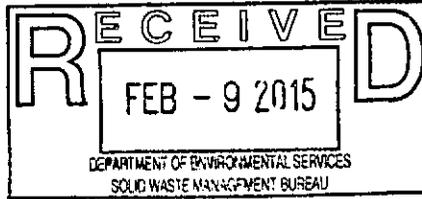
**Prepared By:
CMA Engineers, Inc.
35 Bow Street
Portsmouth, NH 03801
Phone Number: (603) 431-6196
Contact Name: Robert J. Grillo, P.E.
Contact Email: rgrillo@cmaengineers.com**

Date of Report: February 4, 2015

CMA
ENGINEERS

February 4, 2015

Mr. Paul M. Gildersleeve, P.E.
Solid Waste Management Bureau
New Hampshire Department of Environmental Services
29 Hazen Drive, P.O. Box 95
Concord, New Hampshire 03302-0095



CMA
ENGINEERS, INC.
CIVIL/ENVIRONMENTAL
ENGINEERS

35 Bow Street
Portsmouth, New Hampshire
03801-3819

Phone: 603/431-6196

**RE: NCES – North Country Environmental Services, Trudeau Rd, Bethlehem, NH
Stage V Contract Documents and Technical Specifications
Hard Copy Addendum Transmittal
DES-SW-SP-03-002, WMD Doc Log # 13337, 13390, 13419, 13423, 13477, 13883,
13995 and 14056
CMA #833-D.1**

Dear Mr. Gildersleeve:

On behalf of North Country Environmental Services (NCES), CMA Engineers, Inc. is submitting hard copies of the Addenda issued for the NCES Stage V Landfill Expansion project. The addenda have also been forwarded to you electronically. There were four Addenda issued for the project for bids due on February 5, 2015.

If you have any questions, please do not hesitate to contact us.

Very truly yours,
CMA ENGINEERS, INC.

A handwritten signature in black ink, appearing to read "Adam J. Sandahl".

Adam J. Sandahl, P.E.
Project Engineer

AJS:kao

Enclosures

**ADDENDUM NUMBER 1:
NORTH COUNTRY ENVIRONMENTAL SERVICES, INC.
STAGE V LANDFILL EXPANSION
CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS**

**Issued: January 21, 2015
For Bids Due: February 5, 2015**

A. INVITATION TO BID

1. *The INVITATION TO BID has been revised to remove the paragraph concerning procurement of select sand and screened till at the adjacent lot. A revised copy of the INVITATION TO BID is attached.*

B. BID PROPOSAL FORM

1. *The BID PROPOSAL FORM has been modified to:*
 - a. Provide separate Bid Items for EXCAVATION and FILLING which will now be bid on a unit price basis.
 - b. Bid Item 29 – Screened Till Fill (Procured and Processed at Adjacent Property) has been removed from the BID PROPOSAL FORM
 - c. Bid Item 30 – Select Sand (Procured and Processed at Adjacent Property) has been removed from the BID PROPOSAL FORM
 - d. Bid Item 31 – Addition or Reduction of Common Excavation has been removed from the BID PROPOSAL FORM
 - e. New Bid Item 30 – On Site Screened Till has been added to this form
 - f. Bid item enumeration has been updated to accommodate these changes
 - g. A revised copy of the BID PROPOSAL FORM is attached

C. AGREEMENT

1. *The Change Order form has been revised to include language for the Contractor to request a Change Order. A copy of the revised Change Order form is attached.*

D. SECTION 00150 – MEASUREMENT AND PAYMENT

1. The terms of Bid Item 1 – General Conditions have been revised
2. Bid Item 2 – Excavation and Filling has been revised for excavation ONLY. Language has been added to this Bid Item for:
 - a. Requiring that this Bid Item be bid as unit pricing
 - b. Excavated quantities will be determined by survey
 - c. Requiring the Contractor to segregate excavated material greater than and less than 6” diameter and where these materials shall be stockpiled
3. Bid Item 3 – Filling has been added to this Section

4. Bid Item 7 – Waste Excavation & Odor Control has been revised to limit the required haul distance to 2,000 feet
5. Bid Item 8 – Temporary Stormwater Management has been revised to require the Contractor to be responsible for managing the Temporary Stormwater Management system from implementation through Phase I Substantial Completion and from the start of Phase II construction through Phase II Substantial Completion
6. Bid Items 29, 30 and 31 have been removed from this Section
7. Bid items for 60-mil HDPE liner and drainage geocomposite have been revised to clarify that the Contractor is responsible for including sufficient material quantities in their bid to cover all waste, overlap and runoff.
8. A new Bid Item 30 – On-Site Screened Till has been added to this section
9. Bid Items have been renumbered to accommodate these changes
10. A copy of the revised Section 00150 Measurement and Payment is attached

E. SECTION 02223 – FILLING

1. Part 2.01(B) – Common Borrow Fill has been revised to reduce the maximum particle size from 8” to 6”

F. SECTION 02276 – HIGH DENSITY POLYETHYLENE (HDPE) LINER

1. Part 1.04(F) – Liner Leak Location Survey has been revised to include provisions in the event of high secondary leachate flow in Stage V Phase I after the Leak Location Survey has been completed.

G. STOCKPILE LOCATION PLAN

1. *A STOCKPILE LOCATION PLAN is attached to this Addendum to depict on-site stockpile locations.*

END OF ADDENDUM NO. 1

INVITATION TO BID

North Country Environmental Services, Inc. Stage V Landfill Expansion

Sealed proposals for the Stage V Landfill Expansion at the North Country Environmental Services, Inc. (NCES) facility in Bethlehem, New Hampshire will be received at the offices of CMA Engineers, Inc., 35 Bow Street Portsmouth, New Hampshire 03801 until Thursday, February 5, 2015 at 2:00 p.m. Bids received after the specified time will not be accepted.

The landfill expansion project includes among other things, expansion of the existing 60 mil HDPE primary and secondary liner systems; berm construction, installation of leachate forcemain piping, construction of a gravel road; waste excavation and relocation; installation of leachate collection piping; installation of gas header piping; and installation of drainage geocomposite, geosynthetic clay liner, select sand, screened till and stone; construction of stormwater ponds, piping and stormwater structures and temporary stormwater management. The work also includes general site work including excavation, stockpiling and filling, demolition, erosion control, loaming and seeding and general site restoration.

The Bidder is required to provide separate pricing for procurement and installation of 60-mil HDPE liner and drainage geocomposite in the event the Owner chooses to procure these materials separately. The Owner may remove the Bidder's procurement of the 60-mil HDPE liner and drainage geocomposite from the project without penalty to the Owner.

Stone fill required for this project will be processed on-site by the Owner for installation by the Contractor in accordance with the Contract Documents. Contractor shall be responsible for loading and transport of materials to the work area. Stone Fill includes:

- ¾" Stone
- 1.5" Stone
- NHDOT Type C Stone
- NHDOT Type A Rip-Rap fill
- Roadway Gravels

The Contractor is required to provide unit pricing for each of the above items in the event of a material shortage.

This construction project will proceed in two phases. The first phase is to be substantially completed within 180 calendar days of the start date of the Notice to Proceed. The second phase is to be completed by August 28, 2016. It is anticipated that the Notice to Proceed will be issued, and work will commence by April 27, 2015.

A mandatory pre-bid conference will be held at the site on Friday, January 16, 2015 at 10:00 a.m. Bids will be due no later than 2:00 p.m. on Thursday, February 5, 2015.

The successful bidder will be required to furnish a Performance Bond and a Payment Bond each in the amount of 100% of the Contract Price.

The Owner reserves the right to waive any informalities in any or all proposals, to reject any or all proposals, or accept any proposal submitted for the project, as deemed by the Owner to be in its best interests based upon qualifications, experience, demonstrated ability to perform, cost, and other factors deemed by the Owner to bear on the successful outcome of the Contract.

John Gay, Engineering Manager

CHANGE ORDER

CONTRACTOR:

OWNER:

SITE:

PROJECT:

CHANGE ORDER NUMBER: _____

DATE: _____

CONTRACT DESCRIPTION:

(Agreement) (Addendum) by and between

and

dated _____

as thereafter amended or changed pursuant to the terms of such Agreement (hereinafter referred to as the "Agreement") for the proper performance of all necessary, required and/or related Work to:

at the Site.

If Contractor believes that a Field Order from Owner justifies an increase in the Agreement Price or an extension of the Agreement Time, Contractor shall send a written notice to Owner requesting a Change Order within five (5) days after receipt by Contractor of such Field Order otherwise, Contractor shall perform all work required by the Field Order promptly and no change in the Agreement Price nor Agreement Time shall be permitted.

Contractor and Owner, intending to be legally bound hereby, agree to make the following changes to the Agreement:

- I. Contractor shall provide all necessary and required labor, materials, tools, services, equipment and incidentals to

- II. This Change Order shall incorporate by reference the terms and conditions of the Agreement as fully as if reproduced in its entirety herein.

BID PROPOSAL

Bidder: _____

Project: Stage V Landfill Expansion

Owner: North Country Environmental Services, Inc.

The undersigned, hereafter referred to as the BIDDER has examined the Contract Documents prepared in connection herewith by CMA Engineers, Inc., the ENGINEER. In addition, he has examined the site and is familiar with all the conditions surrounding the Work contemplated. He hereby submits the following:

BIDDER agrees to perform all the work described in the CONTRACT DOCUMENTS for the following unit prices or lump sums:

Signature Date

PART I - PHASE I (2015) BID PROPOSAL

No.	Item	Unit	Est Qty	UNIT PRICE (FIGURES)	TOTAL PRICE (FIGURES)
1	General Conditions	L.S.	1		
2	Excavation	C.Y.	90,000		
3	Filling	C.Y.	25,000		
4	Erosion Control & Site Stabilization	L.S.	1		
5	Demolition	L.S.	1		
6	Roadway, Site Work and Stormwater Ponds	L.S.	1		
7	Waste Excavation & Odor Control	L.S.	1		
8	Temporary Stormwater Management	L.S.	1		
9	Screened Till Fill	L.S.	1		
10	Secondary 60-mil HDPE Textured Liner	S.F.	199,000		
11	Installation of Secondary 60-mil HDPE Textured Liner	S.F.	199,000		
12	Secondary Bi-Planar 250-mil Drainage Geocomposite	S.F.	199,000		
13	Installation of Secondary Bi-Planar 250-mil Drainage Geocomposite	S.F.	199,000		
14	Secondary Leachate Collection System	L.S.	1		
15	Select Sand	L.S.	1		
16	Primary 60-mil HDPE Textured Liner	S.F.	199,000		
17	Installation of Primary 60-mil HDPE Textured Liner	S.F.	199,000		
18	Primary Bi-Planar 300-mil Drainage Geocomposite	S.F.	199,000		
19	Installation of Primary Bi-Planar 300-mil Drainage Geocomposite	S.F.	199,000		
20	Primary Leachate Collection System	L.S.	1		
21	Forcemain	L.S.	1		
22	Stormwater Management and Stabilization	L.S.	1		
23	Landfill Gas Improvements	L.S.	1		

PHASE I SUBTOTAL (FIGURES):

(Written) _____ Dollars and
 _____ Cents

PART II - PHASE II (2016) BID PROPOSAL

No.	Item	Unit	Est Qty	UNIT PRICE (FIGURES)	TOTAL PRICE (FIGURES)
1	General Conditions	L.S.	1		
2	Excavation	C.Y.	N/A		N/A
3	Filling	C.Y.	N/A		N/A
4	Erosion Control & Site Stabilization	L.S.	1		
5	Demolition	L.S.	1		
6	Roadway, Site Work and Stormwater Ponds	L.S.	N/A		N/A
7	Waste Excavation & Odor Control	L.S.	N/A		N/A
8	Temporary Stormwater Management	L.S.	1		
9	Screened Till Fill	L.S.	1		
10	Secondary 60-mil HDPE Textured Liner	S.F.	159,000		
11	Installation of Secondary 60-mil HDPE Textured Liner	S.F.	159,000		
12	Secondary Bi-Planar 250-mil Drainage Geocomposite	S.F.	159,000		
13	Installation of Secondary Bi-Planar 250-mil Drainage Geocomposite	S.F.	159,000		
14	Secondary Leachate Collection System	L.S.	1		
15	Select Sand	L.S.	1		
16	Primary 60-mil HDPE Textured Liner	S.F.	159,000		
17	Installation of Primary 60-mil HDPE Textured Liner	S.F.	159,000		
18	Primary Bi-Planar 300-mil Drainage Geocomposite	S.F.	159,000		
19	Installation of Primary Bi-Planar 300-mil Drainage Geocomposite	S.F.	159,000		
20	Primary Leachate Collection System	L.S.	1		
21	Forcemain	L.S.	1		
22	Stormwater Management and Stabilization	L.S.	1		
23	Landfill Gas Improvements	L.S.	1		

PHASE II SUBTOTAL: (FIGURES)

(Written) _____ Dollars and
 _____ Cents

TOTAL (PHASE I + PHASE II):

(Written) _____ Dollars and
 _____ Cents

PART III - SUPPLEMENTAL UNIT PRICES

Should certain additional work be required, or should quantities of certain classes of work be increased or decreased from those on which the Contract Sum is based, by order or approval of the Engineer, the undersigned agrees that the following supplemental unit prices may be used as the basis of payment to him/her or credit to the Owner for such addition, increase, or decrease in the work as determined solely by the Owner.

Supplemental prices shall cover all costs, complete in place, and the prices given shall balance with the respective amount per unit to be paid to the Contractor under applicable items of Parts I & II – Base Bid, or refunded to the Owner (in the case of deductions or decreases). No additional adjustments will be allowed for overhead, profit, insurance, or indirect expenses of the Contractor beyond the prices as listed. Owner has the right to reject any or all supplemental unit prices when in Owner's opinion the price appears not to be balanced with Owner's assessment of balanced prices in comparison to other bidders. These prices shall apply to both Phase I (2015) and Phase II (2016) work.

PART II - SUPPLEMENTAL UNIT PRICE ITEMS

No.	Item	Unit	Est Qty	UNIT PRICE (FIGURES)	TOTAL PRICE (FIGURES)
24	3/4" Stone	Ton	N/A		N/A
25	1.5" Stone	Ton	N/A		N/A
26	NHDOT Type C Stone	Ton	N/A		N/A
27	NHDOT Type A Rip-Rap Fill	Ton	N/A		N/A
28	Crushed Gravel (NHDOT Item 304.3)	Ton	N/A		N/A
29	Gravel (NHDOT Item 304.2)	Ton	NA		N/A
30	On-Site Screened Till	C.Y.	NA		N/A

III. Contractor shall obtain the necessary insurance coverage and Certificates of Insurance as required by the Agreement prior to performing any Work.

IV. All other terms and conditions of the Agreement shall remain the same.

V. Change Order Summary:

- A. The original Agreement Price was \$ _____
- B. Net change by previously authorized Change Orders \$ _____
- C. The Agreement Price prior to this Change Order was \$ _____
- D. The Agreement Price for this Change Order is \$ _____
- E. The new Agreement Price of the Agreement (including this Change Order) is \$ _____
- F. The Agreement Time for Substantial Completion of the Work required pursuant to the Agreement and this Change Order shall (be _____, 20__ (remain unchanged).

IN WITNESS WHEREOF, the parties hereto set forth their signatures as of the date first set forth above.

WITNESS:

CONTRACTOR:

By: _____
Printed Name: _____

By: _____
Printed Name: _____
Title: _____

WITNESS:

OWNER:

CASELLA WASTE SYSTEMS, INC.

By: _____
Printed Name: _____

By: _____
Printed Name: _____
Title: _____

SECTION 00150
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Measurement of Quantities
- B. Scope of Payment
- C. Payment for Increased and Decreased Quantities
- D. Eliminated Bid Items
- E. Partial Payments
- F. Payment for Materials on Hand
- G. Incidental (Subsidiary) Work
- H. Measurement and Payment of Bid Items

1.02 RELATED REQUIREMENTS

- A. PART I Contract Documents
- B. PART II All Technical Specifications

1.03 GENERAL

- A. Each unit and lump sum price stated in the Bid Proposal shall constitute full compensation, as herein specified, for each item of the work completed.
- B. All unit price bid items will be measured to determine final quantities of Work in place after completion of the Work and prior to the Final Payment of the Contract.
- C. All units of measurement shall be standard United States units as applied to the specific items of work by industry tradition and as interpreted by the Engineer.

1.04 PARTIAL PAYMENT/MONTHLY PAY ESTIMATE

- A. After Award of the Contract and prior to the Contractor's Mobilization on-site, the Contractor shall submit a breakdown of component quantities (and their unit prices) of the individual lump sum unit bid prices. This information shall form the basis for preparation of the monthly cost estimate in the "Monthly Progress Summation" form.
- B. Prior to request for partial payment, the Contractor's superintendent or other authorized representative of the Contractor shall meet with the Engineer and determine and agree upon quantities of the unit price work accomplished and/or completed during the work period.
- C. Once each month the Contractor will prepare a "Monthly Progress Summation" form as part of his partial payment request. The Payment Application shall be prepared on a form acceptable to the Owner and approved by the Engineer. The form shall be in a computer spreadsheet format and compatible with Microsoft Excel.
- D. These completed forms will provide the basis of the Engineer's review of monthly quantity estimates upon which payment will be made. Items not appearing on the "Monthly Progress Summation" will not be considered for payment.

- E. The Contractor shall submit with each payment application a bill of sale, invoice, or other documentation warranting that the Owner has received the material and equipment free and clear of all liens and that the materials and equipment are covered by appropriate insurance per paragraph 14.2 of the General Conditions.

1.05 SCOPE OF PAYMENT

- A. For lump sum payment items, payments to the Contractor will be based upon the Engineer's estimate of percentage completion of the lump sum tasks. The estimate shall be based on approximated quantities of work completed in accordance with the Plans and Specifications and shall be reviewed and approved by the Engineer.

For unit price payment items (where applicable), payments to the Contractor will be made for the actual quantities of contract items performed and accepted in accordance with the plans and specifications. Upon completion of the construction, if these actual quantities show either an increase or decrease from the quantities given in the Proposal Form, the contract unit prices will still prevail, except as provided hereinafter.

- B. The Contractor shall accept as payment as herein provided, full compensation for furnishing all materials, labor, tools, equipment, and incidentals necessary to the completed work and for performing all work contemplated and embraced by the contract. The payment shall be made with the prices contained in the Bid Proposal and shall include compensation for all loss or damage arising from the nature of the work, or from the action of the elements, or from any unforeseen difficulties which may be encountered during the prosecution of the work and until its final acceptance by the Engineer, and for all risks of every description connected with the prosecution of the work, except as provided herein, and also for all expenses incurred in consequence of the suspension of the work as herein authorized.
- C. The payment of any partial estimate or of any retained percentage except by and under the approved final invoice in no way shall affect the obligation of the Contractor to repair or renew any defective parts of the construction or to be responsible for any damage due to such defects.

1.06 PAYMENT FOR INCREASED OR DECREASED QUANTITIES

- A. When alterations in the quantities of work not requiring supplemental agreements are ordered and performed, the Contractor shall accept payment in full at the contract price for the actual quantities of work done. No allowance will be made for anticipated profits.

Unit quantity bid items and prices shall apply to extra authorized work or decreases in work as determined by the Engineer, where required work is in addition to or decreased from the limits of work indicated on the Plans.

- B. Increased or decreased work involving supplemental agreements will be paid for as stipulated in such agreements.
- C. Measurements for increased or decreased work shall be based on actual field surveys performed jointly by the Engineer and Contractor unless other measurement techniques are approved by the Engineer.

1.07 ELIMINATED ITEMS

- A. The Engineer may eliminate any items from the Contract should they be found unnecessary for the proper completion of the work contracted. Such action shall in no way invalidate the contract, and no allowance will be made for items so eliminated in making final payment to the Contractor.

1.08 PARTIAL PAYMENT

- A. Partial Payments shall be made monthly as the work progresses. All partial invoices and payments shall be subject to correction in the final quantity invoice and payment.
- B. No monthly payment shall be required to be made when, in the judgment of the Engineer, the work is not proceeding in accordance with the provisions of the contract, or when, in his judgment, the total value of the work done since the last payment amounts to less than \$10,000.

1.09 PAYMENT FOR MATERIAL DELIVERED ON LUMP SUM PROJECTS

- A. At the discretion of the Engineer, acting upon the request of the Contractor, an invoice, accompanied by receipted bills, may be made for payment of all or part of the value of acceptable, non-perishable materials and equipment which are to be incorporated into the contract which have been delivered to the site of the work or in acceptable storage places, and not used at the time of such invoice.
- B. Materials, when so paid for by the Owner shall become the property of the Owner and in the event of default on the part of the Contractor, the Owner may use, or cause to be used, these materials in the construction of the work provided for in the contract.
- C. The Contractor shall be responsible for any damage to, or loss of, these materials.
- D. The amount thus paid by the Owner shall go to reduce estimated amounts due the Contractor as the material is used in the work.

1.10 INCIDENTAL WORK

- A. Incidental work items for which payment is not measured or made include but are not limited to, the following items:
 - 1. Bond, insurance, and administrative costs.
 - 2. Incidental Site Preparation, including removal of existing debris in the work area, and disposing of the materials at authorized disposal facilities.
 - 3. Clean up.
 - 4. Security, signs, safety equipment, etc.
 - 5. Restoration of property.
 - 6. Cooperation with other Contractors.
 - 7. Utility crossing, unless otherwise paid for.
 - 8. Minor items - such as replacement of fences, guard rails, rockwalls, etc.
 - 9. Dewatering.
 - 10. Roadway and parking area - signage.
 - 11. Erosion control.
 - 12. Preconstruction photographs.

13. Temporary utilities.
14. Traffic regulation.
15. Other associated work.
16. Testing.
17. All other work indicated on the Drawings or in the Specifications which is required and not specifically indicated in the bid items below.

Item Number 1 – General Conditions

MEASUREMENT: This item will not be measured as a unit.

PAYMENT: Payment for General Conditions will be full compensation for all labor, materials & equipment for work not in other items. Work incidental to this item includes equipment and personnel mobilization and demobilization, office trailers, mobile phones, fax machines, per diem accommodations, fuel, survey, record drawing data collection, contract administration, office administration, field management.

The amount bid for General Conditions cannot exceed ten percent (10%) of the total Bid Price.

Partial payment will be as follows:

50% of the lump sum bid will be paid upon complete mobilization. Once mobilization is complete and two weeks of successful progress is made.

40% of the lump sum bid will be paid upon Final Completion.

10% once all record drawing information is submitted and deemed complete and 10 consecutive days of passing leakage test (30 gallons per acre per day) on Phase I only.

Item Number 2 – Excavation

MEASUREMENT: This per Cubic Yard item will be measured by survey. A pre construction survey will be completed by the owner and a post construction survey (likely aerial survey) will be performed by the owner and the two compared to evaluate the final excavation quantity. Pay estimates will be evaluated and agreed upon by the field Engineer and contractor's representative.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to complete all excavation and grading to the prepared subgrade as shown on the Plans and as necessary to complete the work. Item also includes excavation and filling to the proposed landfill subgrade and to proposed perimeter berm grades outside the landfill footprint, and sorting and stockpiling excavated materials in designated areas as required in all respects of the Contract Documents. Contractor shall segregate excavated materials as rock greater than 6" diameter and soil and rock less than 6" diameter. Rocks that are 6" or greater in diameter shall be stored in the Phase II work area. Excess soil and rock less than 6" diameter shall be stored on the landfill in areas designated by the Owner and not more than 2,000 feet from the Stage V work area.

Item Number 3 – Filling

MEASUREMENT: This per Cubic Yard item will be measured by survey. A pre construction survey will be completed by the owner and a post construction survey (likely aerial survey) will be performed by the owner and the two compared to evaluate the final fill quantity. Pay estimates will be evaluated and agreed upon by the field Engineer and contractor's representative.

MEASUREMENT AND PAYMENT

North Country Environmental Services Stage V Landfill Expansion 1/15 – Revised 01/21/15

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to complete all common borrow filling and grading to the prepared subgrade as shown on the Plans and as necessary to complete the work. Item also includes filling to proposed perimeter berm grades outside the landfill footprint as required in all respects of the Contract Documents.

Item Number 4 – Erosion Control & Site Stabilization

MEASUREMENT: This item will be an estimated percentage of total work under this item completed during each pay period.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to complete all erosion control and site stabilization work as shown on the Plans. Payment for this item includes the installation and maintenance of all temporary erosion control devices and all appurtenant work in full conformance with the Drawings and Specifications.

This item shall include all other work required to complete the Work not included on other payment items.

Item Number 5 – Demolition

MEASUREMENT: This item will be an estimated percentage of total work under this item at the time of the pay period close.

PAYMENT: Payment for this item will be full compensation for all labor, materials and equipment required to demolish existing leachate manholes, valve chamber, forcemain, Geokon unit, underground electric, culverts, gas headers/laterals and groundwater wells in full conformance with the Drawings and Specifications.

Item Number 6 – Roadway, Site Work and Stormwater Ponds

MEASUREMENT: This item will be an estimated percentage of total work under this item at the time of the pay period close.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to construct the perimeter access road including installation of common borrow to achieve required subgrades, gravels, woven geotextile, guardrail and all appurtenant work in full conformance with the Drawings and Specifications.

Item Number 7 – Waste Excavation & Odor Control

MEASUREMENT: This item will be an estimated percentage of total work under this item at the time of the pay period close.

PAYMENT: Payment for this item will include full compensation for all labor, materials and equipment required to excavate and relocate intermediate cover soils and waste materials in full conformance with the Drawings and Specifications. Work includes removing waste materials to the required grade, decommissioning and extending the existing landfill gas collection system in the excavation area, installation of temporary tarp and ballasts, and relocation and filling of waste materials, including installation of daily and intermediate soil cover materials, and provision and utilization of odor control agent as deemed necessary by Engineer and Owner. Item also includes preparation and implementation of Site Safety & Contingency Work Plan. Contractor shall relocate

MEASUREMENT AND PAYMENT

North Country Environmental Services Stage V Landfill Expansion 1/15 – Revised 01/21/15

waste to areas designated by the Owner at a distance of not more than 2,000 feet from the Stage V work area.

Item Number 8 – Temporary Stormwater Management

MEASUREMENT: This item will be an estimated percentage of total work under this item at the time of the pay period close.

PAYMENT: Payment for this item will include full compensation for all labor, materials and equipment required to temporarily manage stormwater generated within the Stage V footprint in full conformance with the Drawings and Specifications. Work includes construction of primary and secondary stormwater containment walls and providing stormwater discharge pumps to remove accumulated stormwater within the Stage V footprint.

Contractor shall take all measures and precautions necessary to properly control the temporary stormwater management system and containment berm required for the connection to the existing Stage IV Phase I primary and secondary liner systems and construction of the new Stage V sump. Contractor shall prevent any stormwater from escaping from the containment area to the leachate collection system. Contractor shall operate and maintain the containment system and pumps 24 hours per day for the duration that the containment system is operational, and have on-site back up pumps and back-up gas/diesel powered generators in the event existing electrical connections or generator cease to function. Contractor shall be responsible for managing the Temporary Stormwater Management from implementation through Phase I Substantial Completion and from the start of Phase II construction through Phase II Substantial Completion.

Item Number 9 – Screened Till Fill

MEASUREMENT: This item will be an estimated percentage of total work under this item at the time of the pay period close.

PAYMENT: Payment for the screened till fill materials will be full compensation for all labor, materials, equipment required to procure and install the screened till in full conformance with the Drawings and Specifications.

Item Number 10 – Secondary 60-mil HDPE Textured Liner

MEASUREMENT: This item will be measured as the square foot area calculated to be lined within the proposed cell. Area will be calculated perpendicular to slopes. Any waste, overlap or anchor trench run out will not be measured. Measurement of this item shall be determined by survey of the installed Secondary Liner as the number of square feet bounded by the extrusion weld of the Stage V connection to existing Stage IV and the limit of the anchor trench as detailed on Sheet 11 Detail 9 of the Construction Drawings.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to procure the 60-mil textured HDPE secondary liner system. This includes all warranties, providing all quality control documentation excess materials needed to account for waste, overlap and anchor trench run out and all other work required to achieve full compliance with the Drawings and Specifications.

60-mil textured HDPE liner may be procured by the Owner for either or both phases of the project. The Owner will provide a quantity of liner equal to the square footage of the cell, accounting for

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slopes, plus an additional 10% to account for waste, overlap and anchor trench run out. Additional liner required to complete the project, if any, shall be procured by the Contractor at its cost in the event the Owner procures the liner. The Owner may remove this item from either or both phases of the project without penalty to the Owner.

Item Number 11 – Installation of Secondary 60-mil HDPE Textured Liner

MEASUREMENT: This item will be measured as the square foot area lined within the cell. Area will be measured perpendicular to slopes. Any waste, overlap and anchor trench run out will not be measured. Measurement of this item shall be determined by survey of the installed Secondary Liner as the number of square feet bounded by the extrusion weld of the Stage V connection to existing Stage IV and the limit of the anchor trench as detailed on Sheet 11 Detail 9 of the Construction Drawings.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to install the 60-mil textured HDPE secondary liner system. This includes all seaming, testing, replacing, or other remedial work, warranties, providing all quality control documentation, excess materials needed to account for waste, overlap and anchor trench run out, and all other work required to achieve full compliance with the Drawings and Specifications.

Item Number 12 – Secondary Bi-Planar 250-mil Drainage Geocomposite

MEASUREMENT: This item will be measured as the square foot area calculated to be lined within the proposed cell. Area will be calculated perpendicular to slopes. Any waste, overlap or anchor trench run out will not be measured. Measurement of this item shall be determined by survey of the installed Secondary Liner as the number of square feet bounded by the extrusion weld of the Stage V connection to existing Stage IV and the limit of the anchor trench as detailed on Sheet 11 Detail 9 of the Construction Drawings.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to procure the secondary double sided drainage geocomposite, including all warranties, quality control documentation and excess materials needed to account for waste, overlap and anchor trench run out in full conformance with the Drawings and Specifications.

Drainage geocomposite may be procured by the Owner for either or both phases of the project. The Owner will provide a quantity of drainage geocomposite equal to the square footage of the cell, accounting for slopes, plus an additional 10% for waste, overlap and anchor trench run out. Additional drainage geocomposite required to complete the project, if any, shall be procured by the Contractor at its cost in the event the Owner procures the drainage geocomposite. The Owner may remove this item from either or both phases of the project without penalty to the Owner.

Item Number 13 – Installation of Secondary Bi-Planar 250-mil Drainage Geocomposite

MEASUREMENT: This item will be measured as the square foot area lined within the cell. Area will be measured perpendicular to slopes. Any waste, overlap and anchor trench run out will not be measured. Measurement of this item shall be determined by survey of the installed Secondary Liner as the number of square feet bounded by the extrusion weld of the Stage V connection to existing Stage IV and the limit of the anchor trench as detailed on Sheet 11 Detail 9 of the Construction Drawings.

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PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to install the secondary double sided drainage geocomposite including all warranties, quality control documentation and excess materials needed to account for waste, overlap and anchor trench run out in full conformance with the Drawings and Specifications.

Item Number 14 – Secondary Leachate Collection System

MEASUREMENT: This item will be an estimated percentage of total work under this item at the time of the pay period close.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to furnish and install all secondary leachate collection piping and cleanouts, pump station manhole and riser, non-woven geotextiles, additional double-sided geocomposite, geosynthetic clay liner, ¾" crushed stone and other materials in full conformance with the Drawings and Specifications.

Item Number 15 – Select Sand

MEASUREMENT: This item will be an estimated percentage of total work under this item at the time of the pay period close.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to procure, and install select sand in full conformance with the Drawings and Specifications.

Item Number 16 – Primary 60-mil HDPE Textured Liner

MEASUREMENT: This item will be measured as the square foot area calculated to be lined within the proposed cell. Area will be calculated perpendicular to slopes. Any waste, overlap or anchor trench run out will not be measured. Measurement of this item shall be determined by survey of the installed Secondary Liner as the number of square feet bounded by the extrusion weld of the Stage V connection to existing Stage IV and the limit of the anchor trench as detailed on Sheet 11 Detail 9 of the Construction Drawings. Note that the Secondary Liner surveyed quantity will be used to determine the square foot quantity of this item.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to procure the 60-mil textured HDPE primary liner system. This includes all warranties, providing all quality control documentation, excess materials needed to account for waste, overlap and anchor trench run out and all other work required to achieve full compliance with the Drawings and Specifications.

60-mil textured HDPE liner may be procured by the Owner for either or both phases of the project. The Owner will provide a quantity of liner equal to the square footage of the cell, accounting for slopes, plus an additional 10% to account for waste, overlap and anchor trench run out. Additional liner required to complete the project, if any, shall be procured by the Contractor at its cost in the event the Owner procures the liner. The Owner may remove this item from either or both phases of the project without penalty to the Owner.

Item Number 17 – Installation of Primary 60-mil HDPE Textured Liner

MEASUREMENT: This item will be measured as the square foot area lined within the cell. Area will be measured perpendicular to slopes. Any waste, overlap and anchor trench run out will not be measured. Measurement of this item shall be determined by survey of the installed Secondary Liner

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as the number of square feet bounded by the extrusion weld of the Stage V connection to existing Stage IV and the limit of the anchor trench as detailed on Sheet 11 Detail 9 of the Construction Drawings. Note that the Secondary Liner surveyed quantity will be used to determine the square foot quantity of this item.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to install the 60-mil textured HDPE primary liner system. This includes all seaming, testing, replacing, or other remedial work, warranties, providing all quality control documentation, excess materials needed to account for waste, overlap and anchor trench run out, and all other work required to achieve full compliance with the Drawings and Specifications.

Item Number 18 – Primary Bi-Planar 300-mil Drainage Geocomposite

MEASUREMENT: This item will be measured as the square foot area calculated to be lined within the proposed cell. Area will be calculated perpendicular to slopes. Any waste, overlap or anchor trench run out will not be measured. Measurement of this item shall be determined by survey of the installed Secondary Liner as the number of square feet bounded by the extrusion weld of the Stage V connection to existing Stage IV and the limit of the anchor trench as detailed on Sheet 11 Detail 9 of the Construction Drawings. Note that the Secondary Liner surveyed quantity will be used to determine the square foot quantity of this item.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to procure the secondary double sided drainage geocomposite, including all warranties, quality control documentation and excess materials needed to account for waste, overlap and anchor trench run out in full conformance with the Drawings and Specifications.

Drainage geocomposite may be procured by the Owner for either or both phases of the project. The Owner will provide a quantity of drainage geocomposite equal to the square footage of the cell, accounting for slopes, plus an additional 10% for waste, overlap and anchor trench run out. Additional drainage geocomposite required to complete the project, if any, shall be procured by the Contractor at its cost in the event the Owner procures the drainage geocomposite. The Owner may remove this item from either or both phases of the project without penalty to the Owner.

Item Number 19 – Installation of Primary Bi-Planar 300-mil Drainage Geocomposite

MEASUREMENT: This item will be measured as the square foot area lined within the cell. Area will be measured perpendicular to slopes. Any waste, overlap and anchor trench run out will not be measured. Measurement of this item shall be determined by survey of the installed Secondary Liner as the number of square feet bounded by the extrusion weld of the Stage V connection to existing Stage IV and the limit of the anchor trench as detailed on Sheet 11 Detail 9 of the Construction Drawings. Note that the Secondary Liner surveyed quantity will be used to determine the square foot quantity of this item.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to install the secondary double sided drainage geocomposite including all warranties, quality control documentation and excess materials needed to account for waste, overlap and anchor trench run out in full conformance with the Drawings and Specifications.

Item Number 20 – Primary Leachate Collection System

MEASUREMENT: This item will be an estimated percentage of total work under this item at the time of the pay period close.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to furnish and install all primary leachate collection piping and cleanouts, connection to existing Stage IV Phase I piping, non-woven geotextiles, additional double-sided geocomposite, geosynthetic clay liner, ¾" crushed stone, 1.5" crushed stone (or 4" washed bank run stone) and other materials in full conformance with the Drawings and Specifications.

Item Number 21 – Forcemain

MEASUREMENT: This item will be an estimated percentage of total work under this item at the time of the pay period close.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to furnish and install the 3" forcemain and dual-walled forcemain outside of anchor trench, relocate existing forcemain outside of the Stage V work area and through the Stage IV Phase I waste excavation area and install forcemain air release chamber and other materials in full conformance with the Drawings and Specifications.

Item Number 22 – Stormwater Management and Stabilization

MEASUREMENT: This item will be an estimated percentage of total work under this item at the time of the pay period close.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to furnish and install stormwater improvements in full conformance with the Drawings and Specifications. This work includes construction of Detention Ponds 5 and 6, outlet structure, stone outlet protection, stormwater swales, culverts and headwalls, expansion of the western toe swale, plunge pool and loam and seed disturbed areas.

Item Number 23 – Landfill Gas Improvements

MEASUREMENT: This item will be an estimated percentage of total work under this item at the time of the pay period close.

PAYMENT: Payment for this item will be full compensation for all labor, materials and equipment required to furnish and install HDPE gas header pipe and appurtenances. This includes all pipe fusing and connections, testing, replacing, or other remedial work, warranties, providing all quality control documentation, and all other work required to achieve full compliance with the Drawings and Specifications.

Item Number 24 – ¾" Stone

MEASUREMENT: This item will be measured as the number of tons of ¾" Stone installed under this item at the time of the pay period close. This bid item is in the event of a material shortage, to be approved by the Owner. Tons of ¾" Stone are to be measured on the NCES scale.

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PAYMENT: Payment for this item will be full compensation for all labor, materials and equipment required to furnish additional ¾" Stone necessary to complete the work required to achieve full compliance with the Drawings and Specifications.

Item Number 25 – 1.5" Stone

MEASUREMENT: This item will be measured as the number of tons of 1.5" Stone installed under this item at the time of the pay period close. This bid item is in the event of a material shortage, with quantities to be approved by the Owner. Tons of 1.5" Stone are to be measured on the NCES scale.

PAYMENT: Payment for this item will be full compensation for all labor, materials and equipment required to furnish additional 1.5" Stone necessary to complete the work required to achieve full compliance with the Drawings and Specifications. This bid item is in the event of a material shortage, with quantities to be approved by the Owner.

Item Number 26 – NHDOT Type C Stone

MEASUREMENT: This item will be measured as the number of tons of NHDOT Type C Stone installed under this item at the time of the pay period close. This bid item is in the event of a material shortage, with quantities to be approved by the Owner. Tons NHDOT Type C Stone are to be measured on the NCES scale.

PAYMENT: Payment for this item will be full compensation for all labor, materials and equipment required to furnish additional NHDOT Type C Stone necessary to complete the work required to achieve full compliance with the Drawings and Specifications. This bid item is in the event of a material shortage, with quantities to be approved by the Owner.

Item Number 27 – NHDOT Type A Rip-Rap Fill

MEASUREMENT: This item will be measured as the number of tons of NHDOT Type A Rip-Rap Fill installed under this item at the time of the pay period close. This bid item is in the event of a material shortage, with quantities to be approved by the Owner. Tons of NHDOT Type A Rip-Rap Fill are to be measured on the NCES scale.

PAYMENT: Payment for this item will be full compensation for all labor, materials and equipment required to furnish additional NHDOT Type A Rip-Rap Fill necessary to complete the work required to achieve full compliance with the Drawings and Specifications. This bid item is in the event of a material shortage, with quantities to be approved by the Owner.

Item Number 28 – Crushed Gravel (NHDOT Item 304.3)

MEASUREMENT: This item will be measured as the number of tons of Crushed Gravel (NHDOT Item 304.3) installed under this item at the time of the pay period close. This bid item is in the event of a material shortage, with quantities to be approved by the Owner. Tons of Crushed Gravel (NHDOT Item 304.3) are to be measured on the NCES scale.

PAYMENT: Payment for this item will be full compensation for all labor, materials and equipment required to furnish additional Crushed Gravel (NHDOT Item 304.3) necessary to complete the work required to achieve full compliance with the Drawings and Specifications. This bid item is in the event of a material shortage, with quantities to be approved by the Owner.

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Item Number 29 – Gravel (NHDOT Item 304.2)

MEASUREMENT: This item will be measured as the number of tons of Gravel (NHDOT Item 304.2) installed under this item at the time of the pay period close. This bid item is in the event of a material shortage, with quantities to be approved by the Owner. Tons of Gravel (NHDOT Item 304.2) are to be measured on the NCES scale.

PAYMENT: Payment for this item will be full compensation for all labor, materials and equipment required to furnish additional Gravel (NHDOT Item 304.2) necessary to complete the work required to achieve full compliance with the Drawings and Specifications. This bid item is in the event of a material shortage, with quantities to be approved by the Owner.

Item Number 30 – On-Site Screened Till

MEASUREMENT: This item will be measured as the number of cubic yards of On-Site Screened Till processed and installed under this item at the time of the pay period close. This bid item is provided for the Contractor to process and install screened till from the Stage V excavation area as an alternative to an off-site source subject to the material meeting specification.

PAYMENT: Payment for the screened till fill materials from on-site sources will be full compensation for all labor, materials, equipment required to process and install the screened till in full conformance with the Drawings and Specifications. This Bid Item is subject to the Owner's approval.

END OF SECTION

SECTION 02223
FILLING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Furnishing, placing, and compaction of suitable fill (borrow) and bedding sand.
- B. Placing and compaction of screened till from on-site till materials, procured by Owner.
- C. Coordination with the Engineer for completion of all required tests.

1.02 RELATED REQUIREMENTS

- A. Section 01300 - Submittals
- B. Section 01400 - Quality Assurance/Quality Control
- C. Section 02222 - Excavation
- D. Section 02231 - Select Aggregates
- E. Section 02232 - Stone Fill
- F. Section 02234 - Select Sand
- G. Section 02270 - Erosion Control
- H. Section 02930 - Loaming and Seeding

1.03 REFERENCES

- A. ASTM C136/C117 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate and Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing
- B. ASTM D1557 Method "C" - Moisture-Density Relations of Soils and Soil-Aggregate Mixture using 10 lb. (4.54 kg) Hammer and 18-inch (457 mm) Drop.
- C. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
- D. ASTM D6938 - 08a Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- E. ASTM D5084 - Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
- F. ASTM D5321 - Standard Test Method for Direct Shear Testing of Geosynthetic Material and Soil Interfaces.

1.04 TESTS

- A. Soil testing and compaction tests shall be performed by the Engineer in coordination with the Contractor.
- B. Test and analysis of fill materials shall be performed by the Engineer in coordination with the Contractor.
- C. Tests and analyses of fill materials will be performed in accordance with ASTM C136/C117, ASTM D1557, ASTM D6938-08a, ASTM D5084 and ASTM D5321 and conditions set forth in Section 02223, 2.02 "Quality Control and Quality Assurance."

PART 2 PRODUCTS

2.01 FILL

A. General

For all fill materials to be used, samples, sieve analysis, and laboratory data indicating maximum dry densities and optimum moisture for field control tests shall be obtained by the Engineer prior to use as fill on site. The Contractor shall excavate, screen, and stockpile materials as required for sampling by the Engineer prior to delivery and placement.

B. Common Borrow Fill

Suitable borrow from off-site sources to be utilized as common borrow fill shall consist of soil with all rocks or material greater than 6" removed and no more than 30% passing the No. 200 sieve. Suitable fill shall be free from combustible, organic and frozen materials, loam, roots, topsoil, wood, trash, snow, ice, and other objectionable materials, or as identified by the Engineer.

C. Screened Till

Screened Till for use as the 12 inches of screened till fill and pipe bedding shall consist of inorganic mineral soil free of organic material, loam, trash, snow, ice, frozen soil, or other unsuitable materials and shall conform to the following gradation:

<u>U. S. Standard Sieve Size</u>	<u>% Finer By Weight</u>
1 inch	100
No. 4	80-100
No. 40	60-100

Screened till shall have a hydraulic conductivity of less than 1×10^{-4} cm/sec when as demonstrated by ASTM D5084, when placed and compacted as specified as a subgrade fill beneath the secondary liner.

1. Interface Shear Strength: Testing completed by the Engineer shall demonstrate that the interface shear strength is equal to or greater than a strength envelope of 26^0 between the 60-mil textured HDPE liner and the proposed screened till.
2. The interface shear strength shall be determined by an interface shear test performed in accordance with ASTM D5321. The normal stresses applied shall be 1, 3, 10, 25, and 50 psi. The strain rate shall not exceed 0.04 inches per minute. The 60-mil textured HDPE geomembrane shall be tested in the machine direction. The tests shall be continued until residual shear strengths are achieved, or to a maximum 2-inch displacement. The Screened Till shall be compacted to 93% of maximum dry density per ASTM D1557, and a moisture content of 2% wet of optimum.

The laboratory test reports shall include plots of shear strength versus normal stress for peak and large displacement values, and stress versus strain plots for tests run at each normal load application. A minimum of two (2) tests shall be completed.

3. Test results not meeting the minimum requirements shall be reviewed by the Engineer for possible conformance with the overall design objectives.
- D. For other fill materials see Section 02234 Select Sand, Section 02541 - Gravel Roadway, and Section 02930 - Loaming and Seeding, as applicable.

2.02 QUALITY CONTROL AND QUALITY ASSURANCE

- A. During earthwork operations, the Engineer will be present on the site to monitor and document the Contractor's activities relative to contract compliance.
- B. The Engineer shall complete laboratory analyses of a minimum of two (2) representative samples of common borrow and screened till. The Engineer shall conduct laboratory grain size analysis, moisture density testing, and permeability in accordance with ASTM C136/C117, ASTM D1557, and ASTM D5084, respectively, to demonstrate conformance with Parts 2.01 and 3.02 of this Section.
- C. The Contractor shall provide a sample for Engineer's laboratory analysis of at least one (1) representative sample of common borrow fill and screened till for each 5,000 cubic yards of material to be placed. The Engineer shall conduct laboratory grain size analysis and moisture density testing in accordance with ASTM

C136/C117 and D1557, respectively, to demonstrate conformance with Parts 2.01 and 3.02 of this Section.

- D. The results of laboratory testing shall be reviewed by the Engineer prior to placement of fill materials. Costs for re-sampling and subsequent laboratory testing of all non-complying materials shall be borne by the Contractor.
- E. Field tests will be performed by the Engineer on in-place fill and backfill materials to confirm that specified densities are being achieved with the minimum required coverages and compaction equipment utilized by the Contractor. The Engineer will select locations and frequency for in-place density testing. At a minimum, the frequency of field tests shall be as follows:
 - 1. Common Borrow Fill: 1 test per 10,000 ft² installed
 - 2. Screened Till: 1 test per 10,000 ft² installed
- F. Acceptable materials placed and compacted to below the specified density shall alternatively be:
 - 1. Recompact as required to achieve the specified density.
 - 2. Removed and replaced with properly placed and acceptably compacted material.
- G. Materials placed and compacted which do not conform to project specifications for the area placed shall be removed and replaced with suitable material by the Contractor.
- H. The Contractor will bear all costs incurred in the recompaction, removal, and replacement of fill not meeting density requirements.

PART 3 EXECUTION

3.01 PREPARATION

- A. Fill to be used must be reviewed by the Engineer.
- B. The subgrade which is to receive the fill shall be fine-graded and compacted in accordance with Section 02222 "Excavation" and reviewed by the Engineer.
- C. All excavated surfaces shall be within 0.10'(+) and 0.20'(-) ft. of required line and grade.
- D. Surfaces to be filled against which are steeper than 4:1 shall be scarified or stepped and compacted to provide a bond with the new material.
- E. Fill materials will not be placed or compacted on frozen ground or during unfavorable weather conditions. Backfill operations will not be resumed until the moisture content and fill density is satisfactory to the Engineer.

- F. All fill material shall be placed "in-the-dry" on a prepared ground surface acceptable to the Engineer. The Contractor shall drain away ponded areas as required to perform the placement of fill in-the-dry.

3.02 FILLING AND COMPACTION

- A. Approved suitable material shall be installed in lifts no greater than as specified.
- B. Lifts shall be compacted to at least the specified percentage of maximum dry density, within 3% of optimum moisture content. Field testing of these lifts will be performed in accordance with ASTM D6938-08a, and Paragraph 2.02 of this Section.
- C. Do not proceed with the next layer of fill until the preceding layer has been tested and approved by the Engineer.
- D. Areas at which tests indicate insufficient compaction shall be recompact and retested until the areas conform to the requirements of this specification.
- E. For the materials specified herein, the following placement and compaction requirements are included:

	<u>Maximum Lift Before Compaction</u>	<u>Minimum % of Maximum Density per ASTM D1557</u>
Common Borrow Fill	12"	93
Screened Till	12"	93

3.03 BACKFILLING OF UTILITES AND PIPING

- A. After pipes and joints have been inspected and approved by the Engineer, screened till bedding or crushed stone (See Section 02232) shall be carefully placed and compacted and tamped in 6-inch layers under, around, and to the spring line of the pipe to firmly support the pipe, and prevent lateral movement.
- B. Care shall be taken to provide recesses in the bedding or trench bottom, as required, to relieve each bell of any load.
- C. Backfill from the top of the bedding to 12-inches above the pipe shall be completed in 12-inch layers with screened till sand, evenly on both sides of the pipe.
- D. The remainder of the backfill may be material removed from the trench excavation and shall be placed in approximately 12-inch layers and compacted to 93% of the

maximum dry density, as demonstrated by in-place density testing completed by the Engineer.

3.03 FINAL GRADING

- A. Perform all finish grading required to attain the elevations shown on the Plans, to within 0.1 feet, to eliminate all ponded water, or as otherwise indicated.
- B. Areas to be seeded shall be raked to remove all stones and other unsatisfactory material, and shall be suitably compacted.

3.04 TREATMENT AFTER COMPLETION OF GRADING

- A. After grading is complete and the Engineer has finished his reviews, the Contractor shall permit no further excavating, filling, grading, or vehicular access except to maintain erosion or sediment control. Use all means necessary to prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

END OF SECTION

SECTION 02276
HIGH DENSITY POLYETHYLENE (HDPE) LINER

PART I GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Furnishing of Textured 60-mil HDPE liner
- B. Quality Control for liner materials
- C. Field installation of the liner
- D. Leak location survey

1.02 RELATED REQUIREMENTS

- A. Section 01400 - Quality Assurance/Quality Control
- B. Section 01720 - Project Record Drawings
- C. Section 02223 - Filling
- D. Section 02231 - Select Aggregates
- E. Section 02232 - Stone Fill
- E. Section 02234 - Select Sand
- F. Section 02273 - Drainage Geocomposite
- G. Section 02279 - Geosynthetic Clay Liner (GCL)

1.03 APPLICABLE STANDARDS, CODES, AND REGULATIONS

- A. ASTM Standards for High Density Polyethylene Geomembrane
- B. Geosynthetics Research Institute - GRI-GM13 - latest revision
- C. ASTM D5321 - Test Method for Direct Shear Testing of Geosynthetic Material and Soil Interfaces
- D. ASTM D6747 - Standard Guide for Selection of Techniques for Electrical Detection of Potential Leak Paths in Geomembranes

1.04 QUALIFICATIONS

A. Liner Manufacturer:

The liner manufacturer shall have at least five (5) years continuous experience in the manufacture of HDPE geomembrane rolls and/or experience totaling 10,000,000 sq. ft. of manufactured HDPE geomembrane. The manufacturer shall permit the owner or his authorized representatives to visit the manufacturing plant.

B. Liner Installer:

The liner installer shall have successful experience in the installation of HDPE sheet using the dual hot wedge seaming method on projects with similar requirements to this project; and which is acceptable to, or licensed by the manufacturer of the primary materials for the installation of these materials.

Installer shall have a minimum of five (5) years experience performing this type of work.

C. Supervisor:

Installation shall be performed under the direction of a single competent English speaking installation supervisor who shall remain on-site and be in responsible charge throughout the liner installation, including subgrade acceptance, liner layout, seaming, testing and repairs, and all other related activities. The installation supervisor shall have supervised the installation of at least 3,000,000 sf of polyethylene geomembrane. Actual seaming shall be performed under the direction of a master seamer who may be the same person as the installation supervisor, and who has a minimum of 1,000,000 sf polyethylene geomembrane seaming experience using the same type of seaming apparatus as that specified in this project. The installation supervisor or master seamer must be on-site whenever seaming is being performed.

D. Quality Control:

The Contractor shall establish a Quality Control (QC) Representative who shall be responsible in the field for the quality and integrity of the HDPE liner installation. This responsibility shall include the inspection, testing, and documentation of all liner installation work as performed by the installer. The QC Representative shall have performed these duties on a minimum of 3,000,000 sf of HDPE membrane installation.

E. Laboratory:

The Engineer shall engage a qualified, independent laboratory acceptable by the Owner for use in completing the off-site tests of destructive samples specified herein.

Results of independent laboratory testing shall be transmitted directly from the lab to the Engineer and Contractor as soon as the data is available.

F. Liner Leak Location Survey:

The Contractor shall engage a qualified, independent testing company, acceptable by the Owner, to conduct a geomembrane electrical leak location survey following installation of the primary liner and placement of the geocomposite, select drainage sand, and select stone fill.

The independent testing company shall have performed these services on a minimum of 3,000,000 sf of geomembrane installation and shall have been performing such services for a minimum of 5 years.

Pre-qualified independent leak location contractors include:

1. Leak Location Services, Inc.
16124 University Oak

San Antonio, TX 78249
(210) 408-1241

2. Hutchinson Group, Ltd.
4280 Old William Penn Highway
Murrysville, PA 15668
(724) 325-3996

The Owner will monitor Secondary Leachate flow from Stage V Phase I for a period of 60 days after the Leak Location Survey is completed and any repairs are made. If the Secondary Leachate flows do not subside to a rate of less than 30 gallons per acre per day (gpad) for 10 consecutive days during this period, the Owner may require subsequent Leak Location Surveys and repairs to be completed at the cost of the Contractor. The Owner retains the right to hold retainage until secondary leachate flow has stabilized at a rate of 30 gpad or less for 10 consecutive days. Secondary leachate flow monitoring will not be conducted for Phase II construction.

G. Contractor Responsible for Subcontractors:

The roles of any subcontractor shall not relieve the Contractor of any responsibilities whatsoever under this contract. The Contractor shall be responsible for the actions and performance of the manufacturer, installer, supervisor, and QC representative under this contract. A Contractor's representative shall be on-site during all geomembrane installation activities.

1.05 SUBMITTALS

- A. Prior to release of the geomembrane for shipment to the job site, the Contractor shall submit the following to the ENGINEER:
 1. Written certification that the material was manufactured and tested in accordance with the requirements of GRI-GM13.
 2. Quality control certificates for each batch of resin and production of geomembrane in accordance with the testing requirements of GRI-GM13.
 3. Quality control certificates shall be signed by the responsible Quality Assurance (QA) personnel employed by the Manufacturer.
 4. Conformance testing shall be performed in accordance with the requirements and standards specified in GRI-GM13 and as specified herein for the HDPE membrane and its installation. Certificates of compliance shall be submitted for each roll to be used on the project prior to its release for shipment to the job site. Certificates of Compliance for HDPE welding rod to be used on the project shall be submitted.
 5. Shop Drawings showing the following:
 - a. Proposed layout of the HDPE membrane system.

- b. Details of jointing the HDPE membrane, anchoring, penetrations, repair, testing, areas of slack for anticipated thermal contraction, locations of leak detection electrodes and wiring, and other construction details
 - 6. Manufacturer's completed projects resume.
 - 7. Installer's completed project resume.
 - 8. Installer's crew identification list and resumes.
 - 9. Installation schedule.
 - 10. Manufacturer's and installer's warranty as described in Part 1.07.
 - 11. Leak Location Contractor's completed projects resume.
 - 12. Leak location Contractor's crew identification list and resumes.
 - 13. The Contractor shall provide representative samples of the proposed geomembrane to the Engineer to complete direct shear box testing of the proposed 60-mil textured HDPE geomembrane and screened till/select sand to demonstrate compliance of interface friction as required in Section 02223 (Filling).
 - 14. The Engineer shall complete direct shear box testing of the proposed 60-mil textured HDPE geomembrane and drainage geocomposites to demonstrate compliance of interface friction as required in Section 02273 (Drainage Geocomposite).
- B. Roll Identification:
- 1. Each roll shall have a permanently affixed label with the following information:
 - a. Name of manufacturer
 - b. Date of manufacture
 - c. Thickness of material (actual)
 - d. Roll number
 - e. Roll length
 - f. Roll width
- C. Record Drawings and QC Reports (See Parts 3 and 4)

1.06 QUALITY ASSURANCE

A. General:

Quality of the liner installation shall be the responsibility of the Contractor. The Contractor, in fulfilling this responsibility, will be assisted by his designated Manufacturer, Installer, QC representative, and Leak Location Contractor. The Contractor will be responsible for performing the Quality Assurance/Quality Control tasks outlined herein. The Engineer may conduct additional independent

testing and inspections. These actions will not remove any responsibility of the Contractor under this Contract.

B. Lines of Authority:

The Contractor shall establish an Installation Supervisor and a QC Representative who will assist the Contractor in his responsibilities in the quality of the liner installation. The QC Representative shall assist in coordinating the timing and sequencing of liner installation and testing with the Engineer.

C. Leak Location Survey:

The Contractor shall coordinate an electrical leak location survey following installation of the primary liner and placement of geocomposite, and primary select sand and stone (as applicable). The Contractor shall be responsible for removing cover materials to expose located leaks and shall be responsible for coordinating and repairing leaks and geotextile, and replacing sand materials. The contractor shall also be responsible for coordinating and paying for re-testing of the repair areas.

1.07 MATERIAL AND WORKMANSHIP WARRANTY

A. Contractor shall provide a written material warranty signed by the Manufacturer and a workmanship warranty signed by the Installer, both for the repair/replacement of defective materials and workmanship characterized by leakage, abnormal aging or deterioration of materials, and other failures of the flexible membrane to perform as required. The specified warranty period is ten (10) years for materials and two (2) years for workmanship after date of final acceptance. The terms and conditions of the warranties are presented in Exhibits D and E to the Agreement.

B. The warranty shall be a direct warranty from the Manufacturer (or Installer as the case may be) to the Owner. The warranties shall be signed and presented to the Owner prior to Substantial Completion. No payment in excess of 90 percent of all payments to be due under the appropriate payment items for HDPE liner shall be made until the warranties, in their correct form hereunder, are received and approved by the Owner.

1.08 SUBGRADE CERTIFICATION

A. Prior to installation of liner materials, the Contractor shall submit a certification, signed also by the installer, that they have inspected the subgrade and accept the conditions for liner installation.

1.09 GEOMEMBRANE PRE-CONSTRUCTION MEETING

- A. As soon as practical after the Contractor mobilizes the installation crew, but before any installation activities occur, a specific pre-construction conference shall be held.

The following persons shall be present:

1. Engineer Project Manager and Resident Engineer
2. General Contractor and Superintendent
3. Engineer Subconsultant QA Representative (if applicable)
4. Geomembrane Installer Site Superintendent and Quality Control Representative
5. Affected Subcontractors

- B. Agenda:

1. Introductions and Explanation of Roles
2. General Overview of Specifications and Plans
3. Review Proposed Installation Schedule
4. Review of Installer/Contractor QC Procedures
5. Review of Engineers QA Procedures
6. Destructive Test Sites
7. Leak Location Survey
8. Review of Contractor Personnel - Roles and Responsibilities
9. Reports and Record Drawing Information
10. Site Cleaning

PART 2 PRODUCTS

2.01 MATERIALS

- A. Properties:

1. The geomembrane shall be manufactured from new, first quality polyethylene resin of the type specified. Polyethylene geomembrane shall meet all requirements for the specified end use. Reclaimed polymer shall not be added to the resin except for regrind, reworked or trim polymer of exactly the same formulation as the geomembrane produced during the manufacturing process. "Regrind" polymer shall not exceed 10% by weight. Recycled or reclaimed sheet materials shall not be included in the manufacturing process.

- B. Resin - all batches or resin shall be tested for the following characteristics:

Resin Density	ASTM D 1505/D 792	.932
Melt Index	ASTM D 1238 E	<1.0 g/10 min.

Any resin not meeting the above specification shall not be used in the manufacture of material. The Contractor shall furnish results of all such tests to the Engineer and shall certify the quality of the raw material.

- C. The double sided textured geomembrane shall demonstrate the following typical properties.

<u>PROPERTY</u>	<u>TEST</u>	<u>VALUE</u>	
Thickness	ASTM D5994	min avg	57 mils
		lowest for 8 of 10	54 mils
		lowest for 2 of 10	51 mils
Asperity Height	ASTM D 7466		16 mils
Tensile Strength (Yield) (lbs/in.)	ASTM D6693 Type IV		125
Tensile Strength (Break) (lbs/in.)	ASTM D6693 Type IV		100
Elongation at Yield (%)	ASTM D6693 Type IV (1.3" gauge)		12%
Elongation at Break (%)	ASTM D6693 Type IV (2.0" gauge)		100%
Tear Resistance (lbs)	ASTM D1004 Die C		42
Puncture Resistance (lbs)	ASTM D4833		130
Carbon Black Content	ASTM D1603/4218		2% by weight
High Pressure Oxidative Induction Time (OIT)	ASTM D5885		400 min.
Oven Aging at 85°C	ASTM D5721	% retained after 90 days	80%
High Pressure OIT	ASTM D5885		
UV Resistance	GRI-GM11	% retained after 1600 hours	50%
High Pressure OIT	ASTM D5885		

- D. The geomembrane shall be produced as to be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter, and shall not have striations, non-uniform texturing, pinholes or bubbles on the surface. Texturing shall be on both sides.

Rolls which have evidence of surface defects such as undispersed resin, incomplete texturing, creases, pinholes, non-uniform texturing or other defects,

based upon the judgement of the Engineer, shall be rejected and removed from the site.

E. The Contractor shall provide quality control certificates from the manufacturer for each roll of material. These QC certificates shall match the resin lot numbers with the roll numbers for the 60-mil geomembrane.

1. Samples shall be taken evenly spaced across the entire width of the roll, if no sampling protocol is stipulated in the particular test method, and shall not include the first wrapping or outer layer of the roll (about 3 feet).
2. Quality Control testing of the manufactured geomembrane shall be performed as a minimum in accordance with GRI-GM13, and at the following frequency for the following material properties. Where the following differs from GRI-GM13, the more stringent shall apply. A QC certificate shall be provided for each roll, which documents the following testing:

<u>TEST</u>	<u>PROCEDURE</u>	<u>FREQUENCY</u>
Thickness	ASTM D5944	Each Roll
Specific Gravity	ASTM D1505	500,000 sf
Yield Strength	ASTM D6693-Type IV	50,000 sf
Yield Elongation	ASTM D6693-Type IV	50,000 sf

<u>TEST</u>	<u>PROCEDURE</u>	<u>FREQUENCY</u>
Tensile Strength (1.3" gauge)	ASTM D6693-Type IV	50,000 sf
Tensile Elongation (2.0" gauge)	ASTM D6693-Type IV	50,000 sf
Carbon Black Content	ASTM D1603	50,000 sf

HDPE extrusion welding rod or beads shall exhibit the same properties as the geomembrane.

F. Minimum width of manufactured flexible membrane sheets shall be 22 ft. The edge of the 60-mil rolls shall not have textured material (4-in min) to enable seaming of smooth, non-contaminated product.

G. Shipping and Storage

Material shall be packaged, handled, stored, transported, re-stored, re-handled, and deployed in a manner so as not to cause any damage.

1. Unloading of rolls or pallets at the site should be such that no damage to the geomembrane occurs.
2. Pushing, sliding, or dragging of rolls or pallets of geomembranes shall not be permitted.
3. Offloading at the site shall be performed with cranes or fork lifts in a workmanlike manner such that damage does not occur to any part of the geomembrane.

4. Suitable means of securing the rolls or pallets shall be used such that shifting, abrasion, or other adverse movement does not occur.

H. Storage

1. If storage of rolls or pallets of geomembranes at the site is to occur longer than 6 months, a sacrificial covering or temporary shelter should be provided to protect against precipitation, ultraviolet exposure, and accidental damage.
 2. Temporary storage at the site should be in an area where standing water can not accumulate at any time.
 3. Geomembranes shall be stored on-site in a manner consistent with the manufacturer's recommendations.
 4. Geomembranes shall be stored to avoid deformation of rolled goods or contamination from foreign substances. Rolls shall be fully supported over their entire length. Rolls may be stacked no more than three rolls high.
 - a. Appropriate handling equipment shall be used when moving rolled material, such as slings and spreader bars.
 - b. Damaged rolls will not be used for installation.
- I. Other materials: All welding material shall be of a type recommended and supplied by the Manufacturer and shall be delivered in the original sealed containers - each with an indelible label bearing the brand name, manufacturer's mark number and complete directions as to proper storage.

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

- A. Conditions: Surfaces to be lined shall be smooth and free of vegetation, rocks, stones, sticks, roots, sharp objects or debris of any kind. Rounded corners shall be provided in all directional changes and in the anchor trench to avoid sharp bends in the membrane. No standing water or excessive moisture shall be allowed on the subgrade.
- B. Acceptance: The Installer shall certify in writing that the surface to be lined is acceptable. Submittal of written acceptance may proceed incrementally according to the installation schedule. No geomembrane liner shall be placed on subgrade deemed unsuitable by the Engineer.

3.02 INSTALLATION

- A. The liner shall be placed over the prepared subgrade in such a manner as to minimize handling. The sheets shall be placed to minimize field seaming. Horizontal field seams on the slopes shall not be acceptable. Only those sheets of

liner material which can be seamed in one day shall be unpacked and placed in position. Slope seams shall be minimized and run as close to the line of slope as possible particularly in corners.

Installation of the primary liner shall be sequenced and, where applicable, coordinated with the installation of the underlying geosynthetic clay liner (GCL) such that the GCL is covered by the liner at the end of each day and is kept dry. Any GCL which gets hydrated shall be removed and replaced at no cost to the owner.

- B. Each panel of HDPE membrane shall be laid out and installed in accordance with the approved Shop Drawings. Any changes must be submitted to the Engineer in writing for approval prior to installation of liner.
- C. Installation of the HDPE liner shall be done in the presence of the Engineer or his designated representative. Deployment shall proceed between ambient temperatures of 40°F to 104°F. Geomembrane placement shall not be done during any precipitation, or in the presence of excessive winds.
- D. Bridging of the liner will not be accepted. The liner shall be installed to accommodate thermal contraction at the lowest anticipated operating temperature. Areas that exhibit bridging shall be temporarily ballasted. If the temporary ballast fails to mitigate the bridging, the panel will be cut and additional compensating geomembrane installed and tested.
- E. Deployment:
 - 1. No equipment or tools shall damage the geomembrane or subgrade by handling, traffic or other means. Subgrade ruts or ridges shall be removed prior to final positioning of the geomembrane.
 - 2. No personnel working on the geomembrane shall smoke, wear damaging shoes, or engage in other activities that could damage the geomembrane.
 - 3. The method used to unroll the panels shall not cause scratches or crimps in the geomembrane and shall not damage the supporting soil or underlying geomembrane.
 - 4. Methods used to place panels shall minimize wrinkles, (especially differential wrinkles between adjacent panels or sheets).
 - 5. Adequate loading (e.g., bagged drainage sand or similar items that will not damage the geomembrane) shall be placed to prevent uplift by wind. Continuous loading may be required along edges of panels during periods of high winds.
 - 6. Direct contact by machinery or deployment vehicles (4 or 6-wheel cart) with the geomembrane shall be avoided, i.e., the geomembrane in traffic

areas to be protected by geotextiles, extra geomembrane, or other suitable materials. Proposed protection plan shall be reviewed by Engineer.

- F. Penetrations: The membrane shall be installed around pipes as shown on the Drawings. Install to provide an effective, watertight seal. Construction and installation of the pipe boot shall be performed in the presence of the Engineer or his designated representative. Testing of all pipe boots shall be required.

Liner installer shall coordinate with Contractor on space required for extrusion welding and vacuum testing around pipe/boot penetrations.

Boot fabrication and testing shall be as follows:

1. Boots shall be fabricated in the field to fit the pipe penetration.
2. The boot shall be temporarily removed, skirt attached to a temporary base sheet with the barrel of the boot welded shut, and air tested to 2-3 psi (min/max); apply soapy water to all prefabricated seams to locate any leaks.
3. If no leaks are found, remove temporary base sheet, open boot barrel, and reinstall on pipe.
4. Extrusion weld boot flap to liner, and boot barrel to HDPE pipe.
5. Place liner sleeve over boot barrel covering end of boot and weld sleeve to boot barrel and pipe.
6. Air test sleeve (2-3 min/max psi) for 5 minutes to evaluate boot barrel seal. If no pressure drop is observed, grind and extrude air test penetration and vacuum test extrusion.
7. Vacuum test extrusion seams of boot and skirt joint with liner.

All pipe boots, vents, and patches shall be of the same material as the membrane sheet. Gaskets, sealing materials, or other means used to secure the membrane shall be compatible with and have a lifespan at least equal to that of the HDPE membrane.

3.03 SEAMING METHODS

- A. Approved process for seaming is fusion welding for all seams. Wherever possible, the split hot wedge seaming method shall be used to allow air pressure testing of the liner seams.
1. Extrusion welding may be allowed for repairs and around penetrations through the liner. All proposed extrusion weld locations shall be approved by the Engineer.

2. Proposed alternatives and locations must be submitted for review to the Engineer.
 3. Details of the specific apparatus to be used for seaming, including seaming using approved methods, shall be submitted for approval by the Engineer prior to commencement of seaming.
- B. Fusion Process: Fusion seams will be produced by self-propelled wedge welding apparatus.
1. The apparatus shall be equipped with gauges to monitor weld temperature.
 2. Weld temperature and machine speed shall be varied according to ambient conditions to maintain and demonstrate a consistent acceptable weld, as described in Section 4.01.B.
 3. All welding surfaces shall be kept clean and dry.
- C. Extrusion Process: Extruded seams will be produced by extruding molten resin between or at the edge of two preheated overlapped sheets of geomembrane to affect a homogeneous bond.
1. The extrusion apparatus shall be equipped with gauges to monitor extrudate and operating temperatures.
 2. Temperature and flow rates shall be varied according to ambient conditions to maintain and demonstrate a consistent acceptable weld, as described in Section 4.01.B.
 3. The extruder shall be purged of all heat degraded or cooled extrudate prior to the commencement of each seaming sequence, and disposed of off the geomembrane surface.
 4. The extrudate rod shall be certified by the Manufacturer and certification supplied as in Section 1.05, Submittals.
 5. Following heat tacking, the weld area shall be prepared by grinding to a depth of less than 0.005 in in the sheet surface to be in contact with the extrudate. Extrudate shall cover all grind marks.
 6. The weld area shall be kept clean and dry.
- D. The installer shall maintain at least one spare operable seaming unit of each type on site at all times.

3.04 SEAMING PROCEDURES

- A. To achieve the proper support and cleanliness of fusion welded seams, the installer shall use a temporary support surface or shield between the geomembrane and the subgrade.

At swales, drainage benches, anchor trenches, or other similar abrupt vertical changes, the installer shall provide temporary shoring or support systems to allow linear seaming of the geomembrane and prevent unnecessary damage. Temporary shoring or bridging shall be adequate to allow proper overlap of adjacent panels and adequate strength to support the weight of materials, equipment and personnel.

- B. Seams shall be aligned so as to create a smooth and wrinkle free surface in the overlap area.

C. Extrusion Welding

1. Grinding required along a seam shall be done concurrent with or within ten minutes of the seaming operation and shall not damage the geomembrane, as in Section 3.02.

2. Installer shall determine preheat requirements and wind effects on extrusion seaming operations.

3. Artificially induced cooling of extrudate welds, by water or any other means, shall not be allowed. Care shall be taken during vacuum testing that extruded welds being vacuum tested are at ambient temperatures.

- D. Cross Seams: The top and bottom excess overlap shall be removed and the top and bottom edge of the cross-seam shall be ground to a smooth transition prior to seaming.

- E. No seaming shall be attempted in wet weather where the geomembrane is exposed to the elements.

- F. Geomembrane deployment or seaming shall proceed between ambient temperatures of 40°F to 104°F.

- G. Where possible, seam overlaps shall be shingled to shed water.

- H. Where possible, low areas shall be patched, tested and inspected first to prevent interference of ponded water with testing procedures.

- I. All patches shall have rounded corners, shall consist of the approved geomembrane material and shall extend beyond the edge of any defect a minimum of 4 in. in all directions.

- J. All seams shall be labeled on the geomembrane with the following information:

1. Machine identification number
2. Operator, date, time
3. Direction of travel of seaming equipment

- K. No "fish mouths" shall be allowed within the seam area. Where "fish mouths" occur, the material shall be cut, patched, and welded.
- L. Any membrane area showing injury due to scuffing, puncture, or distress from any cause shall be replaced or repaired with an additional piece of HDPE membrane at no cost to the Owner.

3.05 PANEL LAYOUT

A. Proposed

1. The Contractor shall submit shop drawings showing proposed placement of panels and seams, and these shall be reviewed by the Engineer, prior to commencement of installation.
2. Seams shall be numbered on an accepted plan and include dimensions.
3. Slope seams shall be run as close to the line of the slope as possible.
4. Penetrations and irregular configurations shall be detailed and submitted to the Engineer for review prior to installation.

B. Record Drawings

1. The Contractor shall provide final record layout drawings of the 60-mil liner to reflect any changes from proposed layout.
2. Record drawings shall include the identification by number and location of all panels, patches and detail work, including the location and identification of areas chosen for destructive test sampling.

All panels, seams, repair patches, cap strips and penetrations shall be documented by field survey performed by a land surveyor licensed to practice in the project state. Locations of leak location electrodes installed beneath the primary liner and leak location test holes in the primary geomembrane shall also be documented by the surveyor on the record drawings.

The survey shall be certified by the surveyor and submitted to the Engineer as an AutoCAD 2004, or higher version, drawing on a compact disk. The geomembrane survey information shall be submitted prior to covering the geomembrane.

Repair locations of leaks discovered during the leak location survey of the primary geomembrane shall be documented by field survey performed by a land surveyor licensed to practice in the project state. Surveyor services are considered subsidiary to the geomembrane installation and repair and the costs of survey documentation shall be the responsibility of the Contractor.

3. Copies of the installer's field QC documentation shall be submitted to the Engineer prior to covering the geomembrane. The installer's report is required prior to acceptance of the geomembrane system. The Contractor

shall not be allowed to place soil or geosynthetic materials over any installed geomembrane until full, written field QC documentation is submitted to the Engineer.

Copies of the installer's field QC documentation shall be submitted to the Engineer prior to covering repair locations following the leak location survey of the primary geomembrane. The Contractor shall not be allowed to replace soil materials over repaired geomembrane until full, written field QC documentation is submitted to the Engineer.

PART 4 QUALITY CONTROL

4.01 QUALITY CONTROL DURING INSTALLATION

- A. Site Test Equipment: The Contractor shall maintain on -site, in good working order, the following items:
1. Field Tensiometer
 - a. The tensiometer shall be motor driven and have jaws capable of traveling at a measured rate of 2 in/min.
 - b. The tensiometer shall be equipped with a gauge which measures the force in unit pounds exerted between the jaws.
 - c. The tensiometer shall be calibrated and certified for use on this project. A copy of the calibration certificate shall be submitted to the Engineer.
 2. Coupon Cutter

A die cutter machined to cut 1"x5" liner sample coupons for field testing shall be provided and maintained in good working condition.
 3. Vacuum Box
 - a. The vacuum box shall consist of a rigid housing with a transparent viewing window on the top and a soft, closed-cell neoprene gasket completely attached to the bottom of the housing.
 - b. The housing shall be equipped with a bleed valve.
 - c. A separate vacuum source shall be connected to the vacuum box such that a negative pressure of 2 - 3 psi (5" - 6" mercury) can be created and maintained inside the box.
 - d. A solution consisting of soap and water shall be dispensed on the seam immediately ahead of the vacuum box.
 - e. Vacuum box testing shall not proceed when temperatures are below 32°F.
 4. Air Pressure Test Equipment - This method shall apply when the split hot wedge seaming method is used.

- a. Equipment shall consist of an air pump capable of generating and maintaining a positive pressure of between 20 and 30 psi.
- b. A manometer capable of reading up to 30 psi attached to a needle or nipple shall be used to pressurize the air channel in the seam.

Spark Testing - This method shall be completed on welds in areas where both air pressure testing and vacuum testing are not possible.

- a. Equipment shall consist of a hand held device capable of generating a high voltage.
 - b. Conductive aluminum tape shall be placed beneath the seam prior to welding.
6. Alternatives shall be submitted for review to the Engineer. All testing methods shall be submitted to the Engineer for review prior to commencement of testing.

B. Non-Destructive Testing

1. Test Seams

- a. Test seams shall be made to verify that adequate conditions exist for field seaming to proceed.
- b. Each seamer shall produce a test seam at the beginning of each shift and every four hours thereafter.
- c. If a seaming operation has been suspended for more than one hour or if an equipment failure occurs for any reason, a test seam shall be produced prior to resumption of seaming operations.

2. Test seams shall be made in the field on pieces of the approved membrane. Each test seam shall be at least 4 ft. long by 1 ft. wide and with sufficient overlap in the seam for peel and shear testing in the field tensiometer.

3. Pass/Fail Criteria: With the Engineer or his representative present, the Contractor shall cut six coupons 1" by 5" from the test seam for field testing. The coupons shall be cut in pairs from both ends and the center of the test seam. From each pair, one coupon shall be tested in the field tensiometer in peel and one in shear. 100% of samples shall pass.

- a. Shear Strength: Both top and bottom of the coupon shall be tested in shear and shall register not less than 90% of the tensile strength at yield of the field parent material as determined in 4.01. B.3.d, and exhibit an acceptable location of break code as defined in 4.01 B.3.c. The shear percent elongation at break shall exceed 50% and is defined as follows:

$$E = L/L_o * 100$$

where

E = elongation %

L = extension at end of test

L_o = original average length (usually 1.0 in)

- b. Peel Adhesion: Both sides of wedge welded seam coupons and one side of extrusion welded seams shall be tested in peel. Acceptable samples tested in peel shall register equal to or more than the greater of 60% of the manufacturer's specified minimum yield strength of the parent sheet or 60% of the tensile strength at yield of the parent material as determined in paragraph 4.01. B3c, and exhibit an acceptable location of break code as defined in 4.01.3.b. The peel separation (incursion) shall not exceed 25% and is defined as follows:

$$S = A/A_o * 100$$

where

S = separation %

A = average are of separation or incursion

A_o = original bonding area

The peel adhesion for the welded tie-in seam connection of new geomembrane to existing geomembrane materials shall register equal to or more than the 60% of the manufacturer's specified minimum shear strength and exhibit an acceptable break code. The parent material strength is not an appropriate comparison for a tie-in seam, due to differing materials.

- c. As defined by GRI-GM13 and ASTM D6392 the following location of break codes are not acceptable and shall result in failure of the test:

Hot Wedge: AD, AD-BRK >25%

Extrusion: AD1, AD2, AD-WLD (unless strength is achieved)

- d. The parent material yield strength shall be determined as follows:

One 1" x 5" coupon will be cut from each sheet (both sides of seam) which makes up the "test seam" and "test sample." The coupons will be cut no less than 4 inches from the center line of the seam with the long dimension of the coupon perpendicular to the line of the seam. Each sample will be tested in tension to

determine its yield strength. The minimum of the two yield strength value obtained will be used as the parent material yield strength.

For the laboratory testing required in paragraph 4.02.A.6, the testing laboratory will be required to record and document the two test coupon's yield strength results and the results of the five shear and ten peel test series required in paragraph 4.02.A.6.a. The test samples shall be of sufficient length to accommodate this testing.

As a result of this testing and as specified in paragraph 4.02.A.3, the CQA inspector may increase the amount of destructive testing at no additional cost to the Owner.

- e. If the seam fails to pass, the welder and seaming apparatus shall not be used for field seaming until acceptable pre-weld tests are achieved.

4. Vacuum Testing

- a. 100% of all vacuum testing shall be observed by the Engineer or his representative.
- b. All extrusion welded and non-air channel seams of the 60-mil liner shall be evaluated using vacuum box testing. The seams of the 60-mil rub sheet shall not require non-destructive testing.
- c. The solution shall be applied to the test section and the vacuum box placed over the section. The bleed valve is then closed and the vacuum valve opened.
- d. Once a tight seal and a negative pressure of 2 - 3 psi has been established, the test section shall be visually examined for a period of not less than 10 seconds to determine whether bubbling of the soapy solution is occurring.
- e. The vacuum box is then moved and the process is repeated on the next adjacent section. A minimum 3 inch visible overlap shall be provided between all test sections.
- f. All locations where bubbling of the solution was observed shall be clearly marked for repairs with a high visibility marker and recorded by number on field test reports.
- g. Any failed portion of seam shall be repaired in accordance with Section 3.03 and 3.04 and re-tested.

5. Air Pressure Testing

- a. The air channel shall be sealed off at both ends.
- b. If the end of a seam will be an integral part of the geomembrane, the sealing shall be done in such a way that it does not harm the geomembrane.

- c. The pressure feed device shall be inserted into the air channel at one end of the seam and pressurized to 30 psi.
 - d. The feed valve shall be closed and the pressure sustained for a period of not less than 5 minutes. The pressure shall then be released by opening the air channel at the opposite end of the seam.
 - e. The drop in pressure on the manometer shall verify the continuity of the air channel. If there is no pressure drop, the seam shall be checked for air channel blockage(s). If more than three problem areas are revealed, the seam shall be removed and a cap strip installed. The cap strip testing shall follow normal air channel test protocols.
 - f. If a pressure loss of greater than 2 psi is observed or if the required pressure cannot be reached then the seam shall be rejected.
 - g. All faulty areas along the seam shall be identified and repaired in accordance with Sections 3.03 and 3.04 and re-tested by non-destructive means.
 - h. Vacuum testing shall be allowed on split wedge welds only when the faulty area cannot be isolated using air pressure testing.
 - i. All holes created during air pressure testing shall be sealed on completion of the test and vacuum tested.
6. Spark Testing
- a. Spark testing shall only be completed in areas where both air pressure testing and vacuum testing are not possible.
 - b. Conductive aluminum tape shall be placed beneath the seam prior to welding. Copper wire shall not be used.
 - c. Upon completion of weld, enable spark tester and hold approximately 1 inch above the weld and move slowly along the entire length of the weld. Spark will indicate a hole in the seam which shall be marked and repaired with an additional weld.
 - d. Spark testing shall not be completed if flammable gases are present in the area to be tested.
7. All liner seams shall be non-destructively tested by the Installer over their full length to verify the integrity of the seam.
- a. Non-destructive testing shall be performed concurrently with field seaming.
 - b. Prefabricated field seams which will be inaccessible after installation, such as those under structures or fastened to penetrations, shall be tested prior to final installation.
 - c. All non-destructive testing shall be observed and documented by the Engineer or his representative.

8. Approved non-destructive testing procedure is as above. Alternate procedures shall be submitted for review to the Engineer prior to the commencement of non-destructive testing. Contractor shall notify the Engineer at least 48 hours prior to commencement of any field testing.

C. Destructive Testing

1. Destructive testing of field seams shall be performed at selected locations in order to verify the criteria given in Section 4.01.B.
 - a. All sampling and testing shall be done concurrently with field seaming so that verification of field seam properties is made as the work progresses and corrective action implemented.
2. Test samples shall be randomly selected with a minimum of one test location occurring within each 500 ft of seam. The Engineer may require a minimum of one destructive sample per day, and retains the option of increasing the number of samples in suspect areas.
 - a. Sample locations shall be determined by the QC Representative and the Engineer, with consideration to the difficulty of subsequent repair and testing of the test site.
 - b. The Installer shall not be informed in advance of the locations where the seam sample will be taken.
3. The Engineer may increase the amount of destructive testing if the results of previous testing indicate a failure rate of 10% or more, at no additional cost to the Owner.
 - a. Additional samples may also be required when Installer or Engineer have reason to suspect the presence of excess crystallinity, contamination, faulty seaming or any other reason affecting seam quality.
4. The test sample shall measure a minimum of 12 in wide by 40 in long with seam centered lengthwise along the sample.
 - a. Prior to cutting the laboratory sample, two (2) one inch wide sample strips shall be cut using an approved template from each end of the sample. Two additional sample strips will be cut to determine parent material yield strength.
 - b. These strips shall be tested by the Installer in the field tensiometer. Parent, peel, and shear yield strength will be recorded in accordance with Section 4.01.B.
 - c. If acceptable, the sample shall be cut into three 12 in lengths.
5. Samples shall be cut by the Installer, indelibly numbered and identified, and the locations recorded and submitted to the Engineer for laboratory testing.

6. The results of laboratory testing shall be faxed directly to the Engineer and Contractor not more than 48 hours after the samples have been received by the testing facility. Laboratory testing results shall determine the acceptability of a seam.
 - a. Laboratory testing shall be performed in accordance with the methods given in ASTM D6693 or ASTM D6392-99 and meet the criteria given in Section 4.01.B.3. In addition to the 2 parent strength coupons, 10 test coupons shall be cut with from 5 coupons for shear and 5 coupons for peel tests. 100% of samples shall pass.
7. The area from which the destructive test sample was taken shall be repaired without delay in accordance with the procedures given in Section 3.03 and 3.04 and shall be non-destructively tested in accordance with Section 4.01.B.

D. Inspection and Acceptance

1. As the work progresses, the QC Representative shall document all locations requiring repair work and verify all repairs have been successfully made by the Installer.
2. The QC Representative shall field verify functional ability and accuracy of Installer's equipment on a daily basis.
3. A field seam shall only be considered acceptable when all destructive test locations on that seam have passed laboratory testing and acceptable non-destructive testing has been performed. The following procedures shall apply in the event that a seam fails field or laboratory testing.
 - a. The Installer may reconstruct the seam between the previous passing test location and the next passing test location and retest, or
 - b. The Installer may elect to trace the extent of an unacceptable seam to some intermediate location. This shall involve taking 1 inch template-cut cross-sections from the seam at a minimum distance of 10 feet in both directions from the failed test location.
 - (1) These samples shall be tested in the field tensiometer in both shear and peel in accordance with Section 4.01.B.3.
 - (2) If one or both of these samples fail the field test, tracing along the seam shall continue at minimum 10 feet increments until a passing result is recorded in both directions from the failed test location. If three additional tests fail on either side of the initial test site, the seam shall be rejected and either cap stripped or reconstructed. Further incremental testing shall be performed until acceptable test results are achieved. These additional tests may continue onto previous or subsequent seam work

performed by the seaming technician, welding machine, or both.

- c. If more than one field seaming unit is employed, tracing of a failed weld shall only be done along seams welded by the same equipment used to weld the seam in question.
 4. Reconstructed seams less than 150 ft in length shall be non-destructively tested in accordance with Section 4.01.B. Reconstructed seams greater than 150 feet in length shall be destructively tested in accordance with Section 4.01.B.3.
 5. The entire geomembrane surface shall be examined continuously by the QC Representative to confirm that it is free of any defects, holes, blisters, undispersed raw materials, or contamination by foreign matter. Upon completion of the installation of each liner, and prior to covering the liner, a final review will be made by the Engineer and the QC Representative.
 6. The geomembrane surface shall be cleaned by the Contractor prior to final review. The liner shall be free of dust, mud, debris or other material that would prevent examination of the surface.
 7. Any defects or suspect areas shall be clearly marked by the Engineer or QC Representative. Such defects or suspect areas shall be repaired and non-destructively tested in accordance with Section 4.01.B by the Contractor.
 8. As the work progresses, the Contractor's representative, Installation Supervisor and QC representative shall make continuous efforts to prevent the accumulation of waste materials on the liner surface and staging areas. Provision shall be made for containment of waste as the installation proceeds.
- F. Submittal of Quality Control Documentation
1. Contractor shall provide written documentation regarding quality control results from each item specified in this section in a format(s) approved by Engineer.
 2. Written documentation will be provided to Engineer on a regular basis as the installation proceeds, at a minimum once per week.
 3. A separate report with all documentation will be submitted upon completion of the installation. A separate report with all documentation will be submitted upon completion of the leak location survey and leak repairs.
- G. Drainage Geocomposite, Select Sand and 1.5" Stone Placement
1. Prior to covering any portion of the liner system, the Contractor shall submit all QC documentation to the Engineer for review, comment and submittal as required to regulatory agencies.

2. The QC representative shall identify any wrinkles which may have been built into the geomembrane. Any wrinkle which may result in fold over of liner material upon placement of sand or stone fill shall be cut, repaired and tested by the Contractor.
3. The QC Representative shall identify any slope toe, declivity, or other surface transitions which might result in bridging of the geomembrane during placement of the sand blanket. Any such area shall be cut, repaired and tested by the Installer.
4. The QC Representative shall coordinate with the installer, engineer and leak location contractor to create 0.25 in diameter test holes in the primary geomembrane to be used in calibration of leak location equipment.
5. Equipment used for placing and compacting the sand blanket or stone fill shall not be driven directly on the geomembrane or composite. Such equipment shall be closely monitored during placement to ensure that no damage occurs to the geomembrane or composite.
6. A minimum thickness of 12 in of select sand or stone fill cover shall be maintained between the geomembrane and drainage geocomposite and earth moving equipment. Only low ground pressure (LGP) tracked vehicles, having a maximum ground pressure of 4.7 psi shall be used at the minimum thickness.
7. For calculating equivalent ground pressure for non-LGP equipment operating on top of greater thicknesses, equivalent ground pressure shall be calculated at 12 in above the liner surface and shall meet LGP.
8. In all cases, the placement of sand blanket or stone fill shall be done with caution and in a manner which is least likely to cause wrinkles in, or damage to, the geomembrane and composite. In order to eliminate wrinkles, significant methods must be employed including but not limited to use of hand labor and equipment to cast and place sand.
9. Drainage sand, stone fill and topsoil materials shall be placed upslope or laterally on slopes greater than 5:1.

G. Electrical Leak Location Survey

1. Following the installation of the primary geomembrane and the placement of the geocomposite and select sand or stone (as applicable), the Contractor shall provide an electrical leak location survey of the entire primary liner. The survey will be conducted to detect leaks in the geomembrane caused during installation of the liner and cover materials.

Electrical leak location survey services are considered subsidiary to the geomembrane installation and repair. The costs of the leak location survey, leak location documentation, repair of geomembrane leaks,

replacement of cover materials, and re-survey of repaired leak locations, shall be the responsibility of the Contractor.

2. The Contractor shall coordinate with the geomembrane Installer, Engineer, and the Leak Location Contractor to position the leak location electrodes beneath the primary geomembrane. The electrodes and wiring shall be a permanent installation with wires left at the edge of the anchor trench with enough wire left to connect to in the future if necessary. Wiring shall exit from the anchor trench and be terminated in accordance with the requirements of the testing company.
3. A minimum of two (2) test holes with a diameter of 0.25 in shall be made in the geomembrane. The locations of these test holes shall be coordinated with the QC Representative, Installation Supervisor, Leak Location Contractor and Engineer.

Test holes shall be made with a drill to remove, rather than displace, the HDPE material in the hole. All burrs from the edges and bottom side of the test holes shall be removed. Test holes shall be made in an area where the geomembrane has intimate contact with the underlying subgrade or GCL.

Test holes shall be located at the farthest positions away from any electrode installed under the geomembrane, but at least 50 ft from the edge of the geomembrane.

Locations of the test holes shall be included in the QC documentation and record drawing survey.

4. The Contractor shall provide electrical isolation at the perimeter of the drainage sand. Electrical isolation is achieved by leaving approximately a one-foot wide area of liner exposed around the perimeter of the landfill cell or leaving a minimum of six inches of bare liner protruding from the backfilled anchor trench.
5. Prior to conducting the leak location survey, the Contractor shall remove all standing water from the surface of the drainage sand.
6. Sufficient moisture must be available at the leak locations in the geomembrane surface for electrical leak detection to be performed accurately. Sufficient moisture shall be provided by the Contractor at least 24 hours in advance of the leak location survey by one of the following methods. Additional water shall be added if necessary during the testing to ensure successful results.
 - a. Rainfall of 0.1 in or greater on the bare geomembrane;
 - b. Uniformly wetting the earth materials covering the geomembrane with water to field capacity.

Additional water may need to be applied shortly before and/or during the leak location survey to moisten the drainage sand materials.

7. A performance test shall be conducted at the test hole locations to verify operation and calibration of the leak location system and equipment.
 - a. Leak location measurements shall be made and recorded along closely spaced parallel lines in the vicinity of the test holes. The lines shall be located in an area extending at least 20 ft before and beyond the test holes. This data is the leak signal plus noise signal (S+N).
 - b. A line of data shall be taken and recorded directly over the test hole with the leak location excitation source turned off or connected to an isolated load to measure the background noise level (BN).

The background noise level shall be defined as the difference between the maximum and minimum measured voltage with the excitation source turned off.
 - c. The recorded leak location data shall be examined to determine the peak-to-peak leak signal plus electrical noise signal to background electrical-noise ratio, $R=(S+N)/BN$, for each of the recorded data lines. The measured leak signals must have the characteristics of an electrical leak. Data points that deviate extremely from the theoretical leak signals shall not be used to determine R.
 - d. The farthest lateral lines of data with an R value greater than 3.0 shall be noted. The average of the lateral distance from the leak for the two lines is defined to be the leak detection distance for the 0.25 in diameter leak.
8. The leak location data shall be taken on survey lines spaced no further apart than twice the leak detection distance determined for a 0.25 in diameter leak as determined in the performance testing. The measurement electrode spacing shall be no less than that used for the performance test. The spacing between measurements shall be no more than that used for the performance test.
9. Leak location data shall be recorded, plotted, and analyzed for leak signals. The positions of the leak signals shall be located and the leaks excavated by the Contractor. The leaks shall be repaired or electrically isolated from the earth materials. Additional leak location survey data shall be collected near the located leak after the leak is repaired or electrically isolated to ensure that no additional leaks are present. The survey data shall be repeated on the two closest survey lines for a distance extending 20 ft before and beyond the leak. If another leak is detected, the process shall be repeated until no additional leaks are detected.
10. Daily results of the work shall be communicated to the Engineer. A report assembled by the Leak Location Contractor documenting the electrical leak location surveys shall be submitted within 14 days of the completion of each leak survey. The reports shall document the methodology used,

the locations and descriptions of the leaks, and a diagram of the facility showing the approximate leak locations.

11. Copies of the installer's field QC documentation shall be submitted to the Engineer prior to covering repair locations following the leak location survey of the primary geomembrane. The Contractor shall not be allowed to replace soil materials over repaired geomembrane until full, written field QC documentation is submitted to the Engineer.

Contractor shall provide written documentation regarding quality control results recorded during repair of located leaks. Documentation shall be made according to each item specified in this section in a format(s) approved by Engineer.

12. Repair locations of leaks discovered during the leak location survey or the primary geomembrane shall be documented by field survey performed by a land surveyor licensed to practice in the project state. The survey shall be certified by the surveyor and submitted to the Engineer prior to covering the geomembrane.

PART 5 COMPLETION OF WORK

5.01 REQUIREMENTS

- A. All required deployment, seaming, repairs, testing, records and site clean-up shall be completed by the Contractor.
- B. Contractor shall submit a comprehensive quality control report, including all QC documentation specified in this section to the Engineer.
- C. The Engineer shall be satisfied that the information provided by the Contractor indicates that the geomembrane has been installed in accordance with the above Specifications.
- D. Contractor shall dispose of all trash, waste material and equipment used in connection with the work and shall leave the premises in an acceptable condition.

END OF SECTION

**ADDENDUM NUMBER 2:
NORTH COUNTRY ENVIRONMENTAL SERVICES, INC.
STAGE V LANDFILL EXPANSION
CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS**

**Issued: January 29, 2015
For Bids Due: February 5, 2015**

A. CONSTRUCTION DRAWINGS - CLEANOUTS

1. *Three additional cleanout extensions are added to the project as shown on the revised Sheet 8 – Proposed Detention Pond 5 & 6 Grading Plan included with this Addendum. The cleanouts are depicted as the southernmost on the plan. The addition of these cleanouts modifies Sheets 5, 6, 7 and 8 where the cleanouts are shown.*
2. *Existing cleanouts to be extended along southern Stage V limits are 8" SDR 17 HDPE pipe with the exception of a 12" SDR 17 HDPE primary cleanout near Pump Station 1.*
3. *An updated CADD file has been submitted to planholders for quantity takeoffs.*

B. CONSTRUCTION DRAWINGS – DETENTION POND 5 CULVERT

1. *The 45' long 18" diameter culvert crossing that outlets to Detention Pond No. 5 has been upgraded from HDPE to RCP. The change is depicted on the attached Sheet 8 and modifies Sheets 6, 7 and 8 where this culvert is shown.*

C. BID PROPOSAL FORM

1. *An electronic version of the Bid Proposal Form has been provided electronically to the planholders.*

END OF ADDENDUM NO. 2

BID PROPOSAL

Bidder: _____

Project: Stage V Landfill Expansion

Owner: North Country Environmental Services, Inc.

The undersigned, hereafter referred to as the BIDDER has examined the Contract Documents prepared in connection herewith by CMA Engineers, Inc., the ENGINEER. In addition, he has examined the site and is familiar with all the conditions surrounding the Work contemplated. He hereby submits the following:

BIDDER agrees to perform all the work described in the CONTRACT DOCUMENTS for the following unit prices or lump sums:

Signature Date

PART I - PHASE I (2015) BID PROPOSAL

No.	Item	Unit	Est Qty	UNIT PRICE (FIGURES)	TOTAL PRICE (FIGURES)
1	General Conditions	L.S.	1		
2	Excavation	C.Y.	90,000		
3	Filling	C.Y.	25,000		
4	Erosion Control & Site Stabilization	L.S.	1		
5	Demolition	L.S.	1		
6	Roadway, Site Work and Stormwater Ponds	L.S.	1		
7	Waste Excavation & Odor Control	L.S.	1		
8	Temporary Stormwater Management	L.S.	1		
9	Screened Till Fill	L.S.	1		
10	Secondary 60-mil HDPE Textured Liner	S.F	199,000		
11	Installation of Secondary 60-mil HDPE Textured Liner	S.F	199,000		
12	Secondary Bi-Planar 250-mil Drainage Geocomposite	S.F.	199,000		
13	Installation of Secondary Bi-Planar 250-mil Drainage Geocomposite	S.F.	199,000		
14	Secondary Leachate Collection System	L.S.	1		
15	Select Sand	L.S.	1		
16	Primary 60-mil HDPE Textured Liner	S.F	199,000		
17	Installation of Primary 60-mil HDPE Textured Liner	S.F	199,000		
18	Primary Bi-Planar 300-mil Drainage Geocomposite	S.F	199,000		
19	Installation of Primary Bi-Planar 300-mil Drainage Geocomposite	S.F	199,000		
20	Primary Leachate Collection System	L.S.	1		
21	Forcemain	L.S.	1		
22	Stormwater Management and Stabilization	L.S.	1		
23	Landfill Gas Improvements	L.S.	1		

PHASE I SUBTOTAL (FIGURES):

(Written) _____ Dollars and
 _____ Cents

PART II - PHASE II (2016) BID PROPOSAL

No.	Item	Unit	Est Qty	UNIT PRICE (FIGURES)	TOTAL PRICE (FIGURES)
1	General Conditions	L.S.	1		
2	Excavation	C.Y.	N/A		N/A
3	Filling	C.Y.	N/A		N/A
4	Erosion Control & Site Stabilization	L.S.	1		
5	Demolition	L.S.	1		
6	Roadway, Site Work and Stormwater Ponds	L.S.	N/A		N/A
7	Waste Excavation & Odor Control	L.S.	N/A		N/A
8	Temporary Stormwater Management	L.S.	1		
9	Screened Till Fill	L.S.	1		
10	Secondary 60-mil HDPE Textured Liner	S.F.	159,000		
11	Installation of Secondary 60-mil HDPE Textured Liner	S.F.	159,000		
12	Secondary Bi-Planar 250-mil Drainage Geocomposite	S.F.	159,000		
13	Installation of Secondary Bi-Planar 250-mil Drainage Geocomposite	S.F.	159,000		
14	Secondary Leachate Collection System	L.S.	1		
15	Select Sand	L.S.	1		
16	Primary 60-mil HDPE Textured Liner	S.F.	159,000		
17	Installation of Primary 60-mil HDPE Textured Liner	S.F.	159,000		
18	Primary Bi-Planar 300-mil Drainage Geocomposite	S.F.	159,000		
19	Installation of Primary Bi-Planar 300-mil Drainage Geocomposite	S.F.	159,000		
20	Primary Leachate Collection System	L.S.	1		
21	Forcemain	L.S.	1		
22	Stormwater Management and Stabilization	L.S.	1		
23	Landfill Gas Improvements	L.S.	1		

PHASE II SUBTOTAL: (FIGURES)

(Written) _____ Dollars and
 _____ Cents

TOTAL (PHASE I + PHASE II):

(Written) _____ Dollars and
 _____ Cents

PART III - SUPPLEMENTAL UNIT PRICES

Should certain additional work be required, or should quantities of certain classes of work be increased or decreased from those on which the Contract Sum is based, by order or approval of the Engineer, the undersigned agrees that the following supplemental unit prices may be used as the basis of payment to him/her or credit to the Owner for such addition, increase, or decrease in the work as determined solely by the Owner.

Supplemental prices shall cover all costs, complete in place, and the prices given shall balance with the respective amount per unit to be paid to the Contractor under applicable items of Parts I & II – Base Bid, or refunded to the Owner (in the case of deductions or decreases). No additional adjustments will be allowed for overhead, profit, insurance, or indirect expenses of the Contractor beyond the prices as listed. Owner has the right to reject any or all supplemental unit prices when in Owner's opinion the price appears not to be balanced with Owner's assessment of balanced prices in comparison to other bidders. These prices shall apply to both Phase I (2015) and Phase II (2016) work.

PART II - SUPPLEMENTAL UNIT PRICE ITEMS

No.	Item	Unit	Est Qty	UNIT PRICE (FIGURES)	TOTAL PRICE (FIGURES)
24	3/4" Stone	Ton	N/A		N/A
25	1.5" Stone	Ton	N/A		N/A
26	NHDOT Type C Stone	Ton	N/A		N/A
27	NHDOT Type A Rip-Rap Fill	Ton	N/A		N/A
28	Crushed Gravel (NHDOT Item 304.3)	Ton	N/A		N/A
29	Gravel (NHDOT Item 304.2)	Ton	NA		N/A
30	On-Site Screened Till	C.Y.	NA		N/A

**ADDENDUM NUMBER 3:
NORTH COUNTRY ENVIRONMENTAL SERVICES, INC.
STAGE V LANDFILL EXPANSION
CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS**

**Issued: February 2, 2015
For Bids Due: February 5, 2015**

A. SECTION 00150 – MEASUREMENT AND PAYMENT

1. Bid Item 6 - Roadway, Site Work and Stormwater Ponds has been revised to remove common borrow filling. Common borrow filling shall be included in Bid Item 3 – Filling. This Bid Item is also revised to remove “Stormwater Ponds” from the title as the ponds and stormwater work are covered under Bid Item 22. Bid Item 6 shall now read:

Item Number 6 – Roadway and Site Work

MEASUREMENT: This item will be an estimated percentage of total work under this item at the time of the pay period close.

PAYMENT: Payment for this item will be full compensation for all labor, materials, and equipment required to construct the perimeter access road including installation of gravels, woven geotextile, guardrail and all appurtenant work in full conformance with the Drawings and Specifications.

END OF ADDENDUM NO. 3

**ADDENDUM NUMBER 4:
NORTH COUNTRY ENVIRONMENTAL SERVICES, INC.
STAGE V LANDFILL EXPANSION
CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS**

**Issued: February 4, 2015
For Bids Due: February 5, 2015**

Leachate pumps and controls and electrical work have been removed from this project as NCES will contract this work separately. References to electrical work on the Construction Drawings and Contract Documents and Technical Specifications shall be ignored for the purpose of bidding. The Contractor is responsible to provide support to this work as necessary including conduit trenching and other ancillary work. The following sections are removed from the Contract Documents and Technical Specifications:

- A. SECTION 11312 – LEACHATE PUMPS AND CONTROLS**
- B. SECTION 16402 – ELECTRICAL WORK**

END OF ADDENDUM NO. 4