Invitation to Bid for
Solid Waste Permit #498
Final Cover System Construction

City of Bristol, Virginia
Integrated Solid Waste Management Facility
Solid Waste Permit #498 Landfill
2655 Valley Drive
Bristol, Virginia 24201
276-645-7380

SCS ENGINEERS

SCS Project #02218208.17 | August 25, 2023

15521 Midlothian Turnpike, Suite 305
Midlothian, VA 23113
804-378-7440

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1 EXECUTIVE SUMMARY

ITB# SW-24-001 August 25, 2023

The City of Bristol, Virginia (the City) is seeking bids from qualified bidders for the Solid Waste Permit #498 Landfill Final Cover System Construction described herein.

This invitation does not commit the City to pay any costs incurred in the preparation of bids, nor commits the City to select any bidders which responds.

This Project Manual has been prepared by SCS Engineers (SCS) for the City of Bristol, Virginia for the construction of the solid waste permit #498 (SWP#498) landfill final cover system at the Integrated Solid Waste Management Facility (ISWMF or Landfill). This Project Manual is intended to comply with the conditions of the solid waste permit #498.

PROPOSED CALENDAR OF EVENTS

Issuance Date	08/25/2023
Pre-Bid Conference Date	09/05/2023
Inquiries Deadline	09/13/2023
Due Date	09/26/2023
Award Notification	TBD

SUBMITTAL REQUIREMENTS

Bids should be submitted to the City of Bristol for the SWP#498 Final Cover System Construction. Three (3) complete sealed copies of bidding documents for the SWP#498 Final Cover System Construction must be received at the City of Bristol, Virginia Procurement Department at 300 Lee Street, Bristol, VA 24201, no later than 2:00 p.m. Eastern Standard Time (per time.gov) on Tuesday the 26th day of September 2023. If proprietary information is included in the bid, then Bidders shall provide one (1) additional copy with all information considered proprietary redacted and suitable for public inspection in accordance with Section 2.2-4342 of the Code of Virginia. Each copy shall be complete and separately bound. Sections shall be identified to facilitate evaluation and to prevent evaluators from unnecessary search or arranging of materials for evaluation purposes. No FAXED nor emailed proposals will be accepted.

The Bid package shall also include one (1) separate unbound copy of the Bid Form to facilitate opening and reading of the Bids. The Bid must be enclosed in a plainly marked package with the Project title, the name and address of the Bidder, and must be accompanied by the Bid Security and other required documents. The sealed envelope containing the Bid must be enclosed in a separate package plainly marked on the outside with the notation “BID ENCLOSED - Invitation to Bid #SW-24-001 for Solid Waste Permit #498 Final Cover System Construction” A mailed Bid must be addressed to the location designated in the Advertisement.

The public opening of the bids will take place at the Council Chambers at City Hall located at 300 Lee Street, Bristol VA 24201, immediately following the bid due deadline. Bids received after the date and time prescribed for the opening of the bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

DOCUMENT 00 11 16

INVITATION TO BID

Project: Solid Waste Permit #498 Final Cover System Construction (ITB# SW-24-001)

Owner:

City of Bristol
2655 Valley Drive
Bristol, VA 24201

Engineer:

SCS Engineers
15521 Midlothian Turnpike, Suite 305
Midlothian, VA 23113 USA

Date: August 25, 2023

Prospective Bidders

Your firm is invited to submit a sealed Bid clearly labeled as follows:

City of Bristol, VA
Attention: Procurement Department
300 Lee Street
Bristol, VA 24201
Bid on Solid Waste Permit#498 Final Cover System Construction
Due Date: September 26, 2023 2:00 PM
ITB# SW-24-001

Bids should be submitted to the City of Bristol for the SWP#498 Final Cover System Construction. Three (3) complete sealed copies of bidding documents for the SWP#498 Final Cover System Construction must be received at the City of Bristol, Virginia Procurement Department at 300 Lee Street, Bristol, VA 24201, no later than 2:00 p.m. Eastern Standard Time (per time.gov) on Tuesday the 26th day of September 2023. If proprietary information is included in the bid, then Bidders shall provide one (1) additional copy with all information considered proprietary redacted and suitable for public inspection in accordance with Section 2.2-4342 of the Code of Virginia. Each copy shall be complete and separately bound. Sections shall be identified to facilitate evaluation and to prevent evaluators from unnecessary search or arranging of materials for evaluation purposes. No FAXED nor emailed proposals will be accepted.

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The Owner requires the Project to be completed by March 28, 2024. Parts of the Work must be substantially completed on or before the following Milestone(s):

- Solid Waste Permit #498 Final Cover System – March 1, 2024

Electronic Bidding Documents may be obtained from the City of Bristol's website or the office of the Engineer by emailing aworth@scsengineers.com (copy twilliams@scsengineers.com).

Hard Copies of Bidding Documents may be obtained from the office of the Engineer at a cost of $200.00 for one set.

Prospective Bidders must either attend the Pre-Bid Conference in person or schedule and conduct a separate site visit prior to Bid submittal. The Pre-Bid Conference will be held at 10:00 AM on the 5th day of September 2023 at the scalehouse at the Bristol Integrated Solid Waste Management Facility, 2655 Valley Drive, Bristol, VA 24201. Prospective Bidders are encouraged to attend this meeting. Site visits other than the pre-bid meeting should be coordinated with Mike Martin by calling 1 (276) 645-7380.

Bidders should submit questions to the Engineer at the pre-bid meeting or via e-mail to aworth@scsengineers.com (copy twilliams@scsengineers.com) prior to the pre-bid meeting. Only responses set for in an Addendum will be binding. Questions are to be submitted by Wednesday, September 13th, 2023.

Submit your Bid on the Bid Form provided. Bidders are required to complete Bid Form 00 41 13.

Your Bid will be required to be submitted under a condition of irrevocability for a period of 60 days after submission subject to Section 2.2-4330 of the Code of Virginia, as amended.

The Owner reserves the right to accept or reject any or all Bids.

END OF DOCUMENT 00 11 16

SECTION 00 21 13[i]

INSTRUCTIONS TO BIDDERS

0.0 INTENT

The intent of this Bid request is to obtain an offer to perform work to complete the construction of the Final Cover System, in accordance with Contract Documents.

1.0 DEFINED TERMS

1.1 BIDDING DOCUMENTS

Contract Documents supplemented with Advertisement for Bids, Invitation to Bid, Instructions to Bidders, Information Available to Bidders, Bid Form, and bid securities, identified.

1.2 CONTRACT DOCUMENTS

Those items so designated in the Agreement, and which together comprise the Contract.

1.3 BID

Executed Bid Form and required attachments submitted in accordance with these Instructions to Bidders.

1.4 BID PRICE

Monetary sum identified by the Bidder in the Bid Form.

2.0 BIDDING DOCUMENTS

2.1

Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). See the Agreement for a list of the Contract Documents. It is Bidder's responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.

2.2

Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.

2.3

Electronic Bidding Documents may be obtained from the City's website or the office of the Engineer by emailing aworth@scsengineers.com (copy twilliams@scsengineers.com). Hard Copies of Bidding Documents may be obtained from the office of the Engineer at a cost of $200.00 for one set. Prospective Bidders may view the Bid Documents at the office of the Owner or the office of the Engineer.

2.4 ELECTRONIC DOCUMENTS

2.4.1

When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to the Bidders as Electronic Documents in the manner specified.

2.4.1.1

Bidding Documents will be provided in Adobe PDF (Portable Document Format) (.pdf) that is readable by Adobe Acrobat Reader Version 2017 or later. It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the Owner and Engineer cannot and do not guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.

2.4.1.2

Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.4.1.1 above. However, Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of Bidding Documents and reproductions prepared from those versions and, further, assumes all risks, costs, and responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in printed paper versions of the documents, and for Bidder's reliance upon such derived information.

3.0 BIDDER QUALIFICATIONS

To demonstrate qualification for performing the Work of this Contract, each Bidder shall submit written evidence including financial data, previous experience, present commitments, information on subcontractors (including firms providing construction quality control), suppliers or others, and other such data as is required by the Bidder's Qualification Statement. Each Bid must contain evidence that the Bidder has a Class A license to do contracting work issued by the Commonwealth of Virginia.

4.0 PRE BID CONFERENCE

4.1

Prospective Bidders must either attend the Pre-Bid Conference in person or schedule and conduct a separate site visit prior to Bid submittal. The Pre-Bid Conference will be held at 10:00 AM on the 5th day of September 2023 at the scalehouse at the Bristol Integrated Solid Waste Management Facility, 2655 Valley Drive, Bristol, VA 24201. Prospective Bidders are encouraged to attend this meeting. Site visits other than the pre-bid meeting should be coordinated with Mike Martin by calling 1 (276) 645-7380.

4.2

General contract and major subcontract Bidders and suppliers are invited to attend.

4.3

Representatives of the Owner and Engineer will be in attendance.

4.4

Summarized minutes of this meeting will be circulated to known Bidders. These minutes will not form part of Contract Documents.

4.5

Information relevant to Bidding Documents will be issued by Addendum.

5.0 SITE AND OTHER AREAS

5.1 Site and Other Areas

5.1.1

The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

5.2 EXISTING SITE CONDITIONS

5.2.1 Subsurface and Physical Conditions; Hazardous Environmental Conditions

5.3 OTHER SITE-RELATED DOCUMENTS

5.3.1

In addition to any documents regarding existing Site conditions referred to in section 5.2, the following other documents relating to conditions at or adjacent to the Site are known to Owner and made available to Bidders for reference:

- Sewerage System Extension Plans dated July 1994

Owner will make copies of these other Site-related documents available to any Bidder upon request.

5.3.2

Owner has not verified the contents of these other Site-related documents, and Bidder may not rely on the accuracy of any data or information in such documents. Bidder is responsible for any interpretation or conclusion Bidder draws from the other Site-related documents.

5.3.3

The other Site-related documents are not part of the Contract Documents.

5.3.4

Bidders are encouraged to review the other Site-related documents, but Bidders will not be held accountable for any data or information in such documents. The requirement to review and take responsibility for documentary Site information is limited to information in (1) the Contract Documents and (2) the Technical Data.

5.4 SITE VISIT AND TESTING BY BIDDERS

5.4.1

Bidder is required to visit the Site and conduct a thorough visual examination of the Site and adjacent areas. During the visit the Bidder must not disturb any ongoing operations at the Site.

5.4.2

A Site visit is scheduled following the pre-bid conference.

5.4.3

Bidders visiting the Site are required to arrange their own transportation to the Site.

5.4.4

All access to the Site other than during a regularly scheduled Site visit must be coordinated through the following Owner contact for visiting the Site: Mike Martin. Bidder must conduct the required Site visit during normal working hours.

Currently occupied premises at Project site are open for examination by Bidders only during the following hours:

- 7:00 AM to 4:00 PM Monday through Friday

5.4.5

Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

5.4.6

On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder general access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site. Bidder is responsible for establishing access needed to reach specific selected test sites.

5.4.7

Bidder must comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

5.4.8

Bidder must fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

5.5 OWNER'S SAFETY PROGRAM

Site visits and work at the Site may be governed by an Owner safety program. If an Owner safety program exists, it will be noted in the Supplementary Conditions.

5.6 OTHER WORK AT THE SITE

In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

6.0 BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.1

The Bid Form that each Bidder will submit contains express representations regarding the Bidder's examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications, and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.

6.2

If Bidder is awarded the Contract, Bidder (as Contractor) will make similar express representations and certifications when it executes the Agreement.

7.0 INTERPRETATIONS AND ADDENDA

7.1

Owner on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.

7.2

Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing. Contact information and submittal procedures for such questions are as follows:

Questions are to be submitted by Wednesday, September 13th, 2023.

7.3

Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than 13 days prior to the date for opening of Bids may not be answered.

7.4

Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

7.5

Bidders must notify Engineer in writing of all conflicts, errors, or discrepancies in the Contract Documents.

8.0 BID SECURITY

8.1

A Bid must be accompanied by Bid security made payable to Owner in an amount of **five** percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a Bid bond issued by a surety meeting the requirements of paragraph 8.1.1. Such Bid bond will be issued in the form included in the Bidding Documents.

8.1.1

Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

8.2

The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract and furnish the required Contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Owner's damages in the case of a damages-form bond. Such forfeiture will be Owner's exclusive remedy if Bidder defaults.

8.3

The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.4

Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

9.0 CONTRACT TIMES

9.1 TIME IS OF THE ESSENCE

All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

9.2 CONTRACT TIMES

See Sections 00 11 16 and 00 70 00

9.3 MILESTONES

See Sections 00 11 16 and 00 70 00

10.0 SUBSTITUTE AND "OR EQUAL" ITEMS

10.1

The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or-equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.

10.2

All prices that Bidder sets forth in its Bid will be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

11.0 SUBCONTRACTORS, SUPPLIERS, AND OTHERS

11.1

The apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work within five days after Bid opening:

- Geosynthetics Supplier and Installer
- Erosion and Sediment Control Installer
- Soils and Geosynthetics Testing Firms
- Landfill gas installer

11.2

If requested by Owner, such list must be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor or Supplier. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor or Supplier, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder will submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

11.3

If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors and Suppliers. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor or Supplier, so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer.

12.0 PREPARATION OF BID

12.1

The Bid Form is included with the Bidding Documents.

12.1.1

All blanks on the Bid Form must be completed in ink and the Bid Form signed in ink. Erasures or alterations must be initialed in ink by the person signing the Bid Form. A Bid price must be indicated for each section, Bid item, alternate, adjustment lump sum price item, and lump price item listed therein.

12.1.2

If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words "No Bid" or "Not Applicable."

12.2

If Bidder has obtained the Bidding Documents as Electronic Documents, then Bidder shall prepare its Bid on a paper copy of the Bid Form printed from the Electronic Documents version of the Bidding Documents. The printed copy of the Bid Form must be clearly legible, printed on 8½ inch by 11-inch paper and as closely identical in appearance to the Electronic Document version of the Bid Form as may be practical. The Owner reserves the right to accept Bid Forms which nominally vary in appearance from the original paper version of the Bid Form, providing that all required information and submittals are included with the Bid.

12.3

A Bid by a corporation must be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation must be shown.

12.4

A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.

12.5

A Bid by a limited liability company must be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.

12.6

A Bid by an individual must show the Bidder's name and official address.

12.7

A Bid by a joint venture must be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.

12.8

All names must be printed in ink below the signatures.

12.9

The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.

12.10

Postal and email addresses and telephone number for communications regarding the Bid must be shown.

12.11

The Bid must contain evidence of Bidder's authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.

12.12

If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder's licensure, or Bidder must certify in writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder's state contractor license number, if any, must also be shown on the Bid Form.

13.0 BASIS OF BID

13.1 LUMP SUM

13.1.1 Bid Items

Bidders must submit a Bid on a lump sum basis for each item of Work listed in the lump sum section of the Bid Form.

14.0 SUBMITTAL OF BID

14.1

Bids should be submitted to the City of Bristol for the SWP#498 Final Cover System Construction. Three (3) complete sealed copies of bidding documents for the SWP#498 Final Cover System Construction must be received at the City of Bristol, Virginia Procurement Department at 300 Lee Street, Bristol, VA 24201, no later than 2:00 p.m. Eastern Standard Time (per time.gov) on Tuesday the 26th day of September 2023. If proprietary information is included in the bid, then Bidders shall provide one (1) additional copy with all information considered proprietary redacted and suitable for public inspection in accordance with Section 2.2-4342 of the Code of Virginia. Each copy shall be complete and separately bound. Sections shall be identified to facilitate evaluation and to prevent evaluators from unnecessary search or arranging of materials for evaluation purposes. No FAXED nor emailed proposals will be accepted.

14.2

The Bid package shall also include one (1) separate unbound copy of the Bid Form to facilitate opening and reading of the Bids. The Bid must be enclosed in a plainly marked package with the Project title, the name and address of the Bidder, and must be accompanied by the Bid Security and other required documents. The sealed envelope containing the Bid must be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED - Invitation to Bid #SW-24-001 for Solid Waste Permit #498 Final Cover System Construction" A mailed Bid must be addressed to the location designated in the Advertisement.

14.3

The public opening of the bids will take place at the Council Chambers at City Hall located at 300 Lee Street, Bristol VA 24201, immediately following the bid due deadline. Bids received after the date and time prescribed for the opening of the bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

15.0 MODIFICATION AND WITHDRAWAL OF BID

15.1

An unopened Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

15.2

If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid and submit a new Bid prior to the date and time for the opening of Bids.

15.3

If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, the Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, the Bidder will be disqualified from further bidding on the Work.

16.0 OPENING OF BIDS

16.1

Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

17.0 BIDS TO REMAIN SUBJECT TO ACCEPTANCE

All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

18.0 EVALUATION OF BIDS AND AWARD OF CONTRACT

18.1

Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.

18.2

Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.

18.3

If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.

18.4

If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest responsive Bid based on the total price with base bid items, or if the alternative bid items are accepted, based on total price with alternative bid item.

18.5 EVALUATION OF BIDS

18.5.1

In evaluating Bids, Owner will consider whether the Bids comply with the prescribed requirements, and such alternates, lump sum prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

18.5.2

In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

18.5.3

Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

19.0 BONDS AND INSURANCE

19.1 PERFORMANCE BOND

A performance bond on the part of the contractor for 100 percent of the contract price. A “performance bond” is one executed in connection with a contract to secure fulfillment of all the contractor’s requirements under such contract.

19.2 PAYMENT BOND

A payment bond on the part of the contractor for 100 percent of the contract price. A “payment bond” is one executed in connection with a contract to assure payment as required by law of all persons supplying labor and material in the execution of the work provided for in the contract.

19.3 BID BOND

Paragraph 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

20.0 SIGNING OF AGREEMENT

When Owner issues a Notice of Award to the Successful Bidder, it will be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder must execute and deliver the required number of counterparts of the Agreement and any bonds and insurance documentation required to be delivered by the Contract Documents to Owner. Within 10 days thereafter, Owner will deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents.

END OF SECTION 00 21 13

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SECTION 00 41 13

BID FORM

1.0 OWNER AND BIDDER

1.1

This Bid is submitted to: City of Bristol 300 Lee St, Bristol, VA 24201

1.2

The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

2.0 ATTACHMENTS TO THIS BID

The following documents are submitted with and made a condition of this Bid:

- Required Bid security;
- List of Proposed Subcontractors;
- List of Proposed Suppliers;
- Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;
- Contractor's license number as evidence of Bidder's State Contractor's License or a covenant by Bidder to obtain said license within the time for acceptance of Bids; and
- Required Bidder Qualification Statement with supporting data.

3.0 BASIS OF BID—LUMP SUM PRICES

3.1 LUMP SUM PRICE BIDS

Bidders should submit lump sum prices for the construction of the SWP#498 landfill final cover system. Bids will be evaluated on the lowest total price. Payment applications will be submitted separately for each category and the City of Bristol may elect to make separate payments for each category.

3.1.1 Base Bid Lump Sum Price – 498 Final Closure System

#	Description	Unit[1]	Lump Sum Price
1	Mobilization/Demobilization	LS	
2	Health and Safety Planning and Accommodations	LS	
3	Clearing, Grubbing, and Stripping	LS	
4	Erosion and Sediment Control	LS	
5	Stormwater Basin Excavation	LS	
6	Membrane Deployment Grade Earthwork	LS	
7	Furnish LFG Horizontal Collector Materials	LS	
8	Install LFG Horizontal Collectors	LS	
9	Furnish LFG Header Materials	LS	
10	Install LFG Headers	LS	
11	Furnish Air and Force Main Materials	LS	
12	Install Air and Force Main	LS	
13	Furnish and Install LFG Drainage Pits	LS	
14	Furnish and Install Horizontal Collector Pit Wellheads with Pumps	LS	
15	Furnish and Install Horizontal Collector Tie in to Existing PVC Wells	LS	
16	Furnish and Install Remote LFG Wellhead and LFG Lateral tie-in to EW-22	LS	
17	Furnish and Install Stormwater Sewer System	LS	
18	Furnish and Install Stormwater Basin Outlet	LS	
19	Furnish 40 mil LLDPE Geomembrane	LS	
20	Install 40 mil LLDPE Geomembrane	LS	
21	Furnish Drainage Geocomposite	LS	
22	Install Drainage Geocomposite	LS	
23	Furnish Erosion Control Layer Material	LS	
24	Install Erosion Control Layer	LS	
25	Furnish Vegetative Support Layer Material	LS	
26	Install Vegetative Support Layer	LS	
27	Furnish and Install Access Road	LS	

[1] LS indicates lump sum price

#	Description	Unit[1]	Lump Sum Price
28	Furnish and Install Permanent Seeding	LS	
29	Furnish and Install Stormwater Conveyance Channels, Downchutes and Culverts	LS	
30	Furnish and Install Stormwater Diversion Berms	LS	
31	Furnish and Install Remote Soil Extraction Wells	LS	
32	Furnish LFG Monitoring Probes Materials	LS	
33	Install LFG Monitoring Probes	LS	
34	Furnish and Install LFG Condensate Sump	LS	

3.1.2 Alternative Bid Item – Lump Sum Price

As an alternative to the geomembrane and drainage geocomposite used in the final cover system (base bid items #19, #20, #21, and #22), the Contractor may elect to submit an alternative bid for the use of the AGRU Integrated Drainage System (IDS) with AGRU MicroDrain Liner (50 mil LLDPE) and the AT081 nonwoven geotextile or equivalent product.

#	Description	Unit[2]	Lump Sum Price
Alt#1	Lump Sum Bid Price for 50 mil LLDPE AGRU MicroDrain Liner and AT081 nonwoven geotextile, Materials, Manufacturing Testing, Installation, Installation Testing	LS	

3.1.3 Total Lump Sum Bid Price

The Total Price 1 is the summation of the base bid items in section 3.1.1. The Total Price 2 is the summation of the base bid items in section 3.1.1 and the Alt#1 item in section 3.1.2, excluding base bid items #19, #20, #21 and #22 in section 3.1.1. The Contractor must provide a bid for Total Price 1. The Contractor may elect to provide a bid for Total Price 2.

Total Price 1	Total Price with Base Bid Items	$
Total Price 2	Total Price with Alternative Bid Item (exclude Bid Items #19-22):	$

4.0 TIME OF COMPLETION

4.1 TIME IS OF THE ESSENCE

Bidder agrees that the Work will be substantially complete and will be completed and ready for final

[2] LS indicates lump sum price

payment on or before the dates or within the number of calendar days indicated in the Agreement.

4.2 CONTRACT TIMES

Bidder agrees that the Work will be substantially complete within by March 1, 2024, and will be completed and ready for final payment by March 28, 2024.

4.3 LIQUIDATED DAMAGES

Bidder accepts the provisions of the Terms and Conditions as to liquidated damages.

5.0 BIDDER'S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

5.1 BID ACCEPTANCE PERIOD

This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

5.2 INSTRUCTIONS TO BIDDERS

Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

5.3 RECEIPT OF ADDENDA

Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date

6.0 BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.1 BIDDER'S REPRESENTATIONS

6.1.1

In submitting this Bid, Bidder represents the following:

6.1.1.1

Bidder has examined and carefully studied the Bidding Documents, including Addenda.

6.1.1.2

Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

6.1.1.3

Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.

6.1.1.4

Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in theBid Documents, with respect to the Technical Data in such reports and drawings.

6.1.1.5

Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Bid Documents, with respect to Technical Data in such reports and drawings.

6.1.1.6

Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder's (Contractor's) safety precautions and programs.

6.1.1.7

Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

6.1.1.8

Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

6.1.1.9

Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

6.1.1.10

The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

6.1.1.11

The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

6.2 BIDDER'S CERTIFICATIONS

6.2.1

The Bidder certifies the following:

6.2.1.1

This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.

6.2.1.2

Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.

6.2.1.3

Bidder has not solicited or induced any individual or entity to refrain from bidding.

6.2.1.4

Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 6.2.1.4:

6.2.1.4.1

Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.

6.2.1.4.2

Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.

6.2.1.4.3

Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.

6.2.1.4.4

Coercive practice means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

Bidder:

_____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(typed or printed)

Address for giving notices:

_____

_____

Bidder's Contact:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Phone: _____

Email: _____

Address:

_____

_____

_____

Bidder's Contractor License No.: (if applicable) _____

END OF SECTION 00 41 13

SECTION 00 43 10

BID BOND

498 FINAL COVER SYSTEM CONSTRUCTION PROJECT
BRISTOL INTEGRATED SOLID WASTE MANAGEMENT FACILITY

Bids shall be accompanied by a cashier's or bank check or Bid Guarantee Bond in the amount of not less than five percent (5%) of the bid made payable to the City of Bristol, Virginia, Owner, and subject to the conditions provided in the Instruction to Bidders.

BID GUARANTY

The undersigned bidder submits herewith bid guaranty in an amount of not less than five percent (5%) of the total amount of the bid offered and agrees and consents that the bid guaranty shall be forfeited to the City as liquidated damages if the required contract bond is not executed within fifteen (15) days from the date of the notice of award and work has not been started as required. The following documents are attached to and made a condition of this bid and constitute required Bid Security:

_____ Certified Check or Bank Check

_____ Bid Bond

BID AMOUNT: $ _____

BIDDER: _____

PERSON PREPARING BID: _____

TELEPHONE NUMBER: _____

ADDRESS: _____

_____

Submittal of signed BID Form signifies understanding and acceptance of all stated terms and conditions and acknowledgment of requirement of compliance with all applicable local, state and federal ordinances, laws, rules and regulations whether expressly stated herein or not.

SIGNATURE: _____

PRINTED NAME: _____

TITLE: _____

COMPANY: _____

DATE: _____

SECTION 00 45 13

BIDDER'S QUALIFICATIONS[i]

1.0 GENERAL INFORMATION

1.1

Provide contact information for the Business:

Legal Name of Business:			
Corporate Office			
Name:		Phone number:	
Title:		Email address:	
Business address of corporate office:			
Local Office			
Name:		Phone number:	
Title:		Email address:	
Business address of local office:			

1.2

Provide information on the Business's organizational structure:

Form of Business:	☐ Sole Proprietorship ☐ Partnership ☐ Corporation		
☐ Limited Liability Company ☐Joint Venture comprised of the following companies:			
	1.		
	2.		
	3.		
Provide a separate Qualification Statement for each Joint Venturer.			
Date Business was formed:		State in which Business was formed:	
Is this Business authorized to operate in the Project location?	☐ Yes ☐ No ☒ Pending		
SCC Identification Number:			

1.3

Identify all businesses that own Business in whole or in part (25% or greater), or that are wholly or partly (25% or greater) owned by Business:

Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			

1.4

Provide information regarding the Business's officers, partners, and limits of authority.

Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	

2.0 LICENSING

2.1

Provide information regarding licensure for Business:

Name of License:			
Licensing Agency:			
License No:		Expiration Date:	
Name of License:			
Licensing Agency:			
License No:		Expiration Date:	

3.0 DIVERSE BUSINESS CERTIFICATIONS

3.1

Provide information regarding Business's Diverse Business Certification, if any. Provide evidence of current certification.

Certification	Certifying Agency	Certification Date
☐ Disadvantaged Business Enterprise		
☐ Minority Business Enterprise		
☐ Woman-Owned Business Enterprise		
☐ Small Business Enterprise		
☐ Disabled Business Enterprise		
☐ Veteran-Owned Business Enterprise		
☐ Service-Disabled Veteran-Owned Business		
☐ HUBZone Business (Historically Underutilized) Business		
☐ Other		
☐ None		

4.0 SAFETY

4.1

Provide information regarding Business's safety organization and safety performance.

Name of Business's Safety Officer:		
Safety Certifications		
Certification Name	Issuing Agency	Expiration

4.2

Provide Worker's Compensation Insurance Experience Modification Rate (EMR), Total Recordable Frequency Rate (TRFR) for incidents, and Total Number of Recorded Manhours (MH) for the last 3 years and the EMR, TRFR, and MH history for the last 3 years of any proposed Subcontractor(s) that will provide Work valued at 10% or more of the Contract Price. Provide documentation of the EMR history for Business and Subcontractor(s).

Year									
Company	EMR	TRFR	MH	EMR	TRFR	MH	EMR	TRFR	MH

5.0 FINANCIAL

5.1

Provide information regarding the Business's financial stability. Provide the most recent audited financial statement, and if such audited financial statement is not current, also provide the most current financial statement.

Financial Institution:		
Business address:		
Date of Business's most recent financial statement:		☐ Attached
Date of Business's most recent audited financial statement:		☐ Attached
Financial indicators from the most recent financial statement		
Contractor's Current Ratio (Current Assets ÷ Current Liabilities)		
Contractor's Quick Ratio ((Cash and Cash Equivalents + Accounts Receivable + Short Term Investments) ÷ Current Liabilities)		

6.0 SURETY INFORMATION

Provide information regarding the surety company that will issue required bonds on behalf of the Business, including but not limited to performance and payment bonds.

Surety Name:			
Surety is a corporation organized and existing under the laws of the state of:			
Is surety authorized to provide surety bonds in the Project location?	☐ Yes ☐ No		
Is surety listed in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" published in Department Circular 570 (as amended) by the Bureau of the Fiscal Service, U.S. Department of the Treasury? ☐ Yes ☐ No			
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

7.0 INSURANCE

Provide information regarding Business's insurance company(s), including but not limited to its Commercial General Liability carrier. Provide information for each provider.

Name of insurance provider, and type of policy (CLE, auto, etc.):	
Insurance Provider	Type of Policy (Coverage Provided)
Are providers licensed or authorized to issue policies in the Project location?	☐ Yes ☐ No
Does provider have an A.M. Best Rating of A-VII or better?	☐ Yes ☐ No
Mailing Address (principal place of business):	
Physical Address (principal place of business):	

Phone (main):		Phone (claims):	

8.0 CONSTRUCTION EXPERIENCE

8.1

Provide information that will identify the overall size and capacity of the Business.

Average number of current full-time employees:	
Estimate of revenue for the current year:	
Estimate of revenue for the previous year:	

8.2

Provide information regarding the Business's previous contracting experience.

Years of experience with projects like the proposed project:				
As a general contractor:		As a joint venturer:		
Has Business, or a predecessor in interest, or an affiliate identified in Paragraph 1.03:				
Been disqualified as a bidder by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been barred from contracting by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been released from a bid in the past 5 years? ☐ Yes ☐ No				
Defaulted on a project or failed to complete any contract awarded to it? ☐ Yes ☐ No				
Refused to construct or refused to provide materials defined in the contract documents or in a change order? ☐ Yes ☐ No				
Been a party to any currently pending litigation or arbitration? ☐ Yes ☐ No				

Provide full details in a separate attachment if the response to any of these questions is Yes.

8.3

List all projects currently under contract in Schedule A and provide indicated information.

8.4

List a minimum of three and a maximum of six projects completed in the last 5 years in Schedule B and provide indicated information to demonstrate the Business's experience with projects similar in type and cost of construction.

8.5

In Schedule C, provide information on key individuals whom Business intends to assign to the Project. Provide resumes for those individuals included in Schedule C. Key individuals include the Project Manager, Project Superintendent, Quality Manager, and Safety Manager. Resumes may be provided for Business's key leaders as well.

9.0 REQUIRED ATTACHMENTS

9.1

Provide the following information with the Statement of Qualifications:

9.1.1

If Business is a Joint Venture, separate Qualifications Statements for each Joint Venturer, as required in Paragraph 1.02.

9.1.2

Diverse Business Certifications if required by Paragraph 3.1.

9.1.3

Certification of Business's safety performance if required by Paragraph 4.1.

9.1.4

Financial statements as required by Paragraph 5.1.

9.1.5

Attachments providing additional information as required by Paragraph 8.2.

9.1.6

Schedule A (Current Projects) as required by Paragraph 8.3.

9.1.7

Schedule B (Previous Experience with Similar Projects) as required by Paragraph 8.4.

9.1.8

Schedule C (Key Individuals) and resumes for the key individuals listed, as required by Paragraph 8.05.

9.1.9

Additional items as pertinent.

This Statement of Qualifications is offered by:

Business: _____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(date signed)

(If Business is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

Schedule A—Current Projects

Name of					
Project Owner			Project		
General Description of					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction					

Project Owner			Project		
General Description of					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction					

Project Owner			Project		
General Description of					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction					

Schedule B—Previous Experience with Similar Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project Completed		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project Completed		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project Completed		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule B—Previous Experience with Similar Projects

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project Completed		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project Completed		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project Completed		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule C—Key Individuals

Project Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	
Project Superintendent			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

Safety Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	
Quality Control Manager			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

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00 51 00 - NOTICE OF AWARD

Date of Issuance:			
Owner:	City of Bristol	Owner's Project No.:	
Engineer:	SCS Engineers	Engineer's Project No.:	02218208.17
Project:	SWP#498 Final Cover System Construction		
Contract Name:			
Bidder:			
Bidder's Address:			

You are notified that Owner has accepted your Bid dated _____ for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

SWP#498 Final Cover System Construction

The Contract Price of the awarded Contract is $_____. Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

Three (3) unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents has been made available to Bidder electronically.

☐ Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner three (3) counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders.
3. Other conditions precedent (if any):

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents.

Owner: City of Bristol

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

Copy: Engineer

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SECTION 00 55 00

NOTICE TO PROCEED[i]

Owner:	City of Bristol	Owner's Project No.:	
Engineer:	SCS Engineers	Engineer's Project No.:	02218208.17
Contractor:		Contractor's Project No.:	
Project:	SWP#498 Final Cover System Construction		
Contract Name:			
Effective Date of Contract:			

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on _____ pursuant to Paragraph II of the Terms and Conditions.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement:

The date to achieve Substantial Completion is March 1, 2024; and the date to achieve readiness for final payment is March 28, 2024.

Owner:	City of Bristol
By *(signature)*:	
Name *(printed)*:	
Title:	
Date Issued:	

Copy: Engineer

END OF SECTION 00 55 00

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SECTION 00 61 13.13 - PERFORMANCE BOND

Contractor [Full formal name of Contractor] Name: Address *(principal place of business)*:	**Surety [Full formal name of Surety]** Name: Address *(principal place of business)*:
Owner Name: **City of Bristol** Mailing address *(principal place of business)*: **300 Lee St** **Bristol, VA 24201**	**Contract** Description *(name and location)*: **Bristol ISWMF** **SWP#498 Final Cover System Construction** **2655 Valley Drive** **Bristol, VA 24201** Contract Price: Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____ *(Full formal name of Contractor)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

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1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:

   3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;

   3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

   3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

   5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

   5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

   5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

   5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

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5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

   7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

   7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

   7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.

12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such

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statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

    14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

    14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

    14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

    14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

    14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

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SECTION 00 61 13.16 - PAYMENT BOND

Contractor	**Surety**
Name: Address *(principal place of business)*:	Name: Address *(principal place of business)*:
Owner Name: **City of Bristol** Mailing address *(principal place of business)*: **300 Lee St** **Bristol, VA 24201**	**Contract** Description *(name and location)*: **Bristol ISWMF** **SWP#498 Final Cover System Construction** **2655 Valley Drive** **Bristol, VA 24201** Contract Price: Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____ *(Full formal name of Contractor)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

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1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond will arise after the following:
   - 5.1. Claimants who do not have a direct contract with the Contractor
     - 5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
     - 5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).
   - 5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).
6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
   - 7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
   - 7.2. Pay or arrange for payment of any undisputed amounts.
   - 7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.
8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.

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9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

    16.1. *Claim*—A written statement by the Claimant including at a minimum:

        16.1.1. The name of the Claimant;

        16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;

        16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;

        16.1.4. A brief description of the labor, materials, or equipment furnished;

        16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

        16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

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16.1.7. The total amount of previous payments received by the Claimant; and

16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

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Contractor's Application for Payment

Owner:	City of Bristol	**Owner's Project No.:**	
Engineer:	SCS Engineers	**Engineer's Project No.:**	02218208.17
Contractor:		**Contractor's Project No.:**	
Project:	SWP#498 Final Cover System Construction		
Contract:			

Application No.: _____ **Application Date:** _____

Application Period: **From** _____ **to** _____

1. Original Contract Price			$ -
2. Net change by Change Orders			$ -
3. Current Contract Price (Line 1 + Line 2)			$ -
4. Total Work completed and materials stored to date (Sum of Column G Lump Sum Total and Column J Unit Price Total)			$ -
5. Retainage			
a. _____ X	$ -	Work Completed	$ -
b. _____ X	$ -	Stored Materials	$ -
c. Total Retainage (Line 5.a + Line 5.b)			$ -
6. Amount eligible to date (Line 4 - Line 5.c)			$ -
7. Less previous payments (Line 6 from prior application)			
8. Amount due this application			$ -
9. Balance to finish, including retainage (Line 3 - Line 4)			$ -

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:

(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;

(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such liens, security interest, or encumbrances); and

(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor: _____

Signature: _____ **Date:** _____

Recommended by Engineer		**Approved by Owner**	
By:		**By:**	
Title:		**Title:**	
Date:		**Date:**	

Approved by Funding Agency			
By:		**By:**	
Title:		**Title:**	
Date:		**Date:**	

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Progress Estimate - Lump Sum Work

Contractor's Application for Payment

Owner:	City of Bristol	**Owner's Project No.:**	
Engineer:	SCS Engineers	**Engineer's Project No.:**	02218208.17
Contractor:		**Contractor's Project No.:**	
Project:	SWP#498 Final Cover System Construction		
Contract:			

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I
			Work Completed					
Item No.	Description	Scheduled Value ($)	(D + E) From Previous Application ($)	This Period ($)	Materials Currently Stored (not in D or E) ($)	Work Completed and Materials Stored to Date (D + E + F) ($)	% of Scheduled Value (G / C) (%)	Balance to Finish (C - G) ($)
			Original Contract					
1	Mobilization/Demobilization					-		-
2	Health and Safety Planning and Accommodations					-		-
3	Clearing, Grubbing, and Stripping					-		-
4	Erosion and Sediment Control					-		-
5	Stormwater Basin Excavation					-		-
6	Membrane Deployment Grade Earthwork					-		-
7	Furnish LFG Horizontal Collector Materials					-		-
8	Install LFG Horizontal Collectors					-		-
9	Furnish LFG Header Materials							
10	Install LFG Headers					-		-
11	Furnish Air and Force Main Materials					-		-
12	Install Air and Force Main					-		-
13	Furnish and Install LFG Drainage Pits					-		-
14	Furnish and Install Horizontal Collector Pit Wellheads with Pumps					-		-
15	Furnish and Install Horizontal Collector Tie in to Existing PVC Wells					-		-
16	Furnish and Install Remote LFG Wellhead and LFG Lateral tie-in to EW-22							
17	Furnish and Install Stormwater Sewer System							
18	Furnish and Install Stormwater Basin Outlet							
19	Furnish 40 mil LLDPE Geomembrane							
20	Install 40 mil LLDPE Geomembrane							
21	Furnish Drainage Geocomposite							
22	Install Drainage Geocomposite							
23	Furnish Erosion Control Layer Material							
24	Install Erosion Control Layer							
25	Furnish Vegetative Support Layer Material							
26	Install Vegetative Support Layer					-		-
27	Furnish and Install Access Road					-		-
28	Furnish and Install Permanent Seeding					-		-
29	Furnish and Install Stormwater Conveyance Channels, Downchutes and Culverts					-		-
30	Furnish and Install Stormwater Diversion Berms					-		-
31	Furnish and Install Remote Soil Extraction Wells							
32	Furnish LFG Monitoring Probes Materials							
33	Install LFG Monitoring Probes							
34	Furnish and Install LFG Condensate Sump							
						-		-
	Original Contract Totals	$ -	$ -	$ -	$ -	$ -		$ -

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Progress Estimate - Lump Sum Work

Contractor's Application for Payment

Owner:	City of Bristol	**Owner's Project No.:**	
Engineer:	SCS Engineers	**Engineer's Project No.:**	02218208.17
Contractor:		**Contractor's Project No.:**	
Project:	SWP#498 Final Cover System Construction		
Contract:			

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I
			Work Completed					
Item No.	Description	Scheduled Value ($)	(D + E) From Previous Application ($)	This Period ($)	Materials Currently Stored (not in D or E) ($)	Work Completed and Materials Stored to Date (D + E + F) ($)	% of Scheduled Value (G / C) (%)	Balance to Finish (C - G) ($)
			Change Orders					
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
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						-		-
						-		-
	Change Order Totals	$ -	$ -	$ -	$ -	$ -		$ -
			Original Contract and Change Orders					
	Project Totals	$ -	$ -	$ -	$ -	$ -		$ -

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Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: City of Bristol
Engineer: SCS Engineers
Contractor:
Project: SWP#498 Final Cover System Construction
Contract:

Owner's Project No.:
Engineer's Project No.: 02218208.17
Contractor's Project No.:

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	Item Quantity	Units	Unit Price ($)	Value of Bid Item (C X E) ($)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
Original Contract											
					-		-		-		-
					-		-		-		-
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				Original Contract Totals	$ -		$ -	$ -	$ -		$ -

EJCDC C-620 Contractor's Application for Payment
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Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: City of Bristol
Engineer: SCS Engineers
Contractor:
Project: SWP#498 Final Cover System Construction
Contract:

Owner's Project No.:
Engineer's Project No.: 02218208.17
Contractor's Project No.:

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	Item Quantity	Units	Unit Price ($)	Value of Bid Item (C X E) ($)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
					Change Orders						
					-		-		-		-
					-		-		-		-
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					-		-		-		-
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					-		-		-		-
				Change Order Totals	$ -		$ -	$ -	$ -		$ -
					Original Contract and Change Orders						
				Project Totals	$ -		$ -	$ -	$ -		$ -

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Stored Materials Summary

Contractor's Application for Payment

Owner:	City of Bristol	**Owner's Project No.:**	
Engineer:	SCS Engineers	**Engineer's Project No.:**	02218208.17
Contractor:		**Contractor's Project No.:**	
Project:	SWP#498 Final Cover System Construction		
Contract:			

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I	J	K	L	M
						Materials Stored			Incorporated in Work			
Item No. (Lump Sum Tab) or Bid Item No. (Unit Price Tab)	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Description of Materials or Equipment Stored	Storage Location	Application No. When Materials Placed in Storage	Previous Amount Stored ($)	Amount Stored this Period ($)	Amount Stored to Date (G+H) ($)	Amount Previously Incorporated in the Work ($)	Amount Incorporated in the Work this Period ($)	Total Amount Incorporated in the Work (J+K) ($)	Materials Remaining in Storage (I-L) ($)
								-			-	-
								-			-	-
								-			-	-
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					Totals	$ -	$ -	$ -	$ -	$ -	$ -	$ -

EJCDC C-620 Contractor's Application for Payment
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SECTION 00 63 36

FIELD ORDER[i]

FIELD ORDER NO.: _____

Owner:	City of Bristol	Owner's Project No.:	
Engineer:	SCS Engineers	Engineer's Project No.:	02218208.17
Contractor:		Contractor's Project No.:	
Project:	SWP#498 Final Cover System Construction		
Contract Name:			
Date Issued:		Effective Date of Field Order:	

Contractor is hereby directed to promptly perform the Work described in this Field Order, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference:

Specification Section(s):

Drawing(s) / Details (s):

Description:

Attachments:

Issued by Engineer

By: _____

Title: _____

Date: _____

END OF SECTION 00 63 36

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SECTION 00 63 49 - WORK CHANGE DIRECTIVE[i]

WORK CHANGE DIRECTIVE NO.: _____

Owner:	City of Bristol	Owner's Project No.:	
Engineer:	SCS Engineers	Engineer's Project No.:	02218208.17
Contractor:		Contractor's Project No.:	
Project:	SWP#498 Final Closure System Construction		
Contract Name:			
Date Issued:		Effective Date of Work Change Directive:	

Contractor is directed to proceed promptly with the following change(s):

Description:

Attachments:

Purpose for the Work Change Directive:

Directive to proceed promptly with the Work described herein, prior to agreeing to change in Contract Price and Contract Time, is issued due to:

☐ Non-agreement on pricing of proposed change. ☐ Necessity to proceed for schedule or other reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price: $ _____ **[increase] [decrease] [not yet estimated]**.

Contract Time: _____ days **[increase] [decrease] [not yet estimated]**.

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price ☐ Cost of the Work ☐ Other

	Recommended by Engineer	Authorized by Owner
By:	_____	_____
Title:	_____	_____
Date:	_____	_____

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SECTION 00 63 63

CHANGE ORDER[i] NO.: _____

Owner:	City of Bristol	Owner's Project No.:	
Engineer:	SCS Engineers	Engineer's Project No.:	02218208.17
Contractor:		Contractor's Project No.:	
Project:	SWP#498 Final Closure System Construction		
Contract Name:			
Date Issued:		Effective Date of Change Order:	

The Contract is modified as follows upon execution of this Change Order:

Description:

Attachments:

Change in Contract Price	Change in Contract Times
Original Contract Price: $ _____	Original Contract Times: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] from previously approved Change Orders No. 1 to No. ___: $ _____	**[Increase] [Decrease]** from previously approved Change Orders No.1 to No. ___: Substantial Completion: _____ Ready for final payment: _____
Contract Price prior to this Change Order: $ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] this Change Order: $ _____	**[Increase] [Decrease]** this Change Order: Substantial Completion: _____ Ready for final payment: _____
Contract Price incorporating this Change Order: $	Contract Times with all approved Change Orders: Substantial Completion: Ready for final payment:

	Recommended by Engineer (if required)	Accepted by Contractor
By:	_____	_____
Title:	_____	_____
Date:	_____	_____
	Authorized by Owner	Approved by Funding Agency (if applicable)
By:	_____	_____
Title:	_____	_____
Date:	_____	_____

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SECTION 00 65 16

CERTIFICATE OF SUBSTANTIAL COMPLETION[i]

Owner:	City of Bristol	Owner's Project No.:	
Engineer:	SCS Engineers	Engineer's Project No.:	02218208.17
Contractor:		Contractor's Project No.:	
Project:	SWP#498 Final Cover System Construction		
Contract Name:			

This ☐ Preliminary ☐ Final Certificate of Substantial Completion applies to:

☐ All Work ☐ The following specified portions of the Work:

_____

Date of Substantial Completion: _____

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work must be as provided in the Contract, except as amended as follows:

Amendments to Owner's Responsibilities: ☐ None ☐ As follows:

_____

Amendments to Contractor's Responsibilities: ☐ None ☐ As follows:

_____

The following documents are attached to and made a part of this Certificate:

_____

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

Engineer

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

END OF SECTION 00 65 16

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SECTION 00 70 00

TERMS AND CONDITIONS

The Agreement for Service ("Contract" or "Agreement") with the successful Offeror will contain the following Terms and Conditions. Offerors taking exception to these Terms and Conditions or intending to propose additional or alternative language must (a) identify with specificity the City Terms and Conditions to which they take exception or seek to amend or replace; and (b) include any additional or different language with their bid. Failure to both identify with specificity those terms and conditions Offeror takes exception to or seeks to amend or replace as well as to provide Offeror's additional or alternate terms and conditions may result in rejection of the bid.

A. Procedures

The extent and character of the services to be performed by the Offeror shall be subject to the general control and approval of the City and their authorized representative(s). Any change to the Contract must be approved in writing by the City.

B. Delays and Delivery Failures

The Offeror must keep the City advised at all times of services' status relative to the schedule as agreed upon by the parties. If delay is foreseen, the Offeror shall give immediate written notice to the Purchasing Department and include an expected resolution timeframe. Should the Offeror fail to deliver the proper item(s)/service(s) at the time and place(s) contracted for, or within the resolution timeframe submitted with the delay notification or should the Offeror fail to make a timely replacement of rejected items /services when so required, the City may purchase items/services of comparable quality and quantity in the open market to replace the undelivered or rejected items/services. The Offeror shall reimburse the City for all costs in excess of the Agreement price when purchases are made in the open market; or in the event that there is a balance the City owes to the Offeror from prior transactions, an amount equal to the additional expense incurred by the City as a result of the Offeror's nonperformance shall be deducted from the balance as payment.

C. Business, Professional, & Occupational License Requirement

All firms or individuals doing business in the City are required to be licensed in accordance with the City Code Section 18-28. - License Requirement.

Questions regarding licensing should be directed to the Office of Commissioner of Revenue, telephone (276) 645-7316.

D. Authorization to Conduct Business in the Commonwealth

A contractor organized as a stock or nonstock corporation, limited liability company, business trust, or limited partnership or registered as a registered limited liability partnership shall be authorized to transact business in the Commonwealth as a domestic or foreign business entity if so required by Title 13.1 or Title 50 of the Code of Virginia or as otherwise required by law. Any business entity described above that enters into a contract with a public body pursuant to the Virginia Public Procurement Act shall

not allow its existence to lapse or its certificate of authority or registration to transact business in the Commonwealth, if so required under Title 13.1 or Title 50, to be revoked or cancelled at any time during the term of the contract. A public body may void any contract with a business entity if the business entity fails to remain in compliance with the provisions of this section.

E. Insurance

1. The Offeror shall be responsible for its work and every part thereof, and for all materials, tools, equipment, appliances, and property of any and all description used in connection therewith. The Offeror assumes all risk of direct and indirect damage or injury to the property or persons used or employed on or in connection with the work contracted for, and of all damage or injury to any person or property wherever located, resulting from any action, omission, commission or operation under the Contract.

2. The Offeror and all sub-offerors shall, during the continuance of the work under the Contract, provide the following:

    a. Workers' Compensation and Employer's Liability to protect the Offeror from any liability or damages for any injuries (including death and disability) to any and all of its employees, including any and all liability or damage which may arise by virtue of any statute or law in force within the Commonwealth of Virginia.

    b. Comprehensive General Liability insurance to protect the Offeror, and the interest of the City, its officers, employees, and agents against any and all injuries to third parties, including bodily injury and personal injury, wherever located, resulting from any action or operation under the Contract or in connection with the contracted work. The General Liability insurance shall also include the Broad Form Property Damage endorsement, in addition to coverage for explosion, collapse, and underground hazards, where required.

    c. Automobile Liability insurance, covering all owned, non-owned, borrowed, leased, or rented vehicles operated by the Offeror.

    d. Professional Liability against any and all wrongful acts, errors, or omissions on the part of the Offeror resulting from any action or operation under the Contract or in connection with the contracted work.

3. The Offeror agrees to provide the above-referenced policies with the following limits. Liability insurance limits may be arranged by General, Automobile and Professional Liability policies for the full limits required, or by a combination of underlying policies for lesser limits with the remaining limits provided by an Excess or Umbrella Liability policy.

    a. Workers' Compensation: Statutory requirements and benefits. Coverage is compulsory for employers of three or more employees, to include the employer.

b. Employer's Liability:

i. Each Accident: $1,000,000
ii. Disease, Each Employee: $1,000,000
iii. Disease, Policy Limit: $2,000,000

c. Commercial General Liability:

i. General Aggregate $2,000,000
ii. Each Occurrence $1,000,000
iii. Commercial General Liability shall include bodily injury and property damage, personal injury, advertising injury, products and completed operations coverage. General Aggregate limit shall apply separately to the project. Contractor's insurance coverage shall be primary and non-contributory.

d. Automobile Liability: Combined Single Limit of $1,000,000

e. Professional Liability:

i. General Aggregate $2,000,000
ii. Each Occurrence $1,000,000

f. Umbrella Liability: $2,000,000 per occurrence.

4. The following provisions shall be agreed to by the Offeror:

a. No change, cancellation, or non-renewal shall be made in any insurance coverage without a forty-five (45) day written notice to the City. The Offeror shall furnish a new certificate prior to any change or cancellation date. The failure of the Offeror to deliver a new and valid certificate will result in suspension of all payments until the new certificate is furnished.

b. Liability Insurance "Claims Made" basis:

If the liability insurance purchased by the Offeror has been issued on a "claims made" basis, the Offeror must comply with the following additional conditions. The limits of liability and the extensions to be included as described previously in these provisions, remain the same. The Offeror must either:

i. Agree to provide, prior to commencing work under the Contract, certificates of insurance evidencing the above coverage for a period of two (2) years after final payment for the Contract for General Liability policies and five (5) years for Professional Liability policies. This certificate shall evidence a "retroactive date" no later than the beginning of the Offeror's work under this Contract,

or

ii. Purchase the extended reporting period endorsement for the policy or policies in force during the term of this Contract and evidence the purchase of this extended reporting period endorsement by means of a certificate of insurance or a copy of the endorsement itself.

c. The Offeror must disclose the amount of deductible/self-insured retention applicable to the General Liability, Automobile Liability and Professional Liability policies, if any. The City reserves the right to request additional information to determine if the Offeror has the financial capacity to meet its obligations under a deductible /self-insured plan. If this provision is utilized, the Offeror will be permitted to provide evidence of its ability to fund the deductible /self-insured retention.

d. Origin of Insurance

   i. The Offeror agrees to provide insurance issued by companies admitted within the Commonwealth of Virginia, with the Best's Key Rating of at least A:VII.
   ii. European markets including those based in London, and the domestic surplus lines market that operate on a non-admitted basis are exempt from this requirement provided that the Offeror's broker can provide financial data to establish that a market's policyholder surpluses are equal to or exceed the surpluses that correspond to Best's A:VII Rating.

e. Required Certificates

   i. The Offeror will provide an original signed Certificate of Insurance and such endorsements as prescribed herein.
   ii. The Offeror will provide on request certified copies of all insurance coverage related to the Contract within ten (10) business days of request by the City. These certified copies will be sent to the City from the Offeror's insurance agent or representative. Any request made under this provision shall be deemed confidential and proprietary.
   iii. Any certificates provided shall indicate the Contract name and number.

f. The City, its officers and employees shall be Endorsed to the Offeror's Automobile and General Liability policies as an "additional insured" with the provision that this coverage "is primary to all other coverage the City may possess." (Use "loss payee" where there is an insurable interest). A Certificate of Insurance evidencing the additional insured status must be presented to the City along with a copy of the Endorsement.

g. Compliance by the Offeror with the foregoing requirements as to carrying insurance shall not relieve the Offeror of their liabilities provisions of the Contract.

5. Contractual and other Liability insurance provided under this Contract shall not contain a supervision, inspection or engineering services exclusion that would preclude the City from supervising and/or inspecting the project as to the end result. The Offeror shall assume all on-the-job responsibilities as to the control of persons directly employed by it.

6. Precaution shall be exercised at all times for the protection of Persons (including employees) and property.

7. The Offeror is to comply with the Occupational Safety and Health Act of 1970, Public Law 91-956, as it may apply to this Contract.

8. If an "ACORD" Insurance Certificate form is used by the Offeror's insurance agent, the words "endeavor to" and ". . . but failure to mail such notice shall impose no obligation or liability of any kind upon the company" in the "Cancellation" paragraph of the form shall be deleted.

9. The Offeror agrees to waive all rights of subrogation against the City, its officers, employees, and agents.

F. Hold Harmless

The Offeror shall indemnify and hold harmless the City, including its officials and employees, from all liability, losses, costs, damages, claims, causes of action, and suits of any nature (specifically including reasonable attorney's fees and defense costs incurred with the defense of third party claims) incidental to or brought as a consequence of any negligent act, error, omission, or breach of the applicable professional standard of care by the Offeror and /or its subcontractors. The Offeror agrees that this clause shall include, but is not limited to, claims involving infringement of patent or copyright. This section shall survive completion of the Contract. The City is prohibited from indemnifying Offeror and/or any other third parties.

G. Safety

All Offerors and sub-offerors performing services for the City are required and shall comply with all Occupational Safety and Health Administration (OSHA), State and City Safety and Occupational Health Standards, and any other applicable rules and regulations. Also, all Offerors and sub-offerors shall be held responsible for the safety of their employees and any unsafe acts or conditions that may cause injury or damage to any persons or property within and around the work site area under this Contract.

H. Anti-Discrimination

The City of Bristol, VA in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 US.C.§§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

By submitting their bids, offerors certify to the City that they will conform to the provisions of the Federal Civil Rights Act of 1964, as amended, as well as the Virginia Fair Employment Contracting Act of 1975, as amended, where applicable, the Virginians With Disabilities Act, the Americans With Disabilities Act and § 2.2-4311 of the Virginia Public Procurement Act (VPPA). If the award is made to a faith-based organization, the organization shall not discriminate against any recipient of goods, services, or disbursements made pursuant to the contract on the basis of the recipient's religion, religious belief, refusal to participate in a religious practice, or on the basis of race, age, color, gender sexual orientation, gender identity, or national origin and shall be subject to the same rules as other organizations that contract with public bodies to account for

the use of the funds provided; however, if the faith-based organization segregates public funds into separate accounts, only the accounts and programs funded with public funds shall be subject to audit by the public body. (Code of Virginia, § 2.2-4343.1E).

In every contract over $10,000, the provisions in 1. and 2. below apply:

1. During the performance of this contract, the contractor agrees as follows:

    a. The contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, sexual orientation, gender identity, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the contractor. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

    b. The contractor, in all solicitations or advertisements for employees placed by or on behalf of the contractor, will state that such contractor is an equal opportunity employer.

    c. Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.

    d. If the contractor employs more than five employees, the contractor shall (i) provide annual training on the contractor's sexual harassment policy to all supervisors and employees providing services in the Commonwealth, except such supervisors or employees that are required to complete sexual harassment training provided by the Department of Human Resource Management, and (ii) post the contractor's sexual harassment policy in (a) a conspicuous public place in each building located in the Commonwealth that the contractor owns or leases for business purposes and (b) the contractor's employee handbook.

    e. The requirements of these provisions 1. and 2. are a material part of the contract. If the Contractor violates one of these provisions, the City may terminate the affected part of this contract for breach, or at its option, the whole contract. Violation of one of these provisions may also result in debarment from State contracting regardless of whether the specific contract is terminated.

    f. In accordance with Executive Order 61 (2017), a prohibition on discrimination by the contractor, in its employment practices, subcontracting practices, and delivery of goods or services, on the basis of race, sex, color, national origin, religion, sexual orientation, gender identity, age, political affiliation, disability, or veteran status, is hereby incorporated in this contract.

2. The contractor will include the provisions of 1. above in every subcontract or purchase order over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

I. Ethics in Public Contracting

The provisions contained in § 2.2-4367 through § 2.2-4377 of the Virginia Public Procurement Act as set forth in the 1950 Code of Virginia, as amended, shall be applicable to all Contracts solicited or entered into by the City. A copy of these provisions may be obtained from the Purchasing Department upon request.

The above-stated provisions supplement, but do not supersede, other provisions of law including, but not limited to, the Virginia State and Local Government Conflict of Interests Act (§ 2.2-3100 et seq.), the Virginia Governmental Frauds Act (§ 18.2-498.1 et seq.) and Articles 2 and 3 of Chapter 10 of Title 18.2. The provisions apply notwithstanding the fact that the conduct described may not constitute a violation of the Virginia Conflict of Interests Act.

J. Drug-free Workplace

Every Contract of over $10,000 shall include the following provisions:

During the performance of this Contract, the Offeror agrees to (i) provide a drug-free workplace for the Offeror's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the Offeror's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the Offeror that the Offeror maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every subcontract or purchase order of over $10,000, so that the provisions will be binding upon each sub-offeror or vendor.

For the purposes of this section, "drug-free workplace' means a site for the performance of work done in connection with a specific Contract awarded to an Offeror in accordance with this chapter, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana during the performance of the Contract.

K. Immigration Reform and Control Act of 1986

By entering this Contract, the Offeror certifies that it does not and will not during the performance of this Contract violate the provisions of the Federal Immigration Reform and Control Act of 1986, which prohibits employment of illegal aliens.

L. Exemption from Taxes

Pursuant to Va. Code § 58.1-609.1, the City is exempt from Virginia State Sales or Use Taxes and Federal Excise Tax, therefore the Offeror shall not charge the City for Virginia State Sales or Use Taxes or Federal Excise Tax on the finished goods or products provided under the Contract. However, this exemption does not apply to the Offeror, and the Offeror shall be responsible for the payment of any sales, use, or excise tax it incurs in providing the goods required by the Contract, including, but not limited to, taxes on materials purchased by an Offeror for incorporation in or use on a construction project. Nothing in this section shall prohibit the Offeror from including its own sales tax expense in connection with the Contract in its Contract price.

M. Ordering, Invoicing and Payment

All work requested under this Contract shall be placed on a City issued Purchase Order. The Offeror shall not accept credit card orders or payments.

The Offeror shall submit invoices, at the completion of tasks and submission of deliverables; such statement to include a detailed breakdown of all charges for that deliverable.

Payments for services are to be requested as monthly billings submitted by Offeror by the end of the calendar month and payable by the City within 30 days of receipt.

All such invoices will be paid timely by the City unless any items thereon are questioned, in which event payment will be withheld pending verification of the amount claimed and the validity of the claim. The Offeror shall provide complete cooperation during any such investigation.

All invoices shall be forwarded to the following address:

Director of Public Works
City of Bristol, Virginia
2515 Valley Drive
Bristol, VA 24201

Individual Offerors shall provide their social security numbers and proprietorships, partnerships, and corporations shall provide their federal employer identification number on the pricing form.

Offeror shall provide a current Form W-9 – Request for Taxpayer Identification Number and Certification.

N. Payments to Subcontractors

Within seven (7) days after receipt of amounts paid by the City for work performed by a subcontractor under this Contract, the Offeror shall either:

1. Pay the subcontractor for the proportionate share of the total payment received from the City attributable to the work performed by the subcontractor under this Contract; or

2. Notify the City and subcontractor, in writing, of his/her intention to withhold all or a part of the subcontractor's payment and the reason for non-payment.

   The Offeror shall pay interest to the subcontractor on all amounts owed that remain unpaid beyond the seven (7) day period except for amounts withheld as allowed in item 2 above.

   Unless otherwise provided under the terms of this Contract interest shall accrue at the rate of one percent (1 %) per month.

   The Offeror shall include in each of its subcontracts a provision requiring each subcontractor to include or otherwise be subject to the same payment and

interest requirements as set forth above with respect to each lower-tier subcontractor.

The Offeror's obligation to pay an interest charge to a subcontractor pursuant to this provision may not be construed to be an obligation of the City.

O. Substitutions

NO substitutions, additions or cancellations, including those of key personnel are permitted after Contract award without written approval by the Purchasing Department. Where specific employees are proposed by the Offeror for the work, those employees shall perform the work as long as that employee works for the Offeror, either as an employee or subcontractor unless the City agrees to the substitution. Requests for substitutions will be reviewed by the City and approval may be given by the City at its sole discretion. The City shall be notified immediately by the Offeror when the substitution of key personnel or those identified in the bid may be necessary. The substitution process shall be complete within 14 calendar days of the Offeror's notification to the City.

P. Assignment

The Agreement may not be assigned in whole or in part without the prior written consent of the Purchasing Department. The rights and obligations of the Offeror are personal and may be performed only by the Offeror. Any purported assignment that does not comply with this provision is void. This Agreement is binding upon and inures to the benefit of the parties and their respective permitted successors and assigns.

Q. Termination

Subject to the provisions below, the Contract may be terminated by the City upon thirty (30) days advance written notice to the Offeror; but if any work or service hereunder is in progress, but not completed as of the date of termination, then the Contract may be extended upon written approval of the City until said work or services are completed and accepted.

1. Termination for Convenience

   The City may terminate this Contract for convenience at any time in which case the parties shall negotiate reasonable termination costs.

2. Termination for Cause

   In the event of Termination for Cause, the thirty (30) days advance notice is waived and the Offeror shall not be entitled to termination costs.

3. Termination Due to Unavailability of Funds in Succeeding Fiscal Years

   If funds are not appropriated or otherwise made available to support continuation of the performance of this Contract in a subsequent fiscal year, then the Contract shall be canceled and, to the extent permitted by law, the Offeror shall be reimbursed for the reasonable value of any non-recurring costs incurred but not amortized in the price of the supplies or services delivered under the Contract.

4. Availability of Funds

   It is understood and agreed between the parties herein that the City of Bristol Virginia shall be bound hereunder only to the extent of the funds appropriated and available or which may hereafter become available for the purpose of this agreement.

R. Contractual Disputes

The Offeror shall give written notice to the City Manager of intent to file a claim for money or other relief within ten (10) calendar days of the occurrence giving rise to the claim or at the beginning of the work upon which the claim is to be based, whichever is earlier.

The Offeror shall submit its invoice for final payment within thirty (30) days after completion or delivery.

The claim, with supporting documentation, shall be submitted to the City Manager by US Mail, return receipt requested, courier, or overnight delivery service, no later than sixty (60) days after final payment. If the claim is not disposed of by agreement, the City Manager shall reduce his decision to writing and mail via U.S. mail or otherwise forward a copy thereof to the Offeror within thirty (30) days of the City's receipt of the claim.

The City Manager's decision shall be final unless the Offeror appeals within thirty (30) days by submitting a written letter of appeal to the City Manager, or his designee. The City Manager shall render a decision within sixty (60) days of receipt of the appeal.

No Offeror shall institute any legal action until all statutory requirements have been met. Each party shall bear its own costs and expenses resulting from any litigation, including attorney's fees.

S. Prime Offeror Responsibilities

The Offeror(s) shall be responsible for completely supervising and directing the work under the resulting Contract(s) and all subcontractors that they may utilize. Subcontractors who perform work under the resulting Contract shall be responsible to the prime Offeror. The Offeror agrees to be fully responsible for the acts and omissions of their subcontractors and of persons employed by them.

T. Ownership of Documents

Any reports, specifications, drawings, blueprints, negatives, electronic files or other documents prepared by the Offeror in the performance of its obligations under the Contract shall be the exclusive property of the City, and all such materials shall be returned to the City upon completion, termination, or cancellation of this Contract. The Offeror shall not use, willingly allow, or cause such materials to be used for any purpose other than performance of all Offeror's obligations under the resulting Contract without the prior written consent of the City. However, the Offeror may retain file copies which cannot be used without prior written consent of the City. The City agrees that the Offeror shall not be liable for damages, loss, or injury resulting from the future use of the provided documents for other than the project specified when the Offeror is not the firm of record.

U. Submissions

All Project correspondence, design/review documents, reports, etc., prepared by the Offeror shall be distributed to the City Manager for each major phase and sub phase of the Project in the quantities as directed. Within thirty (30) days of completion of each Project phase, submit a Project phase completion report with phase documents to the City Manager.

V. Responsibility for Claims and Liabilities

The City's review, approval, or acceptance of, or payment for, any services required shall not be construed to operate as a waiver by the City of any rights or of any cause of action arising out of the Contract. The Offeror shall be and remains liable to the City for the accuracy and competency of plans, specifications, or other documents or work and Offeror is responsible to the City for any costs incurred resulting from any errors, acts or omissions in the performance of any services furnished.

W. Severability

In the event that any provision shall be adjudged or decreed to be invalid, by a court of competent jurisdiction, such ruling shall not invalidate the entire Agreement but shall pertain only to the provision in question and the remaining provisions shall continue to be valid, binding and in full force and effect.

X. Governing Law /Forum

This Agreement shall be governed and construed in all respects by its terms and by the laws of the Commonwealth of Virginia, without giving effect to its conflicts of law's provisions. Any judicial action shall be filed in the Circuit Court for the City of Bristol, Virginia. Offeror expressly waives any objection to venue or jurisdiction of the Circuit Court for the City of Bristol, Virginia. Offeror expressly consents to waiver of service of process in an action pending in the Circuit Court for the City of Bristol, Virginia pursuant to Virginia Code § 8.01-286.1.

Y. Notices

All notices and other communications hereunder shall be deemed to have been given when made in writing and either (a) delivered in person, (b) delivered to an agent, such as an overnight or similar delivery service, or (c) deposited in the United States mail, postage prepaid, certified or registered, addressed as follows:

TO OFFEROR:	TO CITY OF BRISTOL VIRGINIA:
TBD	City of Bristol Virginia Purchasing Department Emily 300 Lee Street Bristol, VA 24201

Notice is deemed to have been received: (i) on the date of delivery if delivered in person; (ii) on the first business day after the date of delivery if sent by same day or overnight courier service; or (iii) on the third business day after the date of mailing, if sent by

certified or registered United States Mail, return receipt requested, postage and charges prepaid.

Z. Counterparts

This Contract and any amendments or renewals hereto may be executed in a number of counterparts, and each counterpart signature, when taken with the other counterpart signatures, is treated as if executed upon one original of this Contract or any amendment or renewal. A signature by any party to this Contract provided by facsimile or electronic mail is binding upon that party as if it were the original.

AA. Force Majeure

A party is not liable for failure to perform the party's obligations if such failure is as a result of Acts of God (including fire, flood, earthquake, storm, hurricane or other natural disaster), war, invasion, act of foreign enemies, hostilities (regardless of whether war is declared), civil war, rebellion, revolution, insurrection, military or usurped power or confiscation, terrorist activities, nationalization, government sanction, blockage, embargo, strikes at national level or industrial disputes at a national level, or strike or industrial disputes by labor not employed by the affected party, its subcontractors or its suppliers and which affect an essential portion of the contracted for works but excluding any industrial dispute which is specific to the performance of the works or this contract, interruption or failure of electricity or telephone service.

If a party asserts Force Majeure as an excuse for failure to perform the party's obligation, that party must immediately notify the other party giving full particulars of the event of force majeure and the reasons for the event of force majeure preventing that party from, or delaying that party in performing its obligations under this contract that party must use its reasonable efforts to mitigate the effect of the event of force majeure upon its or their performance of the contract and to fulfill its or their obligations under the contract.

An event of force majeure does not relieve a party from liability for an obligation which arose before the occurrence of that event, nor does that event affect the obligation to pay money in a timely manner which matured prior to the occurrence of that event.

The Offeror has no entitlement and City has no liability for: (1) any costs, losses, expenses, damages or the payment of any part of the contract price during an event of force majeure; and (2) any delay costs in any way incurred by the Offeror due to an event of force majeure.

BB. Survival of Terms

Upon discharge of this Agreement, Sections (Notice, Hold Harmless, Warranties, Governing Law/Forum, Contractual Disputes) of these Terms and Conditions continue and survive in full force and effect.

CC. Non-Waiver

No waiver of any provision of this Agreement shall constitute a waiver of any other provision nor shall any waiver of this Agreement constitute a continuing waiver unless otherwise expressly provided.

DD. Workmanship and Inspection

All services provided under this Contract shall be performed in a skillful, workmanlike and professional manner. The Offeror and its employees shall be professional and courteous at all times. The City may, in writing, require the Offeror to remove any employee from work for reasonable cause, as determined by the City. Further, the City may, from time to time, make inspections of the services performed under this Agreement. Any inspection by the City does not relieve the Offeror of any responsibility in meeting the Agreement requirements. Offeror employees that have been removed at the direction of the City shall be replaced within seven calendar days after City notification.

EE. Debarment Status

By participating in this procurement, the vendor certifies that they are not currently debarred by the Commonwealth of Virginia or Federal Government from submitting a response for the type of goods and/or services covered by this solicitation. Vendor further certifies that they are not debarred from filling any order or accepting any resulting order, or that they are an agent of any person or entity that is currently debarred by the Commonwealth of Virginia or Federal Government. If a vendor is created or used for the purpose of circumventing a debarment decision against another vendor, the non-debarred vendor will be debarred for the same time period as the debarred vendor.

FF. Supremacy Clause

Notwithstanding any provision in the bidder's/proposer's response to the contrary, the bidder/proposer agrees that the terms and conditions contained in the City of Bristol, Virginia's Invitation to Bid or Request for Proposal prevail over contrary terms and conditions contained in the bidder's/proposer's response.

GG. Equal Employment Opportunity

The offeror hereby agrees that it will incorporate or cause to be incorporated into any contract for construction work, or modification thereof, as defined in the regulations of the Secretary of Labor at 41 CFR Chapter 60, which is paid for in whole or in part with funds obtained from the Federal Government or borrowed on the credit of the Federal Government pursuant to a grant, contract, loan, insurance, or guarantee, or undertaken pursuant to any Federal program involving such grant, contract, loan, insurance, or guarantee, the following equal opportunity clause:

During the performance of this contract, the contractor agrees as follows:

1. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following:

Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

2. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.

3. The contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.

4. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

5. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

6. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

7. In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

8. The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance:

   Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

The offeror further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally assisted construction work: Provided, that if the offeror so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract.

The offeror agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of contractors and subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance.

The offeror further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a contractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and subcontractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the offeror agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this grant (contract, loan, insurance, guarantee); refrain from extending any further assistance to the offeror under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such offeror; and refer the case to the Department of Justice for appropriate legal proceedings.

HH. Antitrust

By entering into a contract, the contractor conveys, sells, assigns, and transfers to the City of Bristol Virginia all rights, title and interest in and to all causes of action it may now have or hereafter acquire under the antitrust laws of the United States and the Commonwealth of Virginia, relating to the particular goods or services purchased or acquired by the City of Bristol Virginia under said contract.

II. Liquidated Damages

If the Contractor fails to achieve Milestone #1 Completion of the Work within the Contract Time and as otherwise required by the Contract Documents, the Owner shall be entitled to retain or recover from the Contractor, as Step One Liquidated Damages and not as a penalty, the following per diem amount commencing upon the first day following expiration of the Contract Time and continuing until the actual date of Milestone #1 Completion. Such liquidated damages are hereby agreed to be a reasonable pre-estimate of damages the Owner will incur as a result of delayed Milestone #1 Completion of the Work:

One Thousand Dollars ($1,000.00) per consecutive calendar day for up to 15 Calendar Days beyond expiration of the Contract Times; then,

Two Thousand Dollars ($2,000.00) per consecutive calendar day after 15 Calendar Days beyond expiration of the Contract Times

If the Contractor fails to achieve Substantial Completion of the Work within the Contract Time and as otherwise required by the Contract Documents, the Owner shall be entitled to retain or recover from the Contractor, as Step Two Liquidated Damages and not as a penalty, the following per diem amount commencing upon the first day following expiration of the Contract Time and continuing until the actual date of Substantial Completion. Such liquidated damages are hereby agreed to be a reasonable pre-estimate of damages the Owner will incur as a result of delayed Substantial Completion of the Work:

One Thousand Dollars ($1,000.00) per consecutive calendar day for up to 15 Calendar Days beyond expiration of the Contract Times; then,

Two Thousand Dollars ($2,000.00) per consecutive calendar day after 15 Calendar Days beyond expiration of the Contract Times

If the Contractor fails to achieve Final Completion of the Work within the Contract Time, as Step Three Liquidated Damages and not as a penalty, the following per diem amount commencing upon the first day following the actual date of Substantial Completion and continuing until the actual date of Final Completion. Such liquidated damages are hereby agreed to be a reasonable pre-estimate of damages the Owner will incur as a result of delayed Final Completion of the Work:

One Thousand Dollars ($1,000.00) per consecutive calendar day for up to 15 Calendar Days beyond expiration of the Contract Times; then,

Two Thousand Dollars ($2,000.00) per consecutive calendar day after 15 Calendar Days beyond expiration of the Contract Times

The Owner may deduct liquidated damages described above from any unpaid amounts then or thereafter due the Contractor under this Agreement. Should the amount of any liquidated damages exceed the amount due or to become due to the Contractor, then the Contractor and his sureties shall be liable for and shall pay to the Owner the amount of any such excess.

JJ. Good Housekeeping

In accordance with the Clean Water Act, established by the Environmental Protection Agency (EPA) and enforced by the Virginia Department of Environmental Quality (DEQ), the City of Bristol Virginia is required to implement and enforce written procedures as part of the Municipal Separate Storm Sewer System (MS4) permit program requirements to prevent, to the maximum extent practicable, potential pollutants that will lead to a point discharge at a natural drainage way. The City of Bristol Virginia's written procedures are provided in the Good Housekeeping/Pollution Prevention (GH/PP) manual provided to the Contractor. The Contractor shall employ good housekeeping practices outlined in the GH/PP manual and as directed in response to City inspection reports on all City properties and immediately remediate all spills containing potential pollutants as directed in the manual. If, through an audit or inspection, the EPA or DEQ renders fines to the City on account of poor practices determined to be the fault of Contractor, the City reserves the right to collect compensation from the Contractor. Contractors applying pesticides and herbicides shall provide evidence of appropriate certification in accordance with Virginia Law.

By signing the Contract, the Contractor acknowledges receipt of the GH/PP manual and certifies Contractor's understanding of its roles, responsibilities and liabilities associated with the City's MS4 Program. If the Contractor has any questions during the term of this contract concerning the Good Housekeeping and Pollution Prevention Manual, the Contractor may contact the Landfill Environmental & Safety Compliance Officer.

KK. Contract Provisions for Non-Federal Entity Contracts Under Federal Awards

1. All contracts awarded in excess of $100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations, 29 CFR Part 5. Each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. No laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

2. Contracts in excess of $150,000 must contain a provision requiring compliance with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Contract Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency.

3. A contract award will not be made to parties listed on the government-wide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180.

4. Contractors that apply or bid for an award exceeding $100,000 must file the required certification per the Byrd Anti-Lobbying Amendment (31 U.S.C. 1352). The contractor certifies that it will not and has not used Federal appropriated

funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award will be disclosed.

5. As appropriate and to the extent consistent with law, the non-Federal entity should, to the greatest extent practicable under a Federal award, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cements, and other manufactured products). The requirements of this section must be included in all subawards including all contracts and purchase orders for work or products under this award. For purposes of this section:

    a. "Produced in the United States" means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.

    b. "Manufactured products" means items and construction materials composed in whole or in part of nonferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

6. Contractor must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds $10,000 or the value of the quantity acquired during the preceding fiscal year exceeded $10,000; procuring solid waste management services in a manner that maximized energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

LL. Contract Times

1. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

2. The Work will be substantially complete March 1, 2024, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions by March 28, 2024.

3. Parts of the Work must be substantially completed on or before the following Milestone(s):

4. Final Cover System Completion - March 1st, 2024

MM. Modification of Contract

1. Pursuant to the statutory requirements of Section 2.2-4309 of the Code of Virginia, 1950, as amended, modifications to the contract which exceed the greater of $50,000 or twenty-five percent of the contract require advance approval by Bristol, Virginia City Council. In no event may the amount of any contract, without adequate consideration, be increased for any purpose, including, but not limited to, relief of an offeror from the consequences of an error in its bid or offer. Nothing shall prevent a public body from placing greater restrictions on contract modifications.

NN. Contractor/Consultant/Supplier Agreement: U.S. DOT 1050.2A – Appendix A

1. Compliance with Regulations: The contractor (hereinafter includes consultants) will comply with the Acts and the Regulations relative to Nondiscrimination in Federally-assisted programs of the U.S. Department of Transportation, the Federal Highway Administration, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.

2. Nondiscrimination: The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR Part 21.

3. Solicitations for Subcontracts, Including Procurements of Materials and Equipment: In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor's obligations under this contract and the Acts and the Regulations relative to Nondiscrimination on the grounds of race, color, or national origin.

4. Information and Reports: The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Recipient or the Federal Highway Administration to be pertinent to ascertain compliance with such Acts, Regulations, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the contractor will so certify to the Recipient or the Federal Highway Administration, as appropriate, and will set forth what efforts it has made to obtain the information.

5. Sanctions for Noncompliance: In the event of a contractor's noncompliance with the Non discrimination provisions of this contract, the Recipient will impose such contract sanctions as it or the Federal Highway Administration may determine to be appropriate, including, but not limited to:
    a. withholding payments to the contractor under the contract until the contractor complies; and/or

b. cancelling, terminating, or suspending a contract, in whole or in part.

6. Incorporation of Provisions: The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as the Recipient or the Federal Highway Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request the Recipient to enter into any litigation to protect the interests of the Recipient. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

OO. Contractor/Consultant/Supplier Agreements: U.S. DOT 1050.2A – Appendix E

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

<u>Pertinent Nondiscrimination Authorities:</u>

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d *et seq*., 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin); and 49 CFR Part 21;
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Federal-Aid Highway Act of 1973, (23 U.S.C. § 324 *et seq*.), (prohibits discrimination on the basis of sex);
- Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 *et seq*.), as amended, (prohibits discrimination on the basis of disability); and 49 CFR Part 27;
- The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 *et seq*.), (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982, (49 USC § 471, Section 47123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131 – 12189) as implemented by Department of Transportation regulations at 49 C.F.R. parts 37 and 38;
- The Federal Aviation Administration's Non-discrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures non-discrimination against minority

populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;

- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1681 et seq).

ATTACHMENT A

Sample Contract

CONTRACT FOR

Contract Number:

This contract entered into this_____day of_____2023, by _____hereinafter called the "Contractor" and the City of Bristol Virginia, hereinafter called the "City".

WITNESSETH that the Contractor and the City, in consideration of mutual covenants, promises and agreements herein contained, agree as follows:

SCOPE OF SERVICES: The Contractor shall provide the services to the City as set forth in the Invitation for Bid attached hereto.

CONTRACT PERIOD: The contract period is from_____.

COMPENSATION AND METHOD OF PAYMENT: The Contractor shall be paid in accordance with the Contract Documents in the amount of_____, subject to the Contract Document, Section 01 22 00 Measurement and Payment and Section 00 41 13 Bid Form. There shall be no addition(s) or deletion(s) to the Contract without the prior written approval of a Change Order issued by the City.

CONTRACT DOCUMENTS: The Contract Documents shall consist of the contract, Invitation for Bid and all attachments to the Invitation for Bid.

CONTRACTOR:	CITY OF BRISTOL VIRGINIA:
By:_____	By:_____
Title:_____	Title:_____
Date:_____	Date:_____

END OF SECTION 00 70 00

SECTION 01 11 00

SUMMARY OF WORK

1.0 GENERAL

1.1 SECTION INCLUDES

- Work summary
- Owner supplied products
- Contractor's use of site and premises.
- Owner Occupancy
- Progress Meetings

1.2 WORK SUMMARY

The work to be performed under these contract documents includes, but is not limited to, the following:

- Mobilization and demobilization
- Providing temporary field offices, storage, sanitary facilities, and communication equipment.
- Health and safety planning accommodations
- Establishment and maintenance of erosion and sediment control throughout the project
- Construction layout and surveying, investigate/locate existing site features including buried landfill gas pipe, Construction Quality Control (CQC) testing, record drawings and related documentation
- Clearing, grubbing, and stripping; to include removal of existing debris, trees, shrubs, etc.
- Construction of temporary access roads/construction entrances as needed for access for the work. Location of the roads, if any, to be coordinated with the OWNER.
    - Contractor will control dust generated by the Contractor's operations
- Earthwork to prepare final cover system bedding layer as shown in plans and specifications
- Maintenance and restoration of stockpiles and borrow areas associated with the work including appropriate erosion and sediment controls.
- Installation of landfill gas system expansion, including the following:
    - Trenching, placement, testing, and backfilling for new landfill gas header, air lines, force main, and horizontal collectors
    - Tying new HDPE horizontal collectors into existing PVC landfill gas wells
    - Installing new dual extraction wellheads for new horizontal collector wells and retrofitting existing PVC landfill gas wells
    - Making all necessary connections and installing various LFG valves
    - Installing LFG drainage pits with riser and adjacent stub-up pipes
    - Construction of Remote LFG Wellhead and connection to the header
    - Construction of remote soil extraction wells with connection to the existing 6" LFG header
- Installation of stormwater management features, including:

  - Excavation and earthwork for stormwater basin and perimeter stormwater channels
  - Construction of stormwater pipes, drop inlets, and slope drain pipes for the stormwater sewer system
  - Following the installation of the final cover system, construct the stormwater diversion berms in accordance with the plans and specifications
    - Removal of existing stormwater structures as indicated in the plans and plugging existing line
  - Installation of stormwater basin outlet structure and connecting to existing culvert
- Installation of the LFG monitoring probes including drilling, installation of PVC riser, backfill with pea gravel, bentonite plug, concrete pad, and steel protective casing as well as related construction items required for installation
- Testing and installation of geomembrane and drainage geocomposite for final cover system
- Construction of final cover termination and tie-in to existing grades
- Installation of 18" Erosion Control Cover Layer
- Installation of 6" Vegetative Support Layer
- Installation of the access road atop the 498 final cover system
- Repair/replacement of existing features impacted during construction
- Temporary and permanent seeding and establishment of grass on all disturbed areas within the limits of construction

1.3 OWNER SUPPLIED PRODUCTS

The following items Furnished by Owner for Installation by Contractor:

- N/A

1.4 CONTRACTOR'S USE OF SITE AND PREMISES

1.4.1

Owner agrees to make the Site accessible to Contractor during normal working hours (Monday through Friday 7:00 a.m. to 4:00 p.m. excluding holidays observed by the City or Bristol Virginia). Equipment maintenance, preparation, fueling, site maintenance, planning, and administration may occur outside of these hours as long as no material placement or construction occur. Contractor may work on Saturdays, Sundays, and extended days if provided written authorization from Owner. Contact Owner to coordinate Site access.

1.4.2

Construction operations limited to areas noted on Drawings.

1.4.3

Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

1.4.4

Contractor shall provide and maintain such sanitary accommodations for the use of its employees and those of its Subcontractors as may be necessary to comply with the requirements and regulations of the local and state departments of health. These accommodations shall be at Contractor's expense.

1.5 OWNER OCCUPANCY

1.5.1

The Owner will occupy the property during the entire period of construction.

1.5.2

Cooperate with Owner to minimize conflict, and to facilitate Owner's operations.

1.5.3

Schedule the Work to accommodate Owner occupancy.

1.6 PROGRESS MEETINGS

Progress meetings will be held at least every other week, unless Owner directs otherwise, to discuss the activities and accomplishments for the preceding weeks, review the work location and activities for the upcoming week, identify the Contractor's personnel and equipment assignments for the upcoming week(s), and discuss potential construction problems. The date, time, and location of progress meetings will be established at the pre-construction conference.

END OF SECTION 01 11 00

SECTION 01 20 00

MEASUREMENT AND PAYMENT

1.0 GENERAL

1.1 APPLICATIONS FOR PAYMENT

1.1.1 Payment Terms

Payments shall be made in accordance with the procedures in the Terms and Conditions.

1.1.2 Application Form

Submit three (3) paper copies or one (1) electronic copy of each application on EJCDC C-620-2018 (Section 00 62 76 of the Project Manual).

1.1.3 Content and Format

Utilize Bid Items for listing items in Application for Payment.

1.1.4 Payment Period

Submit at intervals stipulated in the Agreement.

1.1.5 Substantiating Data

When Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question. Include the following with Application for Payment:

1.1.5.1 Construction Quality Control Data

Current soil and geosynthetic quality control test results, data, and daily reports. Test results and product specifications should be provided for all stored materials.

1.1.5.2 Record Documents

Record documents as specified in the project specifications, for review by Owner which will be returned to Contractor.

2.0 PRODUCTS - NOT USED

3.0 EXECUTION

3.1 MEASUREMENT AND PAYMENT – LUMP SUM PAY ITEMS

3.1.1 MOBILIZATION AND DEMOBILIZATION

Measurement for Mobilization and Demobilization will not be made for payment and all items shall be included in the Contract Lump Sum Price. Mobilization shall be compensated as indicated on the bid form. Mobilization shall consist of the performance of construction preparatory operations, including the movement of personnel, equipment, supplies, and incidentals to the project site and for any other pre-construction expense necessary for the start of the work. Mobilization and Demobilization shall also include bonds (not included in another bid item); permits (not included in another bid item); utility services; placement of project identification signs, sanitary facilities; construction photographs; surveying; survey control, field measurements for payment, and record drawings. The CONTRACTOR will clean-up the site, remove all debris, and restore roads and stormwater controls to the pre-construction condition.

The basis of payment shall be as follows:

Total Original Contract Amount, Including Mobilization		Total Limit for Mobilization
More Than	To & Including	
$0	$100,000	10% of total contract amount
$100,000	$500,000	$10,000 plus 3% of total contract over $100,000
$500,000	$1,500,000	$22,000 plus 2% of total contract over $500,000
$1,500,000	More	$42,500 plus 1% of total contract over $1,500,000

Partial payments shall be as follows:

- One-third of the amount established above as the total limit will be released to Contractor with the first progress payment.
- Remaining two-thirds (2/3) to be divided over the next five (5) progress payments on an equal basis.

No deductions will be made, nor will any increase be made, in the lump sum mobilization item amount regardless of decreases or increases in the final Contract Price or for any other cause.

3.1.2 Health and Safety Planning and Accommodations

Measurement for Health and Safety Planning and Accommodations will not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for Health and Safety Planning and Accommodations shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, equipment, and incidentals

required to provide a Health and Safety Plan that addresses respiratory protection procedure to adequately protect employees from site emissions as outlined in the Specifications; safe work procedures; personal protective equipment; laboratory testing; field testing equipment; safety meetings; safety training;. This item includes preparing and implementing the program including documentation, testing, analysis, and safety equipment. The CONTRACTOR will maintain this program for the duration of the project, which should be included in the Lump Sum Price.

3.1.3 Clearing, Grubbing, and Stripping

Measurement for site Clearing, Grubbing, and Stripping will not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for site clearing and grubbing shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, equipment, materials, and incidentals required for removal, including off-site disposal as needed, of surface debris, trees, shrubs, and all other construction items complete and in-place in accordance with the plans and specifications.

3.1.4 Erosion and Sediment Control

Measurement for Erosion and Sediment Control will not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for Erosion and Sediment Control shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, equipment, and incidentals required to provide erosion and sediment control including temporary seeding, sediment traps, silt fence, erosion matting; all temporary erosion and sediment controls; and all other construction items complete and in-place. The cost of maintaining these controls for the duration of the project should be included in the Lump Sum Price. Also include the cost of obtaining a Land Disturbance Permit as the Responsible Land Disturber as required by the City of Bristol and posting the Erosion and Sediment Control Bond to the City.

3.1.5 Stormwater Basin Earthwork

Measurement for Stormwater Basin Earthwork will not be made for payment and all items shall be included in the contract Lump Sum Price. Measurement may be made by the ENGINEER to confirm compliance with the plans and specification, but no adjustment to the bid price will be made.

Payment for Stormwater Basin Earthwork will be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, and earthwork necessary to achieve final grade for the stormwater basin. All soil excavated will be placed in a designated stockpile area and/or used for structural fill, erosion control layer, or vegetative support layer.

3.1.6 Membrane Deployment Grade Earthwork

Measurement for all earthwork to establish and prepare the Membrane Deployment Grade will not be made for payment and all items shall be included in the contract Lump Sum Price. Measurement may be made by the ENGINEER to confirm compliance with the plans and specification, but no adjustment to the bid price will be made.

Payment for all earthwork to establish and prepare the Membrane Deployment Grade will be made at the Lump Sum Price, which price and payment shall be full compensation for all materials, labor, equipment, testing, and incidentals required to excavate, fill, transport, stockpile, load, process,

place, compact, and test to prepare the Membrane Deployment Grade as outlined in the plans and specifications. The Lump Sum Price and payment shall include the cost of any waste relocation activities, Bedding Layer preparation, and leachate seep management in accordance with the plans and specifications. The top of the Bedding Layer will conform to the Membrane Deployment Grade shown in the plans.

3.1.7 Furnish LFG Horizontal Collector Materials

Measurement for Furnishing LFG Horizontal Collector Materials shall not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for Furnishing LFG Horizontal Collectors shall be made at the Lump Sum Price, which price and payment shall be full compensation for all materials, transportation, equipment, testing, storing, and maintaining storage, incidentals, and all else as required by the plans and specifications. No additional payment will be made for replacement of rejected material, testing, or change in material supplier.

3.1.8 Install LFG Horizontal Collectors

Measurement for Installing LFG Horizontal Collectors shall not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for the Installing LFG Horizontal Collectors shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required for construction; and all other construction items complete and in-place in accordance with the plans and specifications.

3.1.9 Furnish LFG Header Materials

Measurement for Furnishing Landfill Gas Header Materials shall not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for Furnishing Landfill Gas Header Materials shall be made at the Lump Sum Price, which price and payment shall be full compensation for all materials, transportation, equipment, testing, storing, and maintaining storage, incidentals, and all else as required by the plans and specifications, including valves, fittings, and materials needed for tie-ins. No additional payment will be made for replacement of rejected material, testing, or change in material supplier.

3.1.10 Install LFG Header

Measurement for Installing Landfill Gas Headers shall not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for Installing Landfill Gas Headers shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required for construction, including road crossings, valves, and tie-ins; and all other construction items complete and in-place in accordance with the plans and specifications.

3.1.11 Furnish Air and Force Main Materials

Measurement for Furnishing Airline and Force Main Materials shall not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for Furnishing Airline and Force Main Materials shall be made at the Lump Sum Price, which price and payment shall be full compensation for all materials, transportation, equipment, testing, storing, and maintaining storage, incidentals and all else required by the plans and specifications, including valves, fittings, and materials needed for tie-ins.

3.1.12 Install Air and Force Main Lines

Measurement for Installing Airline and Force Main Lines shall not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for the Installing Airline and Force Main Lines shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required for construction including tie-in and valves; and all other construction items complete and in-place in accordance with the plans and specifications.

3.1.13 Furnish and Install LFG Drainage Pits

Measurement for Furnishing and Installing LFG Drainage Pits shall not be made for payment and all items shall be included in the contract Lump Sum Price

Payment for the construction of LFG Drainage Pits shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required for construction; and all other construction items complete and in-place in accordance with the plans and specifications.

The CONTRACTOR will exercise caution when excavating to protect bottom liner system and provide materials, labor, and incidentals to make necessary repairs.

3.1.14 Furnish and Install Horizontal Collector Pit Wellheads with Pumps

Measurement for Furnishing and Installing Horizontal Collector Pit Wellheads with Pumps shall not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for the construction of Horizontal Collector Pit Wellheads with Pumps shall be made at the Contract Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required for construction; and all other construction items complete and in-place in accordance with the plans and specifications.

3.1.15 Furnish and Install Horizontal Collector Tie-in to Existing PVC Wells

Measurement to construct the Horizontal Collector Tie-in to Existing PVC Wells shall not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for the construction of LFG Horizontal Collector Tie-in to Existing PVC Wells shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required for construction; and all other construction items complete and in-place in accordance with the plans and specifications.

3.1.16 Furnish and Install Remote LFG Wellhead and LFG Lateral tie-in to EW-22

Measurement to construct the Remote LFG Wellhead with LFG lateral tie-in to the existing extraction well EW-22 shall not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for the construction of Remote LFG Wellhead and LFG Lateral tie-in to EW-22 shall be made at the Contract Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required for construction; and all other construction items complete and in-place in accordance with the plans and specifications.

3.1.17 Furnish and Install Stormwater Sewer System

Measurement to construct Stormwater Sewer System shall not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for the construction of Stormwater Sewer System shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required for construction; and all other construction items complete and in-place in accordance with the plans and specifications. This pay item includes disconnecting the old system, removing existing pipe, removing existing drop inlet, and plugging the existing line as indicated in the plans. This pay item includes erosion and sediment control features associated with the stormwater sewer system.

3.1.18 Furnish and Install Stormwater Basin Outlet and Baffle

Measurement to construct Stormwater Basin Outlet and Baffle shall not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for the construction of Stormwater Basin Outlet and Baffle shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required for construction including connecting to existing culvert; and all other construction items complete and in-place in accordance with the plans and specifications. This pay item includes erosion and sediment control features associated with the stormwater basin outlet and baffle.

3.1.19 Furnish 40 mil LLDPE Geomembrane

Measurement for Furnishing the 40 mil LLDPE Geomembrane will not be made for payment and all items shall be included in the contract Lump Sum Price. Measurement may be made by the ENGINEER to confirm compliance with the plans and specification, but no adjustment to the bid price will be made.

Payment for Furnishing 40 mil LLDPE Geomembrane shall be made at the Lump Sum Price, which price and payment shall be full compensation for all materials, transportation, equipment, testing, storing, and maintaining storage, and all else required, including materials needed for tie-ins, overlaps, anchoring, and repairs, as required by the plans and specifications. No additional payment will be made for replacement of rejected material, testing, or change in material supplier.

3.1.20 Install 40 mil LLDPE Geomembrane

Measurement to install the 40 mil LLDPE Geomembrane will not be made for payment and all items shall be included in the contract Lump Sum Price. Measurement may be made by the ENGINEER to confirm compliance with the plans and specification, but no adjustment to the bid price will be made.

Payment for Installation of the 40 mil LLDPE Geomembrane shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required for Installation including anchor trenches; and all other construction items complete and in-place in accordance with the plans and specifications. No additional payment will be made for replacement of rejected or damaged material, necessary and required overlaps, cutting rolls to size, seams, testing, material in anchor trenches, equipment breakdown, or protection of Work.

3.1.21 Furnish Drainage Geocomposite

Measurement for Furnishing Drainage Geocomposite will not be made for payment and all items shall be included in the contract Lump Sum Price. Measurement may be made by the ENGINEER to confirm compliance with the plans and specification, but no adjustment to the bid price will be made.

Payment for Furnishing Drainage Geocomposite shall be made at the Lump Sum Price, which price and payment shall be full compensation for all materials, transportation, equipment, testing, storing, and maintaining storage, and all else required, including materials needed for tie-ins, overlaps, anchoring, and repairs, as required by the plans and specifications. No additional payment will be made for replacement of rejected material, testing, or change in material supplier.

3.1.22 Install Drainage Geocomposite

Measurement to install the Drainage Geocomposite will not be made for payment and all items shall be included in the contract Lump Sum Price. Measurement may be made by the ENGINEER to confirm compliance with the plans and specification, but no adjustment to the bid price will be made.

Payment for Installation of the Drainage Geocomposite shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required for Installation including anchor trenches; and all other construction items complete and in-place in accordance with the plans and specifications. No additional payment will be made for replacement of rejected or damaged material, necessary and required overlaps, cutting rolls to size, seams, testing, material in anchor trenches, equipment breakdown, or protection of Work.

3.1.23 Furnish Erosion Control Layer Material

Measurement to Furnish Erosion Control Layer material will not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for Furnishing Erosion Control Layer Material will be made at the Lump Sum Price, which price and payment shall be full compensation for all materials, labor, transportation, equipment, testing, stockpiling, and maintaining stockpiles, and incidentals required as outlined in the plans and specifications. No additional payment will be made for replacement of rejected material, testing, or change in material supplier.

3.1.24 Install Erosion Control Layer

Measurement to Install the Erosion Control Layer soil shall not be made for payment and all items shall be included in the contract Lump Sum Price. Measurement may be made by the ENGINEER to confirm compliance with the plans and specification, but no adjustment to the bid price will be made.

Payment for Installation of the Erosion Control Layer will be made at the Lump Sum Price, which price and payment shall be full compensation for all materials, labor, equipment, testing, and incidentals required, including loading, hauling, processing, placing, grading, compacting and testing as outlined in the plans and specifications. No additional payment will be made for replacement of rejected material or testing.

3.1.25 Furnish Vegetative Support Layer Material

Measurement to Furnish the Vegetative Support Layer shall not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for Furnishing Vegetative Support Layer materials will be made at the Lump Sum Price, which price and payment shall be full compensation for all materials, labor, transportation, equipment, testing, stockpiling, and maintaining stockpiles, and incidentals required as outlined in the plans and specifications. No additional payment will be made for replacement of rejected material, testing, or change in material supplier.

3.1.26 Install Vegetative Support Layer

Measurement to Install the Vegetative Support Layer shall not be made for payment and all items shall be included in the contract Lump Sum Price. Measurement may be made by the ENGINEER to confirm compliance with the plans and specification, but no adjustment to the bid price will be made.

Payment for Installation of the Vegetative Support Layer will be made at the Lump Sum Price, which price and payment shall be full compensation for all materials, labor, equipment, testing, and incidentals required, including loading, hauling, processing, placing, grading, compacting and testing, as outlined in the plans and specifications. No additional payment will be made for replacement of rejected material or testing.

3.1.27 Furnish and Install Access Road

Measurement to construct the Permit 498 Access Road will not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for the construction of the Access Road shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, equipment, materials, and incidentals required for construction, including loading, hauling, processing, placing, grading, compacting and testing, in accordance with the plans and specifications. No additional payment will be made for replacement of rejected material, testing, or change in material supplier.

3.1.28 Furnish and Install Permanent Seeding

Measurement for permanent seeding of all areas will not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for permanent seeding of all areas shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required to seed, mulch, and fertilize disturbed areas, water and maintain seeded areas including repairing erosion and re-seeding as necessary; and all other construction items complete and in-place in accordance with the plans and specifications.

3.1.29 Furnish and Install Stormwater Conveyance Channels, Downchutes, and Culverts

Measurement to Furnish and Install Stormwater Conveyance Channels, Downchutes, and Culverts will not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for the construction of stormwater conveyance channels, downchutes, and culverts shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required to construct the channels, install linings, pipes, install new culverts, modify existing culverts, including loading, hauling, processing, placing, grading, compacting and testing, and all other associated construction items complete and in-place in accordance with the plans and specifications. This pay item includes permanent outlet protection for the stormwater conveyance channels, downchutes, and culverts as describes in the plans and specifications.

3.1.30 Furnish and Install Stormwater Diversion Berms

Measurement to construct Stormwater Diversion Berms will not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for the construction of Stormwater Diversion Berms shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, and incidentals required for construction; and all other construction items complete and in-place in accordance with the plans and specifications.

The CONTRACTOR will install the Stormwater Diversion Berms with the plans and specifications. The CONTRACTOR will furnish all labor, materials, equipment, and incidentals required for placement.

3.1.31 Furnish and Install Remote Soil Extraction Wells

Measurement to Furnish and Install Remote Soil Extraction Wells will not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for the construction of Remote Soil Extraction Wells shall be made at the Contract Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required for construction including fittings and connection to HDPE Lateral as shown on the Drawings; and all other construction items complete and in-place in accordance with the plans and specifications.

3.1.32 Furnish LFG Monitoring Probes

Measurement to Furnish LFG Monitoring Probes will not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for Furnishing LFG Monitoring Probes shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, transportation,

equipment, testing, storage/stockpiling, and maintaining storage/stockpiles, and incidentals required for furnishing materials as outlined in the plans and specifications. No additional payment will be made for replacement of rejected material, testing, or change in material supplier.

3.1.33 Install LFG Monitoring Probes

Measurement to Install LFG Monitoring Probes will not be made for payment and all items shall be included in the contract Lump Sum Price.

Payment for Installing LFG Monitoring Probes shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required for construction, including waste removal and disposal; and all other construction items complete and in-place in accordance with the plans and specifications.

3.1.34 Furnish and Install LFG Condensate Sumps

Measurement for Furnishing and Installing LFG Condensate Sumps shall not be made for payment and all items shall be included in the contract Lump Sum Price

Payment for the construction of LFG Condensate Sumps shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, equipment, testing, and incidentals required for construction; and all other construction items complete and in-place in accordance with the plans and specifications.

The CONTRACTOR will exercise caution when excavating to protect bottom liner system and provide materials, labor, and incidentals to make necessary repairs.

3.1.35 Alternative Bid Item – Furnish and Install AGRU 50 mil LLDPE MicroDrain Liner with AT081 Nonwoven Geotextile

Measurement to Furnish and Install the AGRU 50 mil LLDPE MicroDrain Liner with overlying AT081 Nonwoven Geotextile will not be made for payment and all items shall be included in the contract Lump Sum Price. Measurement may be made by the ENGINEER to confirm compliance with the plans and specification, but no adjustment to the bid price will be made.

Payment for the Installation of AGRU 50 mil LLDPE MicroDrain Liner with AT081 Nonwoven Geotextile shall be made at the Lump Sum Price, which price and payment shall be full compensation for all labor, materials, transportation, equipment, testing, and incidentals required for placement and seaming. Compensation requires completion of all construction items with the material in-place in accordance with the plans and specifications. No additional payment will be made for replacement of rejected or damaged material, necessary and required overlaps, cutting rolls to size, seams, testing, material in anchor trenches, change in material supplier, equipment breakdown, or protection of Work. If the AGRU 50 mil LLDPE MicroDrain Liner with AT081 Nonwoven Geotextile is selected by the owner, this item will paid instead of the Furnish 40 mil LLDPE Geomembrane, Install 40 mil LLDPE Geomembrane, Furnish Drainage Geocomposite, and Install Drainage Geocomposite drainage line items.

END OF SECTION 01 20 00

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

1.0 GENERAL

1.1 SECTION INCLUDES

- Coordination and project conditions.
- Field engineering.
- Preconstruction meeting.
- Site mobilization meeting.
- Progress meetings.
- Pre-installation meetings.
- Cutting and patching.
- Special procedures.

1.2 COORDINATION AND PROJECT CONDITIONS

1.2.1

Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.

1.3 FIELD ENGINEERING

1.3.1 Equipment and Contractors

Utilize Global Positioning Systems on equipment and for field location acceptable to Engineer. If third party surveying is used, employ Land Surveyor registered in State of Virginia and acceptable to Engineer.

1.3.2 Reference Points

Owner will locate and protect survey control and reference points. Promptly notify Engineer of discrepancies discovered.

1.3.3 Horizontal Datum

Horizontal control datum for survey is NAD 83 (Virginia State Plane South projection).

1.3.4 Vertical Datum

Vertical control datum for survey is NAVD88.

1.3.5 Set Backs

Verify set-backs and easements; confirm drawing dimensions and elevations.

1.3.6 Surveying Services

Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.

1.3.7 Protection of Control Points

Protect survey control points prior to starting site work; preserve permanent reference points during construction.

1.3.8 Loss of Control Points

Promptly report to Engineer loss or destruction of reference point or relocation required because of changes in grades or other reasons.

1.3.9 Dislocated Control Points

Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Engineer.

1.4 PRECONSTRUCTION MEETING

1.4.1 Coordination

Engineer will schedule meeting after Notice of Award.

1.4.2 Attendance

Attendance Required: Owner, Engineer, and Contractor.

1.4.3 Agenda

- Execution of Owner-Contractor Agreement.
- Submission of executed bonds and insurance certificates.
- Distribution of Contract Documents.
- Submission of list of Subcontractors, list of products, schedule of values, and progress schedule.
- Designation of personnel representing parties in Contract, Owner, and Architect/Engineer.
- Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
- Scheduling.

- Scheduling activities of Geosynthetics Installer.

1.4.4 Minutes

Engineer will record minutes and distribute copies within two days after meeting to participants, with electronic copies to Contractor, Owner, and those affected by decisions made.

1.5 SITE MOBILIZATION MEETING

1.5.1 Coordination

Engineer will schedule meeting at Project site prior to Contractor occupancy. Meeting may coincide with or immediately follow preconstruction meeting.

1.5.2 Attendance

Attendance Required: Owner, Architect/Engineer, Contractor, Contractor's Superintendent, and major Subcontractors.

1.5.3 Agenda

- Use of premises by Owner and Contractor.
- Owner's requirements.
- Construction facilities and controls provided by Owner.
- Temporary utilities provided by Owner.
- Survey and layout.
- Security and housekeeping procedures.
- Schedules.
- Application for payment procedures.
- Procedures for testing.
- Procedures for maintaining record documents.
- Requirements for start-up of equipment.
- Inspection and acceptance of equipment put into service during construction period.

1.5.4 Minutes

Engineer will record minutes and distribute copies within two days after meeting to participants, with electronic copies to Contractor, Owner, and those affected by decisions made.

1.6 PROGRESS MEETINGS

1.6.1 Meeting Schedule

Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.

1.6.2 Coordination

Engineer will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

1.6.3 Attendance

Attendance Required: Job superintendent, major subcontractors and suppliers, Owner, Engineer, as appropriate to agenda topics for each meeting.

1.6.4 Agenda

- Review minutes of previous meetings.
- Review of Work progress.
- Field observations, problems, and decisions.
- Review of submittals schedule and status of submittals.
- Maintenance of progress schedule.
- Planned progress during succeeding work period.
- Other business relating to Work.

1.6.5 Minutes

Engineer will record minutes and distribute copies within two days after meeting to participants, with electronic copies to Contractor, Owner, and those affected by decisions made.

1.7 PRE-INSTALLATION MEETINGS

1.7.1 Scheduling

Prior to geosynthetics installation, gas collection system installation, or when required in individual specification sections, convene pre-installation meetings at Project site prior to commencing work of specific section.

1.7.2 Attendance

Require attendance of parties directly affecting, or affected by, Work of specific section.

1.7.3 Scheduling

Notify Engineer four days in advance of meeting date. Meeting Date may coincide with a Progress Meeting.

1.7.4 Agenda and Coordination

Engineer will prepare agenda and preside at meeting:

- Review conditions of installation, preparation and installation procedures.
- Review coordination with related work.

1.7.5 Minutes

Engineer will record minutes and distribute copies within two days after meeting to participants, with electronic copies to Contractor, Owner, and those affected by decisions made.

2.0 PRODUCTS - NOT USED

3.0 EXECUTION – NOT USED

END OF SECTION 01 30 00

SECTION 01 33 00

SUBMITTAL PROCEDURES

1.0 GENERAL

1.1 SECTION INCLUDES

- Submittal procedures
- Construction progress schedules
- Proposed products list
- Product data
- Shop drawings
- Samples
- Design data
- Test reports
- Certificates
- Manufacturer's instructions
- Manufacturer's field reports
- Erection drawings
- Construction photographs

1.2 SUBMITTAL PROCEDURES

1.2.1

Transmit each submittal with a Submittal Form.

1.2.2

Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.

1.2.3

Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.

1.2.4

Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.

1.2.5

Schedule submittals to expedite Project, and deliver to Engineer electronically. Coordinate submission of related items.

1.2.6

For each submittal for review, allow 15 days excluding delivery time to and from Contractor.

1.2.7

Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.

1.2.8

Allow space on submittals for Contractor and Engineer review stamps.

1.2.9

When revised for resubmission, identify changes made since previous submission.

1.2.10

Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

1.2.11

Submittals not requested will not be recognized or processed.

1.2.12

All submittals shall be submitted electronically.

1.3 CONSTRUCTION PROGRESS SCHEDULES

1.3.1

Submit initial schedules within 5 days after date of Owner-Contractor Agreement established in Notice to Proceed. After review, resubmit required revised data within 5 days.

1.3.2

Submit revised Progress Schedules with each Application for Payment.

1.3.3

Distribute copies of reviewed schedules to Project site file, subcontractors, suppliers, and other concerned parties.

1.3.4

Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

1.3.5

Submit computer generated horizontal bar chart with separate line for each major portion of Work, identifying first work day of each week.

1.3.6

Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates, and duration.

1.3.7

Indicate estimated percentage of completion for each item of Work at each submission.

1.3.8

Submit separate schedule of submittal dates for shop drawings, product data, and samples, including Owner furnished products and products identified under Allowances, and dates reviewed submittals will be required from Engineer. Indicate decision dates for selection of finishes.

1.3.9

Indicate delivery dates for Owner furnished products and products identified under Allowances.

1.3.10 Revisions To Schedules

1.3.10.1

Indicate progress of each activity to date of submittal, and projected completion date of each activity.

1.3.10.2

Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.

1.3.10.3

Prepare narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect.

1.4 PROPOSED PRODUCTS LIST

1.4.1

Within 5 days after date of Owner-Contractor Agreement, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1.4.2

For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 PRODUCT DATA

1.5.1

Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

1.5.2

Submit product data electronically.

1.5.3

Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

1.5.4

Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.6 SHOP DRAWINGS

Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

1.7 SAMPLES

1.7.1

Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

1.7.2

Include identification on each sample, with full Project information.

1.7.3

Submit number of samples specified in individual specification sections; Engineer will retain samples.

1.7.4

Reviewed samples which may be used in the Work are indicated in individual specification sections.

1.8 DESIGN DATA

Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.9 TEST REPORTS

Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.10 CERTIFICATES

1.10.1

When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Engineer, in quantities specified for Product Data.

1.10.2

Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

1.10.3

Certificates may be recent or previous test results on material or Product, but must be acceptable to Engineer.

1.11 MANUFACTURER'S INSTRUCTIONS

1.11.1

When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Engineer for delivery to Owner in quantities specified for Product Data.

1.11.2

Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.12 INSTALLATION DRAWINGS

1.12.1

Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.12.2

Data indicating inappropriate or unacceptable Work may be subject to action by Engineer or Owner.

2.0 PRODUCTS - NOT USED

3.0 EXECUTION

Repeated failure to present acceptable submittals or excessive services required of Engineer due to repeated presentation of unacceptable submittals shall result in charges against Contractor for the costs of the additional engineering expenses. It will be considered excessive if more than one correction of any submittal is required. More than one submittal of a correction will result in a charge against Contractor.

END OF SECTION 01 33 00

SECTION 01 35 29

HEALTH AND SAFETY PLAN

1.0 GENERAL

1.1 GENERAL

1.1.1 Exclusion Zone

In the event that the ENGINEER or OWNER identify an exclusion zone, the CONTRACTOR will use only site crew members in the identified area that are trained in accordance with the United States Occupational Safety and Health Administration (OSHA) regulations 29 CFR 1910.120. The workers also need to have completed the minimum 40-hour Hazardous Materials training course and necessary refresher courses. This applies to both the CONTRACTOR's workers and any Subcontractor site workers.

1.1.2 Medical Monitoring Program

All site workers that work in the identified exclusion zone must be under a Medical Monitoring Program as outlined in 29 CFR 1910.120, and be physically capable of wearing a respirator, if necessary.

1.1.3 Stop Work

Actions that potentially endanger workers shall be stopped immediately and brought to the OWNER's attention. Health and Safety is the responsibility of the CONTRACTOR.

1.2 SITE-SPECIFIC HEALTH AND SAFETY PLAN

1.2.1 Preparation

The CONTRACTOR shall prepare a written site-specific Health and Safety Plan (Plan) for use by the CONTRACTOR and Subcontractor site workers. This plan must be prepared to meet the 29 CFR 1910.120 OSHA regulations and shall include as a minimum, the following:

1.2.1.1 Organizational Structure

Organizational Structure to include general supervision, Health and Safety officer, lines of authority, and responsibility and communication. The Health and Safety Officer shall be a worker who will be present at all times during site construction, in addition to his/her other site duties.

1.2.1.2 Comprehensive Work Plan

Comprehensive Work Plan to include the work tasks and objectives, resources needed, and training requirements for workers (health and safety, machine operations license, etc.). This shall also include a section on safety procedures to be followed for excavation and well drilling in landfill waste and work in areas where exposure to landfill gas, condensate, and/or leachate is likely.

1.2.1.3 Health and Safety

Health and Safety to include identification of possible site hazards (e.g., solid waste, landfill gas, and leachate), training levels for each category of site workers, personal protective equipment and medical surveillance needed, site control measures, and confined space entry procedures.

1.2.1.4 Emergency Response Plans

Emergency Response Plans to include all emergency telephone numbers, a highlighted map showing the quickest route to the nearest emergency care facility and written directions to such facility.

1.2.1.5 Air Monitoring Procedures

Air Monitoring Procedures to include frequency and type of air monitoring of exposed refuse, landfill surfaces, boreholes and excavations, and site worker areas, calibration of air monitoring equipment, and action levels of air contaminants for site worker protection. All equipment calibration and field gas measurements shall be recorded with the date and time of sample, and the sampler's name. Sampling shall be done by a CONTRACTOR's worker trained in the use of the gas sampling equipment. These trained workers shall be designated in the CONTRACTOR's Plan.

1.2.1.6 Respiratory Protection Program

Respiratory Protection Program to include written documentation of the CONTRACTOR's respiratory program. The program should address how to protect employees from the sidewall gas emissions.

1.2.1.7 Well Drilling Installation and Excavation Safety Procedures

Well Drilling Installation and Excavation Safety Procedures to include prevention of fall hazards and controlled access zones.

1.2.1.8 Signature Page

A signature page for all site workers covered by the Plan (CONTRACTOR and Subcontractor site workers).

1.2.2 Acceptance

Acceptance of the CONTRACTOR's Plan by the OWNER is necessary prior to the start of site operations. The Plan should incorporate and be consistent with the OWNER's and the LANDFILL OPERATOR's health and safety policies and procedures.

1.2.3 Considerations

The CONTRACTOR shall consider the various materials disposed of (municipal solid waste, construction and demolition debris) that may be encountered during excavation in preparing the Health and Safety Plan.

1.2.4 References

The Health and Safety Plan should reflect information contained in "A Compilation of Landfill Gas Field Practices and Procedures, Solid Waste Association of North America (SWANA), 2020" or latest edition.

1.3 SITE OPERATIONS

1.3.1 Location

The Plan will be kept on site in an easily accessible spot during all site operating hours. All site workers will be notified of the location of the Plan.

1.3.2 Safety Meeting

A Safety Meeting will be held by CONTRACTOR and attended by all CONTRACTOR site workers prior to starting construction. At this safety meeting, the Plan will be reviewed with the site workers, and all site workers will sign the Plan indicating that they have been apprised of the Plan's contents. New site workers must review the Plan with the CONTRACTOR's Health and Safety Officer prior to beginning work on site, and must sign that they have been apprised of the Plan's contents.

1.3.3 Lighting

Site operations will take place in conditions of adequate light only.

1.3.4 Landfill gas

Areas of open refuse (i.e., excavations, trenches and boreholes) will be periodically monitored for combustible gases, methane, carbon monoxide, benzene, hydrogen sulfide and oxygen through the use of field gas meters by the CONTRACTOR. Respiratory protection for acid gases and organic vapors will be used by the worker while monitoring gas levels, if deemed necessary by the CONTRACTOR. Appropriate respiratory protection will be taken by other workers as necessary.

1.3.5 Excavation

No workers will be allowed in any trench or excavation while excavation of the area is in progress. Entry into the excavation shall be made only after the CONTRACTOR's site worker has monitored the air in the excavation, and determined the appropriate level of personal protection required for entry into the excavation. Site workers in excavations must be supervised at all times.

1.3.6 Skin Protection

Site workers will limit their dermal exposure to landfill gas, leachate, condensate, and excavated refuse. Minimal skin protection includes puncture resistant shoes meeting ANSI standards, long pants, long-sleeved shirts, safety glasses, safety vests, hard hats, and rubber gloves to be used when handling refuse.

1.3.7 Start-up and Shut-down

Start-up and shutdown of engines will not be done in areas of excavated refuse or where elevated landfill gas emissions have been documented.

2.0 PRODUCTS

Not used.

3.0 EXECUTION

Not used.

END OF SECTION 01 35 29

SECTION 01 45 00

CONSTRUCTION QUALITY CONTROL

1.0 GENERAL

1.1 SECTION INCLUDES

- Quality Control Requirements
- Tolerances.
- References.
- Labeling.
- Testing and inspection services.
- Examination.
- Preparation.
- Interface shear testing requirements for geosynthetic interfaces

1.2 QUALITY CONTROL REQUIREMENTS

1.2.1 Construction Quality Control

The CONTRACTOR is responsible for construction quality control (CQC) and shall establish and maintain an effective quality control system in compliance with the Contract Documents. The construction quality control system shall consist of plans, procedures, tests and observation, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction and manufacturing operations, both on-site and off-site, and shall be keyed to the proposed construction sequence.

Contractor will be required to provide, coordinate and oversee the following activities on the Project in accordance with the Specifications:

1.2.1.1 Materials Testing

Laboratory and field soil and geosynthetics testing in accordance with the project specifications.

1.2.1.2 Operational Testing

Laboratory and field soil and geosynthetics testing to guide construction operations.

1.2.1.3 Surveying

Field stake-out surveying and surveying to facilitate construction operations.

1.2.2 Construction Quality Assurance

The Owner is responsible for and will provide Construction Quality Assurance (CQA), which will provide independent monitoring and verification of compliance with all construction and CQC requirements.

Minimum testing requirements are included in applicable Specification sections. Owner will provide the following testing on the Project:

1.2.2.1 Materials Testing

Laboratory and field soil and geosynthetics testing as outlined in the project specifications.

All tests which fail to comply with the minimum requirements shall be retested at Contractor's expense using Owner's contracted representatives. Owner reserves the right to direct additional testing and sampling.

1.2.2.2 Surveying

Provision of construction quality assurance surveying.

1.2.2.3 Drawings

Record drawings.

Results of all analyses shall be submitted to Engineer as soon as they are available. Should any analyses show that the product or material tested does not comply with the Specification, Contractor shall remove, repair, or replace the product or material at no expense to Owner. Contractor may, at his option and expense, perform additional testing to substantiate the claim the product or material complies with the specification requirements.

1.3 MEASUREMENT AND PAYMENT

Separate payment will not be made for providing and maintaining an effective Construction Quality Control program, CONTRACTOR Quality Control (CQC) Plan and associated testing provisions during the progression of the work will not be paid for separately and shall be included within the applicable work item on the bid form.

1.4 QUALITY CONTROL AND CONTROL OF INSTALLATION

1.4.1

Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

1.4.2

Comply with manufacturers' instructions, including each step in sequence.

1.4.3

When manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

1.4.4

Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

1.4.5

Perform Work by persons qualified to produce required and specified quality.

1.4.6

Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.

1.4.7

Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.5 TOLERANCES

1.5.1

Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

1.5.2

Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

1.5.3

Adjust products to appropriate dimensions; position before securing products in place.

1.6 REFERENCES

ASTM D5321 - Standard Test Method for Determining the Shear Strength of Soil Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear

1.6.1

For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.

1.6.2

Conform to reference standard by date of issue current on date of Contract Documents, except where specific date is established by code.

1.6.3

Obtain copies of standards where required by product specification sections.

1.6.4

When specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.

1.6.5

Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of Engineer shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.7 TESTING AND INSPECTION SERVICES

1.7.1

The Contractor may employ a third party firm to support construction quality control on the project.

1.7.2

Employ and pay for services of an independent testing agency or laboratory acceptable to Owner to perform specified testing. Refer to Section 01 45 29 for laboratory requirements.

1.7.3

The independent firm will perform tests, inspections, and other services specified in individual specification sections and as required by Engineer.

1.7.4

Testing, inspections and source quality control may occur on or off project site. Perform off-site testing as required by Engineer.

1.7.5

Reports will be submitted by independent firm to Engineer and Contractor, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

1.7.6

Contractor shall cooperate with independent firm; furnish samples of materials, equipment, tools, storage, safe access, and assistance by incidental labor as requested.

1.7.6.1

Notify Engineer and independent firm 48 hours prior to expected time for operations requiring services.

1.7.6.2

Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

2.0 PRODUCTS

2.1 CONSTRUCTION QUALITY CONTROL PLAN

2.1.1 Content of the CQC Plan

The CQC plan shall include, as a minimum, the following to cover all construction and manufacturing operations, both on site and off site, including work by subcontractors, fabricators, suppliers and purchasing agents:

2.1.1.1 Organizational Chart

A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the Site Superintendent or someone higher in the CONTRACTOR's organization. Site Superintendent in this context shall mean the individual with responsibility for the overall management of the project including quality and production.

2.1.1.2 Resumes

A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the Site Superintendent or someone higher in the CONTRACTOR's organization. Site Superintendent in this context shall mean the individual with responsibility for the overall management of the project including quality and production.

2.1.1.3 Letter of Authorization

A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities and responsibilities. Copies of these letters and documents will also be furnished to the Owner.

2.1.1.4 Testing

Control, verification and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, and person responsible for each test.

2.1.1.5 Inspection

Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

2.1.1.6 Deficiencies

Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

2.1.1.7 Daily Report and Monthly Report

Reporting procedures, including proposed reporting formats.

2.1.1.8 A list of the definable features of work.

A definable feature of work is a task which is separate and distinct from other tasks and has separate control requirements. It could be identified by different trades or disciplines, or it could be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the Pre-Construction Conference and subsequent progress meetings.

2.1.1.9 Samples

Samples of all daily report and inspection forms.

2.1.1.10 Laboratories

The name and address of all quality control laboratories.

2.1.2 Acceptance of Plan

Acceptance of the CONTRACTOR's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Owner reserves the right to require the CONTRACTOR to make changes in his CQC plan and operations including removal of personnel, as necessary, to obtain the quality specified.

2.1.3 Notification of Changes

After acceptance of the CQC plan, the CONTRACTOR shall notify the ENGINEER in writing a minimum of seven (7) calendar days prior to any proposed change. Proposed changes are subject to acceptance by the ENGINEER and OWNER.

3.0 EXECUTION

3.1 CONSTRUCTION QUALITY CONTROL ORGANIZATION

3.1.1 CQC System Manager

The CONTRACTOR shall identify an individual within his organization at the site of the work who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the CONTRACTOR. This CQC System Manager shall be on the site at all times during construction and will be employed by the CONTRACTOR, except as noted in the following. An alternate for the CQC System Manager will be identified by the CQC System Manager in the plan to serve in the event of the system manager's absence. Periods of absence may not exceed 2 weeks at any one time, and not more than 15 workdays during a calendar year. The requirements for the alternate will be the same as for the designated CQC system manager.

3.1.2 CQC Organizational Staffing

The CONTRACTOR shall provide a CQC staff which shall be at the site of work at all times during progress of the work, with authority to take any action necessary to ensure compliance with the contract.

3.1.3 CQC Staff

Following are the minimum requirements for the CQC staff. These minimum requirements will not necessarily assure an adequate staff to meet the CQC requirements at all times during construction. The actual strength of the CQC staff may vary during any specific work period to cover the needs of the work period. When necessary for a proper CQC staffing on-site, the CONTRACTOR will add additional staff at no cost to the OWNER. This listing of minimum staff in no way relieves the CONTRACTOR of meeting the basic requirements of quality construction in accordance with contract requirements. All CQC staff members shall be subject to acceptance by the OWNER.

3.1.3.1 CQC System Manager:

The CQC System Manager shall demonstrate that they have a minimum of 2 years landfill construction experience on construction similar to this contract. The CQC System Manager shall be

assigned as system manager but may also have duties as project superintendent in addition to quality control.

3.1.3.2 Supplemental Personnel

A staff shall be maintained under the direction of the CQC system manager to perform all QC activities. The staff must be of sufficient size to ensure adequate QC coverage of all work phases, work shifts, and work crews involved in the construction. These personnel may perform other duties, but must be fully qualified by experience and technical training to perform their assigned QC responsibilities and must be allowed sufficient time to carry out these responsibilities. The QC plan will clearly state the duties and responsibilities of each staff member.

3.1.4 Organizational Changes

The CONTRACTOR shall obtain OWNER acceptance before replacing any member of the CQC staff. Requests shall include the names, qualifications, duties, and responsibilities of each proposed replacement.

3.2 EXAMINATION

3.2.1 Existing Conditions

Verify existing site conditions are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

3.2.2 Specific Conditions

Examine and verify specific conditions described in individual specification sections.

3.3 CONTROL

3.3.1 Construction Quality Control

Construction Quality Control is the means by which the CONTRACTOR ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. The controls shall be adequate to cover all construction operations, including both on-site and offsite fabrication, and will be keyed to the proposed construction sequence. The controls shall be conducted by the CQC System Manager for all definable features of work, as follows:

3.3.1.1

A review of each paragraph of applicable specifications.

3.3.1.2

A review of the contract plans.

3.3.1.3

A check to assure that all materials and/or equipment to be used have been tested, submitted, and approved.

3.3.1.4

A check to assure that provisions have been made to provide required control inspection and testing.

3.3.1.5

Examination of the work area to assure that all required preliminary work has been completed and in compliance with the contract.

3.3.1.6

A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawing or submitted data, and are properly stored.

3.3.1.7

A review of the appropriate activity hazard analysis to assure safety requirements are met.

3.3.1.8

Discussion of procedures for constructing the work including repetitive deficiencies. Document construction tolerances and workmanship standards for the work.

3.3.1.9

A check to ensure that the portion of the plan for the work to be performed has been accepted by the ENGINEER.

3.3.1.10

A check of preliminary work to ensure that it is in compliance with contract requirements. Review minutes of the preparatory meeting.

3.3.1.11

Verification of full contract compliance. Verify required control inspection and testing.

3.3.1.12

Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with sample panels if appropriate.

3.3.1.13

Resolve all differences between parties.

3.3.1.14

Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

3.3.1.15

The ENGINEER shall be notified at least 24 hours in advance of beginning any actions. A meeting shall be conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the above actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The CONTRACTOR shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.3.2 Follow-up

Daily checks shall be performed to assure continuing compliance with contract requirements, including control testing, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The CONTRACTOR shall not build upon or conceal non-conforming work.

3.3.3 Additional Requirements

Additional control may be required on the same definable features of work if the quality of ongoing work is unacceptable as determined by the ENGINEER; or if there are changes in the CQC staff or in the onsite production supervision or work crew; or if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.4 TESTS

3.4.1 Testing Procedure

The CONTRACTOR shall perform tests specified or required to verify that control measures are adequate to provide a product which conforms to contract requirements. Testing includes operation and/or acceptance tests when specified. The CONTRACTOR shall procure the services of an approved testing laboratory or establish an approved testing laboratory at the project site. Testing laboratories are subject to approval by the ENGINEER as specified in Section 01 45 29, Quality Control Testing Laboratories. A list of CQC tests to be performed shall be by the furnished by the CONTRACTOR as a part of the CQC plan. The list shall give the test name, frequency, specification paragraph containing the test requirements, the personnel and laboratory responsible for each type of test, and an estimate of the number of tests required. The CONTRACTOR shall perform the following activities and record and provide the following data:

3.4.1.1

Verify that testing procedures comply with contract requirements.

3.4.1.2

Verify that facilities and testing equipment are available and comply with testing standards.

3.4.1.3

Check test instrument calibration data against certified standards.

3.4.1.4

Verify that recording forms and the test identification control number system, including all of the test documentation requirements, have been prepared

3.4.1.5

Results of all tests performed, both passing and failing tests, will be recorded on the Quality Control report for the date performed. Tests shall be clearly labeled as passing or failing. Invitation for Bids/Project Manual paragraph reference, location where tests were taken, and the sequential control number identifying the test will be given. An information copy of tests performed by an off-site or commercial test facility will be provided directly to the ENGINEER. Failure to submit timely test reports, as stated, may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.4.2 Testing Laboratories

3.4.2.1 Capability Check

The ENGINEER reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques.

3.4.2.2 On-Site Laboratory and Equipment

The OWNER reserves the right to utilize the CONTRACTORS quality control testing laboratory and equipment to check the CONTRACTOR'S testing procedures, techniques, and test results at no additional cost to the OWNER.

3.5 COMPLETION INSPECTION

At the completion of all work or any increment thereof established by a completion time stated in the Contract or stated elsewhere in the Project Manual, the CQC system manager shall conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved plans and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. The CQC system manager or staff shall make a second inspection to

ascertain that all deficiencies have been corrected and so notify the ENGINEER. These inspections and any deficiency corrections required by this paragraph will be accomplished within the time stated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates.

END OF SECTION 01 45 00

SECTION 01 45 29

QUALITY CONTROL TESTING LABORATORIES

1.0 GENERAL

1.1 DESCRIPTION

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained by the General Contractor.

1.2 REFERENCE SPECIFICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

- ASTM D 3740 Standard Practice for Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
- ASTM E 329 Standard Practice for Use in Evaluation of Testing and Inspection Agencies as Used in Construction

1.3 REQUIREMENTS

1.3.1 Accreditation Requirements:

Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing associated with the project.

1.3.2 Inspection and Testing:

Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by Engineer. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Engineer to such failure.

1.3.3 Written Reports

Testing laboratory shall submit test reports to Resident Engineer, Contractor, unless other arrangements are agreed to in writing by the Resident Engineer. Submit reports of tests that fail to meet construction contract requirements.

1.3.4 Verbal Reports

Give verbal notification to Resident Engineer immediately of any irregularity.

1.4 APPROVAL OF LABORATORY

The CONTRACTOR shall submit the Qualifications of his proposed Quality Control Testing Laboratory(s) to the ENGINEER for approval within 14 days after receipt of notice to proceed and prior to initiating work or subcontractor agreements.

1.5 TESTING EQUIPMENT CALIBRATION

1.5.1 Calibration

Calibrated at maximum 12 month intervals or interval specified by applicable ASTM requirement whichever is more frequent. Calibration shall utilize devices of accuracy traceable to either National Institute of Standards and Technology (formerly the National Bureau of Standards) or accepted values of natural physical constants.

1.5.2 Certification

Submit copy of certificate of calibration for all test equipment utilized, made by accredited calibration agency to the ENGINEER for approval.

1.6 SUBMITTALS

1.6.1 Certificate of Compliance of Laboratory Qualifications

CONTRACTOR shall submit the name and address of organization, laboratory qualifications, certificates of calibration for all test equipment, and blank test forms for the following:

- Independent Geosynthetics QC Laboratory
- Independent Soils QC Laboratory
- Manufacturing Quality Control Laboratory

1.7 TEST REPORTS

Promptly submit reports of inspections and tests to ENGINEER within 48 hours of test, including:

- Date issued.
- Project title and number.
- Testing laboratory name and address.
- Name and signature of inspector.

- Date of inspection or sampling.
- Record of temperature and weather.
- Date of test.
- Identification of product and specification section.
- Location in project.
- Type of inspection or test.
- Results of tests and observations regarding compliance with Contract Documents.

2.0 PRODUCTS

Not used.

3.0 EXECUTION

3.1 EARTHWORK

3.1.1 General:

The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified herein, within the agreed to time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:

3.1.1.1

Observe fill and subgrades/bedding layer during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the Engineer regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to Engineer extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.

3.1.1.2

Provide part time observation of fill placement and compaction and field density testing to verify that earthwork compaction obtained is in accordance with contract documents.

3.1.1.3

Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for fill.

END OF SECTION 01 45 29

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

1.0 GENERAL

The requirements of this Section apply to, and are a component of, each section of the specifications. The CONTRACTOR is responsible for furnishing all labor, equipment, materials, and provisions to provide temporary facilities and controls, including but, not limited to the CONTRACTOR'S field office, CONTRACTOR'S storage area(s), utility connections/hookups and permits for water service, electrical service, telephone service, maintenance of traffic, barricades, fences, damage to existing property, security, access roads, drainage, erosion and sediment control measures, parking, and emergencies.

1.1 PROTECTION AND SAFETY

In addition to requirements stated in the General Conditions, Contractor shall:

1.1.1

Not interfere with use of or access to adjacent properties, and maintain free and safe passage to and from the jobsite.

1.1.2

Protect bench marks and existing structures, property corners, roads, paving, and curbs against damage from equipment and vehicular or foot traffic.

1.1.3

Cease operations and notify ENGINEER immediately if safety of adjacent structures appears to be endangered, and not resume operations until safety is restored.

1.1.4

Reduce movement, settlement, or collapse of adjacent services, structures, trees, etc., assume liability for such movement, settlement, or collapse, and promptly repair damage at no cost to OWNER.

1.1.5

Notify ENGINEER of differing subsurface or physical conditions.

1.1.6

Verify required environmental protection devices and procedures are in place, properly maintained, and operational.

1.1.7

Coordinate the Work with OWNER.

1.2 COORDINATION

1.2.1

Arrangements for access to the Site, workmen's parking locations, sites for storing material, sanitary facilities, utilities during construction, etc., shall be coordinated by Contractor with OWNER. OWNER agrees to make the Site accessible to Contractor during normal working hours (Monday through Friday 7:00 a.m. to 4:00 p.m.).

1.2.2

Contact OWNER to coordinate Site access.

1.3 TELEPHONE SERVICES

Contractor shall ensure all Contractor's personnel have appropriate communication devices.

1.4 FIELD OFFICE

Contractor shall provide and maintain a suitable temporary field office as necessary at the Site for its own use. Contractor shall be responsible for necessary permits to install the temporary office and utilities. The location of the field office shall not interfere with OWNER's operations. Contractor responsible for all electrical and telecommunication services.

1.4.1 Existing Facilities

Do not use existing facilities for field offices or for storage.

1.4.2 Storage Areas And Sheds

Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products

1.4.3 Preparation

Fill and grade sites for temporary structures sloped for drainage away from buildings.

1.4.4 Removal

At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

1.5 SANITARY FACILITIES

Contractor shall provide and maintain such sanitary accommodations for the use of its employees and those of its Subcontractors as may be necessary to comply with the requirements and regulations of the local and state department of health. These accommodations shall be at Contractor's expense. Existing facility use is not permitted. Provide facilities at time of project mobilization.

1.6 MAINTENANCE OF TRAFFIC

1.6.1

It shall be the sole responsibility of Contractor to furnish and maintain, until the Work has been accepted by OWNER, all items necessary for safety.

1.6.2

This is a landfill. At no time shall Contractor impede any operations at any time without appropriate notification to and approval of the OWNER.

1.6.3

Traffic control on public roads shall be in accordance with the current Federal Highway Administration Manual on Uniform Traffic Control Devices (MUTCD). Costs for maintenance of traffic control shall be at Contractor's expense.

1.6.4

Contractor shall operate vehicles and equipment in a safe manner.

1.6.5

The Contractor shall promptly remove excavated material or other debris that may be spilled or tracked onto the traveled pavement during the conduct of the Work.

1.6.6

Flagging should only be employed when required to control traffic or when other methods of traffic control are inadequate to warn and direct drivers. At least one lane of traffic shall be maintained at all times. When work is not in progress, traffic is to be returned to the normal fashion.

1.7 TEMPORARY ELECTRICITY

1.7.1

Provide and pay for power service required from utility source as needed for construction operation.

1.7.2

Complement existing power service capacity and characteristics as required for construction operations.

1.8 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

Provide and maintain lighting for construction operations. Maintain lighting and provide routine repairs.

1.9 SECURITY

1.9.1

CONTRACTOR shall be responsible for protection of the site, and all work, materials, equipment and existing facilities thereon, against vandals and other unauthorized persons.

1.9.2

No claim shall be made against the OWNER by reason of any act of an employee or trespasser, and CONTRACTOR shall make good all damage to the OWNER's property resulting from his failure to provide security measures as specified.

1.9.3

Security measures shall be at least equal to those usually provided by OWNER to protect his existing facilities during normal operation, but shall also include such addition security fencing, barricades, lighting and other measures as required to protect the site.

1.10 ACCESS ROADS

CONTRACTOR shall construct, grade, stabilize and maintain temporary access roads to various parts of the site as required to complete the project.

1.11 PARKING

CONTRACTOR shall provide and maintain suitable parking areas for the use of all construction workers and other performing work by furnishing services in connection with the project, as required to avoid any need for parking personnel vehicles where they may interfere with public traffic, OWNER operations, or construction activities.

1.12 WATER CONTROL

Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment. The CONTRACTOR shall keep all natural drainage and water courses unobstructed or provide equal courses effectively placed, and prevent accumulations of surface water.

1.13 DUST CONTROL

Execute Work by methods to minimize raising dust from construction operations.

1.14 NOISE CONTROL

Provide methods, means, and facilities to minimize noise produced by construction operations.

1.15 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

1.15.1

Remove temporary utilities, equipment, facilities, and materials prior to Final Application for Payment inspection.

1.15.2

Clean and repair damage caused by installation or use of temporary work.

1.15.3

Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

2.0 PRODUCTS - NOT USED

3.0 EXECUTION - NOT USED

END OF SECTION 01 50 00

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

1.0 GENERAL

1.1.1 Final Inspection

1.1.1.1 Certification

Upon suspected completion of project, submit to CQA Engineer written certification that the work has been completed in accordance with the Contract Documents and is ready for the CQA Engineer's inspection.

1.1.1.2 Inspection

Final Inspection meeting will be held at the site to determine completeness.

1.1.1.3 Punch List

A final "punch list" of items to be completed will be reviewed by the OWNER, ENGINEER, Quality Assurance personnel, and CONTRACTOR at this meeting. CQA Engineer will prepare the punch list. Complete items on punch list and notify CQA Engineer of completeness.

1.1.1.4 Cleaning

Schedule a final cleaning as approved by the Engineer to enable the OWNER to accept a completely clean project. Clean up debris and dirt.

1.1.2 Application for Final Payment

OWNER's payment of final application shall terminate the Contract except as provided for bonds and warranties for the guarantee period.

1.1.3 Submittals

1.1.3.1

Provide one complete set of Contract Drawings and project manual recording changes to the work to indicate actual installation. Addenda items, bulletin drawings, change order items, field changes, and items changed during project meetings shall be included on the marked up drawings. Changes shall be noted in legible red letters at least 1/8 inch high. These records are a specific Contract requirement, and final payment will not be made until these drawings and project manual have been submitted in an acceptable form.

1.1.3.2

At the conclusion of the project, the CONTRACTOR shall submit a complete list of Subcontractors, manufacturers, and suppliers who participated in the construction or who furnished materials or equipment. The address of each firm shall be included, together with types of materials or work performed.

1.1.3.3

Statement of payment of taxes.

1.1.3.4

Affidavit of Payment of Debts and Claims.

1.1.3.5

Affidavit of Release of Liens.

1.1.4 Cleaning Requirements

1.1.4.1

Maintain the site in a neat and orderly condition. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this work. Provide adequate storage for items waiting removal from the site. No open accumulation of refuse will be permitted. Debris must be removed from within the project area on a daily basis.

1.1.4.2

Schedule a final cleaning as approved by the CQA Engineer to enable the OWNER to accept a completely clean project. Thoroughly remove from premises debris remaining from construction activities and properly dispose. Leave premises in a clean, neat, orderly, and safe condition. Sweep paved areas.

1.1.4.3

Restore areas damaged from construction activities.

1.1.4.4

Remove construction facilities and equipment from the project site.

1.1.5 Disposal Fee

1.1.5.1

A tip fee will not be charged for waste resulting from the CONTRACTOR's activities on the site provided that the CONTRACTOR delivers the waste to the working area and coordinates his activities with the landfill operator.

2.0 PRODUCTS

Not Used

3.0 EXECUTION

Not Used

END OF SECTION 01 70 00

SECTION 02 21 00

SURVEYING AND RECORD DOCUMENTS

1.0 GENERAL

1.1 SUMMARY

Section includes requirements for surveying, field engineering, and record documents.

1.2 CONTRACTOR'S SURVEYOR

CONTRACTOR is required to utilize a positioning system and/or an independent surveyor licensed in Virginia to provide field engineering and surveying services as required for layout and construction of the project as indicated on the Drawings and specified herein. The CONTRACTOR's surveyor shall:

- Locate existing features,
- Generate cut sheets,
- Provide construction stake out.

The Owner's surveyor will perform the following:

- Create final Record Drawings,
- Create the Geomembrane Record Drawing,
- Provide survey base maps for record Drawings,
- Provide survey controls, and verify the work as the Owner deems necessary.

1.3 DEFINITIONS

1.3.1 Existing Features

Existing Features include but are not limited to the following:

EXAMPLE LIST ONLY:

- Access Roads
- Buried piping
- Grass lined, rip rap lined, and Flexamat lined channels
- Groundwater Monitoring wells, Gas Monitoring Probes, LFG soil extraction well, and LFG collection wells
- Leachate Systems
- Manholes
- Stormwater Systems (Drop inlets, slope drains, Culverts, ditches, etc.)
- Stormwater Basins

1.3.2 Independent Surveyor:

Employed by an organization which is independent from the CONTRACTOR.

1.4 SUBMITTALS

Within 14 days before commencing work, submit the following items to the ENGINEER for review:

1.4.1 Qualifications of Surveyor

Submit surveyor's name, Virginia license number, and qualifications.

1.4.2 Project Record Documents

Upon Substantial Completion of the Work, notify ENGINEER for development of record documents. Final payment will not be made until satisfactory record documents are recorded by ENGINEER.

1.5 MONTHLY INSPECTIONS

To verify the CONTRACTOR's monthly progress payment requests, the following items shall be made available for monthly inspection by the ENGINEER:

1. Record Documents, including updated construction schedule
2. CONTRACTOR SURVEYOR'S Measurements, Notes, and Cut Sheets

1.6 SITE CONDITIONS

1.6.1 Existing Grades

The Contract Drawings depict approximate current surface elevations. Filling activities, maintenance activities, regrading, and routine settlement may have occurred since the original survey.

1.6.2 Existing Features

CONTRACTOR is required to field verify the location of existing features. The OWNER'S record drawings are available to the CONTRACTOR. The existence and location of features are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and existing features. The OWNER and the ENGINEER take no responsibility for the accuracy of these record drawings implied or otherwise.

1.6.3 Field Verification

Prior to construction, verify the location of existing features at points of connection or tie-in to the Work.

1.6.4 Field Conditions and Measurements

The CONTRACTOR shall base all measurements, both horizontal and vertical, from established benchmarks. The CONTRACTOR shall be responsible for field verification of all dimensions and conditions at the job site.

1.6.5 Discrepancies

Should the CONTRACTOR discover any discrepancy between actual conditions and those indicated which prevent following good practice or the intent of the Drawings and Specifications, he shall notify the ENGINEER in writing and request clarification and instructions. The CONTRACTOR shall not proceed with his work until he has received the same from the ENGINEER.

1.6.6 No Additional Payment

No claims shall be made for extra payment or extensions of Contract completion time if the CONTRACTOR fails to notify the ENGINEER of any discrepancy before proceeding with the aspect of the Work.

2.0 PRODUCTS

Not Used

3.0 EXECUTION

3.1 FIELD SURVEY WORK

3.1.1 Control Points

The OWNER will identify existing project control points at the site for the CONTRACTOR. The OWNER will, at the CONTRACTOR'S cost and as soon as possible, replace lost or destroyed project control points to the same accuracy of the existing project control points. Base replacements on the original survey control points. Relate all work to the facility elevation datum and coordinate system. The CONTRACTOR is responsible for all construction layout and staking.

3.1.2 Benchmarks

Establish and maintain a minimum of two permanent benchmarks on the site, referenced to data established by survey control points. Record benchmark locations, with horizontal and vertical data, on Project Record Documents. Do not change or relocate benchmarks or control points without prior written approval by the OWNER. Promptly report lost or destroyed reference points or requirements to relocate reference points because of necessary changes in grades or locations.

3.1.3 Site Improvements

Work from lines and levels established by benchmarks and markers to set lines and levels as needed to properly locate each element of the Project. Locate and lay out site improvements, including stakes for slopes, grading, fill and topsoil placement, utility slopes and invert elevations by

instrumentation and similar appropriate means. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.

3.1.4 Relocation of Existing Utilities

Furnish information necessary to adjust, move or relocate existing features, structures, utility poles, lines, services or other appurtenances located in, or affected by construction. Coordinate with local authorities having jurisdiction.

3.1.5 Surveyor's Log

Keep neat legible notes of all measurements and calculations made by him while surveying and laying out the work. Maintain a surveyor's log of control and other survey work. Make this log available for reference.

3.2 TOLERANCES

Elevations and 2 foot contour lines shown on the drawings are approximate. However, minimum and maximum slope requirements shown on the drawings and specified herein must be observed at all times. Slopes shall be constructed as indicated.

3.2.1 Liner

3.2.1.1 Earthwork

Earthwork shall be graded to ±0.2 feet of required grade provided required minimum slopes are maintained and minimum thicknesses for components of the liner or cover system are obtained.

3.2.1.2 Piping

Piping shall be graded to ±0.1 feet provided required slopes are maintained. Landfill gas piping shall maintain continuous slopes, as required by ENGINEER, to enable condensate drainage.

3.3 RECORD DOCUMENTS

3.3.1 General

Do not use existing record documents for construction purposes. Protect new record documentation from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the ENGINEER's reference during normal working hours. Store record documents and samples in CONTRACTOR'S field office apart from documents used for construction. Provide files, racks, and secure storage for record documents and samples. Backup electronic documents at least once per week.

3.3.2 Recording

1. Label and file record documents and samples in accordance with Specification Section number listings in Table of Contents of this Invitation for Bids/Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

2. Preparation of project record documents shall be by personnel skilled as a draftsman competent to prepare the required drawings.
3. Record and update daily record information from field notes, on set of blue line prints, and copy of Invitation for Bids/Project Manual.
4. Record information concurrently (daily) with construction progress. Do not conceal work until required information is recorded.
5. Record deviations from required lines and levels, and advise the ENGINEER when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.

3.3.3 Record Drawings

Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

Mark record sets with red erasable pencil. Mark new information that is important to the OWNER, but was not shown on Contract Drawings or Shop Drawings. Note related Change Order numbers where applicable. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set. Legibly mark each item to record actual construction, including:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Measured locations of liner systems, internal utilities, and appurtenances concealed in construction, referenced to visible and accessible features of construction.
3. Field changes (dimensions and detail)
4. Changes by Modifications made by the ENGINEER or OWNER.
5. Details not on original Contract Drawings.
6. References to related Shop Drawings and Modifications.
7. Depths of various elements of the Work in relation to datum.

3.3.4 Record Specifications

Maintain one complete copy of the Project Manual, including addenda and one copy of other written construction documents such as Change Orders and Field Order issued in printed form during construction. Mark these documents to show substantial variations in actual work performed in comparison with the text of the Specifications, Change Order, and Field Order. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and product data. Legibly mark up each Section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
2. Changes made by Change Order or Field Order.
3. Other matters not originally specified.

3.3.5 Geomembrane Record Drawing

The OWNER's surveyor or ENGINEER shall prepare a geomembrane record drawing. The contractor will coordinate installation of the geomembrane to allow owner's surveyor to record the layout. The CONTRACTOR will not place additional layers until the survey is complete. This drawing shall be signed and sealed by the surveyor. The minimum scale is 1" = 50', and the maximum sheet size is 24" X 36". The following information is mandatory:

1. 2' contours
2. Approximate Location and size of all panels installed and seam welds
3. Label all panel and roll numbers
4. Label destructive sample numbers and geomembrane repair numbers
5. Label and locate the location of each repair, cap strip, liner penetration, pipe boot, and destructive sample.
6. Horizontal and vertical coordinates of the anchor trench
7. Slopes and breaks in grade

3.3.6 Record Product Data

Maintain one copy of each approved Product Data submittal. Mark these documents to show significant variations in actual work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the work which cannot be otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.

Upon completion of mark-up, submit complete set of record Product Data to the ENGINEER for the OWNER'S records.

3.3.7 Record Sample Submitted

Immediately prior to the date or dates of Substantial Completion, the CONTRACTOR will meet at the site with the ENGINEER and the OWNER'S personnel to determine which of the submitted samples that have been maintained during progress of the work are to be transmitted to the OWNER for record purposes. Comply with delivery to the OWNER'S sample storage area.

3.3.8 Miscellaneous Record Submittals

Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the work. Immediately prior to the date or dates of substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the ENGINEER for the OWNER'S records. Miscellaneous record submittals include but are not limited to:

- Field test records
- Inspection certificates
- Manufacturer's certificates
- Manufacturer's Warrantees

3.3.9 Inspection

Verify locations of survey control points and existing features prior to starting work. Promptly notify ENGINEER of any discrepancies.

3.3.10 Survey for Measurement and Payment

Measurement for payment calculations shall be performed by the OWNER'S surveyor. Drawings and calculations shall be checked and sealed by the SURVEYOR. In the event of a dispute, Contractor must provide documentation from a Surveyor Licensed in the Commonwealth of Virginia. An Independent Surveyor may be called to verify grades and or volumes in the event of any disagreements.

END OF SECTION 02 21 00

SECTION 31 00 00

EARTHWORK

1.0 GENERAL

1.1 DESCRIPTION

1.1.1

The work in this section includes all labor, materials, equipment, construction quality control (CQC) testing, and incidentals required to perform earthwork for the final cover system installation as shown on the Plans and as specified herein and in General Conditions.

1.1.1.1

Earthwork includes, but is not limited to excavation, filling, backfilling and compacting earthen materials to achieve base grades and final grades for the final cover system installation. This includes backfilling of trenches and anchor trenches; sheeting and shoring; dewatering; general backfilling and compacting, constructing diversion fs, and grading around structures; segregating, stockpiling, screening, and other material processing of excavated materials for on-site use; disposing of earth materials, as required to complete construction and associated features shown on the Plans.

1.1.2

The cost of all excavation shall be incorporated into the base bid. No distinction will be made insofar as payment between soil, rock and waste materials if encountered.

1.1.3

CONTRACTOR is responsible for all construction layout and staking.

1.1.4 Related Work Specified Elsewhere

- Section 31 10 00 Clearing, Grubbing, and Stripping
- Section 31 05 13 Erosion Control and Vegetative Support Layers
- Section 31 05 16 Aggregates
- Section 31 05 19.16 LLDPE Geomembrane
- Section 31 05 19.17 Agru MicroDrain Geomembrane
- Section 31 23 33 Trenching, Backfilling and Compacting

1.2 DEFINITIONS

1.2.1 Excavation

Excavation means the removal of soil, waste, rock, debris and other materials to the proposed grading limits indicated on the PLANS.

1.2.2 Unauthorized Excavation

Unauthorized excavations shall be backfilled and compacted as specified for authorized excavations at no additional cost to the OWNER.

1.2.3 Additional Excavation

When excavation has reached required subgrade elevations, notify the ENGINEER, who will make an inspection of conditions. If the ENGINEER determines that bearing materials at required subgrade elevations are unsatisfactory, continue excavation until satisfactory bearing materials are encountered. Replace excavated material with suitable fill material as directed by the ENGINEER.

1.2.4 Maximum Dry Density

Maximum dry weight in pounds per cubic foot (pcf) of a specific soil material as determined by ASTM D698.

1.2.5 Optimum Moisture Content

The moisture content at which the maximum dry density of a soil material is determined by ASTM D698.

1.2.6 Filled Areas

Filled areas are areas which have received trench backfill, structural fill or embankment materials, placed and compacted as specified herein.

1.2.7 Reference Standards

- ASTM D698 — Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort
- ASTM D1556 — Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- ASTM D2434 — Standard Test Method for Permeability of Granular Soils (Constant Head)
- ASTM D2487 — Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- ASTM D4373 — Standard Test Method for Calcium Carbonate Content of Soils

- ASTM D5084 Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
- ASTM D6913 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
- ASTM D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- ASTM D7928 Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

1.3 SUBMITTALS

1.3.1

Refer to SECTION 01 33 00 – SUBMITTAL PROCEDURES for submittal requirements.

1.3.2

Sheeting, shoring and bracing shall be designed and signed by a registered professional ENGINEER and submitted for approval.

1.4 SAFETY

All excavation guidelines shall comply with CONTRACTOR'S Health and Safety Plan and the applicable requirements as stated in SECTION 01 35 29 – HEALTH AND SAFETY PLAN and the following:

- OSHA excavation safety standards 29 CFR, s.1926-650, Subpart P.
- State and County construction safety regulations.

1.4.1 Utility

Contact "Miss Utility" prior to any excavation.

1.5 PROJECT CONDITIONS

1.5.1 Site Information

The CONTRACTOR shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the confirmation of the ground, the characteristics and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the execution of the work, the general and local conditions and all other matters which can in any way affect the work under this Contract.

Additional test borings and other exploratory operations may be performed by CONTRACTOR, at the CONTRACTOR'S option; however, the OWNER will not pay for such additional exploration.

1.5.2 Existing Structures

Shown on the Plans are certain surface and underground structures adjacent and/or within the work. This information has been obtained from existing records. It is not guaranteed to be correct or complete and is shown for the convenience of the CONTRACTOR. The CONTRACTOR shall explore ahead of the required excavation to determine the exact location of all structures. They shall be supported and protected from injury by the CONTRACTOR. If they are broken or injured, they shall be restored immediately by the CONTRACTOR at his expense.

1.5.3 Protection of Persons and Property

1.5.3.1

Barricade open excavations or trenches occurring as part of this work and post warning signs or lights, as appropriate.

1.5.3.2

CONTRACTOR shall plan and conduct operations to prevent damage or disturbance to existing structures and utilities, buried utilities, existing monitoring wells, roads, signs, trees and bench marks.

1.5.3.3

Protect existing slopes, embankments, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

1.5.3.4

Failure of ENGINEER to order the use of bracing or sheeting or shoring shall not in any way or to any extent relieve the CONTRACTOR of any responsibility concerning the condition of excavations or of his obligations under this Contract.

1.5.3.5

Work is restricted to the area provided for CONTRACTOR'S use.

1.5.3.6

Side slopes shall be maintained in stable condition under all normal anticipated weather conditions for the period that the excavation will be open. The CONTRACTOR shall regrade side slopes to be a more stable configuration if so directed by ENGINEER.

1.5.4 Dust Control

The CONTRACTOR shall conduct operations and maintain the area of his activities, including sweeping and sprinkling of roadways, so as to minimize the creation and dispersion of dust to the satisfaction of the OWNER.

1.5.5 Traffic

Traffic inside and outside the site is anticipated. The CONTRACTOR shall coordinate with the OWNER regarding traffic control during construction. CONTRACTOR shall primarily utilize the access road on the eastern perimeter of the landfill.

1.6 QUALITY CONTROL

1.6.1 Regulations

All materials and labor furnished under this section shall comply with OSHA, ASTM, ANSI and other applicable Federal, State and County codes and regulations including revisions to the date of the Contract. Comply with the pertinent sections of the following standards:

Virginia Erosion and Sediment Control Handbook (VESCH), latest edition

Virginia Department of Transportation (VDOT) Road & Bridge Specifications, latest edition

1.6.2 Specifications

Provide Construction Quality Control (CQC) in accordance with Section 01 45 00 - CONSTRUCTION QUALITY CONTROL.

1.6.3 Workers

Use adequate number of skilled workers who are thoroughly trained and experienced in the specified requirements and the methods needed for proper performance of the work in this Section.

2.0 PRODUCTS

2.1 MATERIALS

2.1.1 General Fill Material

2.1.1.1 Availability On-Site

It is intended that on site soils from the stormwater basin excavation may be used as a portion of the fill material. General Fill is available on-site from borrow areas depicted on the plans, pipe trenches, other related excavations, or may be excavated from surrounding areas approved by the ENGINEER.

2.1.1.2 Quality

General Fill shall be inorganic soil, that is not excessively wet or saturated, free of stone, rock or gravel larger than three (3) inches in any dimension, and free of debris, waste, frozen materials, vegetation, organic materials, roots, and other deleterious matter. The CONTRACTOR must provide preconstruction testing as required by the Specifications to demonstrate suitability. The suitable excavated soil materials shall be capable of maintaining its stability on all slopes. Excess or unsuitable material shall be removed and disposed as directed by the ENGINEER to the designated areas on-site stockpiles.

2.1.1.3 Off-site General Fill

If off-site soils are to be used, the CONTRACTOR shall identify the source a minimum of 3 weeks in advance of intent to import. The Owner's Quality Assurance personnel shall be given access to the site to obtain necessary samples for testing and proofing of the soil material.

2.1.1.4 Use of General Fill

General Fill shall be used for backfilling and filling as shown on the PLANS, and for areas as otherwise directed by the ENGINEER. Fill material is material used for trench backfill, structural fill and backfill and embankment.

2.1.2 Controlled Subgrade Material

Controlled subgrade material is the upper 12 inches of material prior to placement of the geomembrane within the final cover area. Controlled subgrade shall be inorganic soil free of roots, limbs, stone, rock or gravel larger than three (3) inches in any dimension trash, excessive organics, and deleterious material. The soil shall have a classification of SC, ML, CL, MH, or CH as defined in the Unified Soil Classification System (ASTM D 2487), or otherwise approved by the ENGINEER.

2.1.3 Bedding Layer

The top 6" of intermediate/daily cover will function as a Bedding Layer and is to be smooth and free of sticks, rocks larger than 1 inch, or other irregularities which could puncture the synthetic cap. Not more than 1 percent by weight of particles larger than 3/8-inch in diameter shall be allowed within the Bedding Layer. The surface of the Bedding Layer will contain no particles larger than 3/8 inches, and the surface will be free of sharp or angular stone that may puncture the geomembrane. Mechanical screening, raking or other methods to remove oversize particles shall be provided by CONTRACTOR as necessary. Hand grooming of the surface may be required.

2.1.3.1 Stability

The satisfactory excavated soil materials shall be capable of maintaining its stability on all slopes. Excess or unsatisfactory material shall be removed and disposed as directed by the ENGINEER to the designated areas on-site designated by the OWNER.

2.1.3.2 Protection of Subgrade

Bedding Layer material shall be protected from excessive heat and desiccation cracking, freezing, or softening by precipitation, after placement and compaction. If disturbed, Bedding Layer shall be recompacted or reworked to meet specifications.

2.1.4 Aggregates

Refer to SECTION 31 05 16 - AGGREGATES.

2.1.5 Trench Backfill

Refer to SECTION 31 23 33 – TRENCHING, BACKFILLING, AND COMPACTING for additional requirements

2.1.6 Embankments

Fill material for structural fill and embankments higher than four feet shall have a maximum density not less than 100 pounds per cubic foot as determined by ASTM D698, and shall contain no more than 25 percent rocks, none being larger than four inches in the greatest dimension. Liquid limit shall not exceed 25 and plasticity shall not exceed 6.

2.1.7 Bedding for Pipe and Pipe Structures

Bedding for Pipe and Pipe Structures shall be general fill free of stones larger than 2 inches, construction debris, refuse, muck, soft clay, loam, sponge material, vegetation/organic matter, or angular rock. Suitable excavation material may be used for backfilling around installed pipe, subject to approval by ENGINEER.

2.1.8 Sheeting and Shoring

Sheeting, shoring and bracing materials shall be timber or steel, designed to retain the earth around structures to prevent cave-in and settlements, and to fulfill all safety requirements.

2.1.9 Other Materials

All other materials, not specifically described, but required for proper completion of the work shall be selected by the CONTRACTOR and approved by the ENGINEER.

3.0 EXECUTION

3.1 PREPARATION

3.1.1 Dewatering

3.1.1.1

The CONTRACTOR shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory foundation condition until the fill, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels.

3.1.1.2

Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottom, and soil changes detrimental to stability of subgrades and foundations. Subgrade soils which become soft, loose, "quick", or otherwise unsatisfactory for support of structure as a result of inadequate dewatering or other construction methods shall be removed and replaced by crushed

stone as required by the ENGINEER at the CONTRACTOR's expense. The bottom of excavations shall be rendered firm and without standing water before placing structures or pipes. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

3.1.1.3

Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

3.1.1.4 Disposal of Water Removed by Dewatering System

Dispose of water in such a manner as to cause no inconvenience to the OWNER, the ENGINEER, or others involved in work about the site. Trench excavations shall not be used as temporary drainage ditches.

3.1.1.5 Construction Quality Assurance (By Others)

3.1.1.5.1

The CONTRACTOR shall coordinate his work with the OWNER's CQA Representative to allow testing and monitoring of all work components to proceed.

3.1.1.5.2

There shall be no additional compensations to the CONTRACTOR for any construction delays caused by the CONTRACTOR's failure to plan, coordinate, and schedule work to include all CQA activities.

3.1.1.6 Construction Quality Control

CONTRACTOR shall provide pre-construction material verification and Construction Quality Control testing of earth materials as indicated in Table 31 00 00 and Section 01 45 00 - CONSTRUCTION QUALITY CONTROL. General fill, backfill, controlled subgrade soil, and erosion control soil are subject to the relevant tests in Table 31 00 00 - 1. The erosion control soil will not be compacted.

Table 31 00 00 - 1 Soils and Aggregates Test Frequency

Test	ASTM Designation or Other Test Method	CQC Frequency	CQA Frequency
Pre-Construction/Stockpile Testing			
Classification	D2487	1 per 2,500 cy and changes in material	1 per project
Atterberg Limits	D4318	1 per 2,500 cy and changes in material	1 per project
Grain Size Analysis	D6913 and D1140	1 per 10,000 cy	1 per project

Natural Moisture Content	D2216	1 per 2,500 cy	1 per project
Moisture-Density Relationship (Standard Proctor)	D698	1 per 2,500 cy and changes in material	1 per project
Shear Strength	D2850 or D1557	1 per 10,000 cy	1 per project
During Construction Testing			
Compacted Density	D2922, D1556, or D2937	5 tests/acre/lift or 1 per 500 linear feet of trench	1 tests/acre/lift or 1 per 1,000 linear feet of trench
Compacted Moisture Content	D3017 or D2216	5 tests/acre/lift or 1 per 500 linear feet of trench	1 tests/acre/lift or 1 per 1,000 linear feet of trench
In-place Moisture Density Road Aggregates and Compacted Soil	D6938 or D2937	1 per 100 linear feet of road, a minimum of 1 test per lift of select fill	1 per 1000 linear feet of road, a minimum of 1 test per lift of select fill
Backfill Placement Depths and Extents	Observation, Field Measurement	Continuous observation	Survey Verification
Bedding Layer and Erosion Control/Vegetative Soil Thickness	Observation, Field Measurement	Continuous observation	Survey Verification (100 ft x 100 ft grid)

Notes:

- Every fifth sample tested with ASTM D6938 shall be verified by ASTM D1556, Sand Cone or ASTM D2937, Drive Cylinder unless Engineer specifies otherwise.
- Every fifth sample tested with ASTM D6938 shall be verified with ASTM D2216, Laboratory Determination of Water Content of Soil, Rock, and Soil-Aggregate Mixtures unless Engineer specifies otherwise.
- Test locations shall be identified by the Contractor by horizontal and vertical control and presented on drawing or sketch indicating dimensions.
- If a test fails to meet the required compaction level or moisture content, then the area represented by that test shall be reworked and retested at the Contractor's expense Corrective measures shall be documented in the Quality Control and Quality Assurance reports.

3.2 GENERAL

3.2.1

The CONTRACTOR shall perform excavations described in whatever substance encountered to dimensions and elevations shown on the Contract Drawings. Excavation shall be unclassified. The CONTRACTOR shall be responsible for verifying the grades and dimensions as shown.

3.2.2

Existing utilities, structures, and fencing shall be protected during the construction period, and if damaged or removed by the CONTRACTOR in his operations, shall be repaired or replaced by the CONTRACTOR at no additional cost to the Owner.

3.2.3

The Owner shall retain a Quality Assurance Officer (QAO) to monitor Earthwork included in this section for construction quality assurance (CQA). The QAO shall be present on site during subgrade approval and fill and backfill operations.

3.3 EXCAVATION

3.3.1 General

3.3.1.1

Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the PLANS.

3.3.1.2

Excavation work shall be performed in a safe and proper manner with appropriate precautions being taken against hazards and in accordance with the Health and Safety Plan. Excavations shall provide adequate working space and clearances for the work to be performed therein. If walls of the excavation cannot be kept stable, the excavation shall be properly shored and braced.

3.3.1.3

Excavation shall be unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered. Well/boring/test pit logs performed on-site are available for information only to the CONTRACTOR.

3.3.1.4

If subgrade "pumping" is encountered during excavation, perform the following:

3.3.1.4.1

Excavate and remove the underlying unsuitable material for a minimum depth of 12 inches.

3.3.1.4.2

Proof-roll and compact by appropriate heavy equipment for at least 6 passes and approve by the ENGINEER.

3.3.1.4.3

Backfill with General Fill or Subbase material as directed by the ENGINEER and compact to a stable condition approved by the ENGINEER.

3.3.1.5

Excavation shall conform to the limits indicated on the PLANS and as specified herein. This work shall include shaping, sloping, grading and other work necessary in bringing the site to the required grade, alignment, and cross-section.

3.3.1.6

Unsatisfactory materials shall be removed to the required depth and replaced to the satisfaction of the ENGINEER with General Fill or Subbase material. Unsatisfactory materials shall be removed and disposed of in the designated areas on-site as directed by the ENGINEER.

3.3.1.7 Stockpiling of Excavated Materials

Satisfactory excavated materials shall be stockpiled in such a manner as to prevent nuisance conditions, including but not limited to endangering work areas or obstructing drive ways and natural water courses. Valve pit covers, valve boxes, or other utility controls shall be left unobstructed and accessible at all times. The CONTRACTOR shall limit operations to the project areas shown on the drawings unless otherwise approved by the ENGINEER. Surface drainage shall not be hindered.

3.4 TRENCH EXCAVATION FOR AIR, LANDFILL GAS AND FORCEMAIN PIPES, AND LIQUIDS MANAGEMENT STRUCTURES

See Section 31 23 33 (Trenching, Backfilling, and Compacting).

3.5 STABILITY OF EXCAVATIONS

3.5.1 General

Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

3.5.2 Side Slopes

Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

3.5.3 Shoring and Bracing

Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations during period excavations will be open. Extend shoring and bracing as excavation progresses.

3.6 STORAGE OF EXCAVATED AND BORROW MATERIALS

Stockpile excavated and borrow materials acceptable for General Fill and Bedding Layer where directed by the ENGINEER. Place, grade, and shape stockpiles for proper drainage.

Comply with all erosion and sediment control requirements by state and local authorities.

3.7 SUBGRADE APPROVAL

Prior to installation, subgrades to receive structures or fill shall be evaluated prior to fill placement by the QAO. Such evaluation may include the observation of subgrade performance during proof-rolling with a loaded tandem dump truck provided by the CONTRACTOR. At least three passes are to be made with a fully loaded tandem dump truck. Areas that are deemed unsuitable (rutting, pumping, etc.) for fill placement by the QAO shall be clearly identified in both horizontal and vertical extent with recommendations for improvements and submitted to the ENGINEER for further action.

3.8 BACKFILL AND FILL

3.8.1 General

Place soil material in layers to required elevations, for each area classification listed below, using materials specified in Part 2 of this Section.

3.8.1.1 General Site Grading

Use General Fill where indicated on the PLANS.

3.8.1.2 Aggregates

Use VDOT designated aggregates and other fill materials as indicated on the PLANS.

3.8.2 Timing of Backfill

Backfill excavations as promptly as work permits.

3.8.3 Depth And Mixing Of Fill Layers

Fill and backfill soil shall be placed in layers that when compacted shall not exceed six (6) inches. Each layer shall be spread evenly and shall be thoroughly bladed and mixed during the spreading to obtain uniformity of material in each layer.

3.8.4 Backfilling of Anchor Trench

The anchor trench shall be backfilled and compacted by CONTRACTOR, as approved by CQA engineer and quality assurance officer. Backfill material shall consist of clean structural fill. Trench backfill material shall be placed in 8 inch thick loose lifts and compacted by a method and equipment type approved by CQA Consultant. Material shall be compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D 698.

3.9 PLACEMENT AND COMPACTION

3.9.1 General

3.9.1.1 Ground Surface Preparation

Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or scarify surfaces so that fill materials will bond with existing surfaces. Subgrade shall be approved by the QAO prior to material placement.

3.9.1.2 Bedding Layer

The in-place Bedding Layer shall be compacted to a minimum of 90% of the maximum dry density and ±3% of optimum moisture content, as determined by ASTM D698 (Standard Proctor). The surface shall be rolled smooth and be free of rocks or stones in excess of 3/8 inch prior to placement of the overlying geomembrane.

The thickness of the Bedding Layer will be a minimum of 6 inches, and the total thickness of soil under the geomembrane will be a minimum of 12 inches. This will be confirmed by CQA surveys on a 100-foot by 100-foot grid over the surface area, before and after the installation of the Bedding Layer. Alternatively, the CONTRACTOR may verify the Bedding Layer thickness and total soil thickness by excavating test pits on a 100-foot by 100-foot grid over the cap surface area under observation of the QAO. The test pits will be excavated by the CONTRACTOR, and the QAO will observe and measure the test pit depths. The CONTRACTOR will backfill test pits with bentonite clay.

The liner installer shall provide written acceptance of the subgrade before installing liner.

3.9.1.3 Synthetic Liner/Cap Protection

Surfaces to be lined/capped shall be smooth and free of all rocks, stones, sticks, roots, sharp objects or debris of any kind which could damage the synthetic liner/cap. The surface should provide a firm, unyielding foundation for the membrane with no sudden, sharp or abrupt changes or break in the grade. No standing water or excessive moisture shall be allowed. Final compaction of the Bedding Layer shall be completed with a smooth steel wheel roller. The liner/cap installation CONTRACTOR shall certify in writing that the surface on which the membrane is to be installed is acceptable before commencing work.

3.9.1.4 Moisture Content

General fill and backfill soil shall be compacted at a moisture content within a range of ±3% of the optimum moisture content, unless otherwise approved by the QAO. As required, general fill and backfill soil shall be dried by aerating with a scarifier, disc harrow, blade, or other equipment or by such other means as may be necessary. As required, fill and backfill soil shall be wetted by the use of water trucks or sprinklers. Dried or wetted fill or backfill soil shall be thoroughly mixed to provide a material of uniform moisture content. Do not place backfill or fill material on surfaces that are submerged soft, muddy, frozen, or unstable.

Where subgrade or fill material must be moisture conditioned before compaction:

- Uniformly apply water to surface of subgrade or fill material. Apply water as necessary to prevent free water from appearing on surface during or subsequent to compaction

operations. The CONTRACTOR shall process soil materials so that moisture is uniformly mixed into soils.

- Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density and moisture range. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced uniformly to a satisfactory value.

3.9.1.5 Nonconforming Material

Re-compact areas or lifts if soil density and moisture tests indicate inadequate compaction and/or moisture. No additional compensation shall be given to the CONTRACTOR due to re-working of failed areas. The extent of area for repair shall be determined by the ENGINEER.

3.9.1.6 Filling Adjacent to Structures

Place backfill and fill materials evenly adjacent to structures or piping to required elevations. Prevent wedging action of backfill against structures or displacement of piping by carrying material uniformly around structure or piping to approximately same elevation in each lift.

3.9.1.7 Landfill Gas Pipe Aggregates

Aggregates surrounding perforated landfill gas collection pipe shall not be compacted, but shall be placed to achieve lines and grades as shown on the Plans.

3.10 COMPACTION OF FILL

Compact fill materials and aggregates not less than the following percentages of maximum dry density in accordance with ASTM D 698 or to a maximum obtainable density as follows:

3.10.1 Compaction

Compaction of each layer, unless otherwise specified, as shown on the Contract Drawings and determined in the field shall be continuous over its entire area and the compaction equipment shall make sufficient trips to verify that the required density has been obtained. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted in six (6) inch maximum compacted thickness lifts. The minimum dry density of the soil shall be at least ninety percent (90) of the maximum dry density as determined by ASTM D698 (standard Proctor), unless otherwise shown on the Contract Drawings.

3.10.2 Compaction Equipment

Compaction equipment shall be of such design that it will be able to compact the fill to the specified density. Prior to placing the fill, at the preconstruction meeting or a minimum of 7 days prior to usage, the CONTRACTOR shall submit to the ENGINEER, for approval, a list of compaction equipment to be used. The ENGINEER shall have 7 days to approve or disapprove the list. The list shall include the type of equipment, manufacturer and size.

3.10.3 Equipment Certification

If, in the opinion of the ENGINEER, the compaction equipment is not acceptable, the CONTRACTOR may demonstrate the suitability of such equipment in a test area within the prepared fill site.

3.10.4 Fill Faces

Fill faces shall be compacted. Compacting operations shall be continued until the slope faces are stable but not too dense for planting and there is no appreciable amount of loose soil on the surface. Compaction efforts should be limited to “walking-in” slopes with a tracked dozer. Compacting of the slopes may be done progressively as the fill is brought to its total height or compacting of the slopes may be done after the fill is brought to its total height.

3.10.4.1 Erosion

CONTRACTOR shall maintain and prevent erosion of at all times during construction. Repair of damages to the Bedding Layer and other soil surfaces due to inadequate maintenance, and erosion shall be at the CONTRACTOR's own expense.

3.11 QUALITY CONTROL

CONTRACTOR to provide testing in accordance with Table 31 00 00-1 Testing Frequency Summary – Earth Material Construction Quality Control Testing.

3.12 GRADING

Uniformly grade all areas disturbed by the project, at trench locations, excavated and fill areas and adjacent transition areas so that finished surfaces are at the proposed grade or are approximately at preexisting grades, adjusted as required to provide positive drainage.

Fill and excavation areas shall be kept free of standing water with positive drainage maintained. Sloping of the fill surface and drainage ditches shall be provided to carry off water as it collects. Pumping shall be required to remove water from areas that cannot drain naturally.

3.13 SEASONAL LIMITS

No fill material shall be placed, spread or rolled while the ground is frozen or thawing, or during unfavorable weather conditions. When the work is interrupted by inclement weather, fill operations shall not be resumed until the moisture content and density of the previously placed fill are as specified. Fill surfaces exposed to inclement weather or standing water shall be scarified to a depth of 6 inches, compacted and tested prior to placing addition fill lifts.

3.14 INTEGRITY OF THE WORK

It shall be the CONTRACTOR's responsibility to maintain the integrity of the work. Work that is damaged by weather or construction activities shall be restored and retested at the CONTRACTOR's expense.

3.14.1 Protection of Graded Areas

Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

3.14.2 Repair

Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

3.14.3 Reconditioning Compacted Areas

Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density and moisture range prior to further construction.

3.14.4 Settling

Where settling is measurable or observable at excavated areas during project, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 FINISHING WORK

3.15.1 Bedding Layer

After the Bedding Layer has been installed, the CONTRACTOR shall maintain it free of ruts, depressions, and damage resulting from the hauling and handling of any material, equipment, tools, etc.

3.15.2 Drainage Structures

All drainage structures shall be constructed and maintained as necessary along the completed section.

3.15.3 Elevations

Unless otherwise specified by the ENGINEER, the elevation of all constructed grades shall be within 0.2 feet of those shown on the PLANS. The thicknesses of all Final Cover System components such as Erosion Control and Vegetative Layers are minimum values.

3.15.4 Finish Grading

After berms, ditches, swales, shoulders, and embankments are completed, the disturbed areas shall be finish graded. Any lumber, undesirable materials, and rocks larger than the 3 inches in size shall be removed from the surface immediately and the surface shall be prepared for final landscaping.

3.16 DISPOSAL OF EXCESS AND WASTE MATERIALS

The Bristol ISWMF does not have an active landfill waste placement operations ("working face") area and is in the process of installing various remedial measures prior to closure. During this interim period, waste that is excavated during construction activities can be relocated and covered within the landfill. Waste relocation within the SWP #498 landfill will be required to establish the newly proposed intermediate/daily soil cover grade.

During the regrading of the intermediate/daily soil cover, the CONTRACTOR shall be responsible for stripping off the existing intermediate/daily soil cover, moving waste as needed to approach design grade, and replacing and restoring the Intermediate Soil Cover layer. CONTRACTOR shall minimize the open area of disturbed waste at any given time.

The CONTRACTOR shall place waste materials encountered during trenching activities in neat piles adjacent to the work area. Prior to the end of the working day, the CONTRACTOR shall haul the excavated waste materials to a designated area for waste relocation at the site, as directed by the OWNER. The CONTRACTOR shall be responsible for stripping off the existing Intermediate Soil Cover material, unloading and spreading the excavated waste, "tracking it in" with suitable equipment, and replacing and restoring the Intermediate/daily Soil Cover layer.

OWNER shall not require the CONTRACTOR to pay tipping fee for disposal of excavated waste materials encountered during work activities. If odors or emissions from the excavated waste become a nuisance as determined by the OWNER, CONTRACTOR shall increase the frequency of excavated waste removal as directed by the ENGINEER.

3.17 MANAGING LEACHATE SEEPS

During earthwork within the #498 landfill, leachate seeps may occur. The CONTRACTOR shall be responsible for addressing leachate seeps. If a leachate seep occurs, CONTRACTOR shall notify ENGINEER. CONTRACTOR shall address leachate seeps in accordance with the drawings (leachate seep management detail) unless otherwise directed by ENGINEER. If the proposed leachate seep management strategy is ineffective, CONTRACTOR will inform and seek guidance from ENGINEER.

END OF SECTION 31 00 00

SECTION 31 05 13

EROSION CONTROL AND VEGETATIVE SUPPORT LAYERS

1.0 GENERAL

1.1 REQUIREMENTS INCLUDED

Provide personnel, equipment, and materials to excavate, haul, and place Erosion Control Layer and Vegetative Support Layer above the synthetic cap to promote vegetative growth.

1.2 RELATED REQUIREMENTS

- Section 01 45 00 Construction Quality Control
- Section 31 00 00 Earthwork
- Section 31 05 16 Aggregates
- Section 31 05 19.16 LLDPE Geomembrane
- Section 31 05 19.17 Agru MicroDrain Geomembrane
- Section 31 23 33 Trenching, Backfilling and Compacting

1.3 REFERENCE STANDARDS

- ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

2.0 PRODUCTS

2.1 EROSION CONTROL LAYER

The Erosion Control Layer soil shall be soil free of debris, roots and other organic matter, frozen material, sharp objects or other harmful matter that may damage the synthetic cap. This soil shall have no particle size greater than two (2) inches. No more than 20% of the soil by weight shall be comprised of particles greater than 1.5 inches. The soil used in the erosion control layer shall be classified as SM, SC, CL, ML, or MH (ASTM D2487) and capable of supporting the minimum required interface shear friction angle per the Construction Quality Control specification (01 45 00).

Soil for the Erosion Control Layer shall come from either an on-site borrow area provided by the Owner or an off-site borrow area provided by the CONTRACTOR.

Laboratory tests will be required in accordance with the Earthwork specification (31 00 00).

2.2 VEGETATIVE SUPPORT LAYER

The Vegetative Support Layer shall be topsoil or amended soil capable of promoting and sustaining vegetative growth. The soil may be either off-site topsoil, on-site topsoil, and/or soil mixed with

suitable organic amendment. Wastewater treatment plant sludge is not a suitable amendment. The soil or soil mixture shall be free of debris, large roots, stumps, or frozen material. The soil shall have a pH between 6 and 7.5 (prior to liming or fertilization), contain at least 1.5 percent organic matter (by weight), and have a maximum particle size of 1 inch. Soluble salts shall be < 500 ppm.

2.3 SUITABLE ORGANIC AMENDMENT (IF NEEDED)

Vegetative Support Layer soil shall be amended with compost as needed to provide the minimum organic matter. The following chart shall be used to increase organic content.

Existing Organic Matter (% by dry wt)	Cubic Yards per Acre Compost
0.0	100
0.5	75
1.0	50

2.3.1 Compost Material

Compost shall be premium compost, McGill SoilBuilder, by McGill Environmental Systems, Waverly, Virginia or approved equivalent.

Compost shall be mature, stable, weed free, and produced by aerobic decomposition of organic matter. Compost shall contain no unprocessed chunks of wood or bark, visible refuse or other physical contaminants, substances toxic to plans, or over 5% sand, silt, clay or rock material by dry weight.

Compost shall be tested and certified in accordance with the United States Composting Council's Seal of Testing Approval program.

Parameter	Range	Testing Method
pH	5.0-8.5	TMECC 4.11A
Soluble Salt Concentration	< 10 dS/m	TMECC 4.10-A
Moisture	30-60% wet wt. basis	SMEWW 2540B
Organic Matter	30-65% dry wt. basis	TMECC 5.07-A
Particle Size	>98% passing ¾" screen	TMECC 2.02-B
Stability (Carbon Dioxide evolution rate)	>80% relative to positive control	TMECC 5.08-B
Maturity (Seed emergence % seedling vigor)	>80% relative to positive control	TMECC 5.05-A
Physical contaminants (man-made inerts)	<1% dry weight basis	TMECC 3.08-A
Chemical contaminants	**Meet or exceed US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels:**	
Arsenic	< 41ppm	TMECC 4.06-AS
Cadmium	< 39 ppm	TMECC 4.06-CD
Copper	< 1,500 ppm	TMECC 4.05-CU
Lead	< 300 ppm	TMECC 4.06-PB
Mercury	< 17 ppm	TMECC 4.06-HG
Molybdenum	< 75 ppm	TMECC 4.05-MO
Nickel	< 420 ppm	TMECC 4.06-NI
Selenium	< 100 ppm	TMECC 4.06-SE
Zinc	< 2,800 ppm	TMECC 4.06-ZN
Biological contaminants (pathogens)	**Meet or exceed US EPA Class A standard, 40 CFR §**	

Parameter	Range	Testing Method
	503.32(a) levels:	
Fecal coliform	< 1,000 MPN per gram, dry wt. basis	TMECC 7.01
Salmonella	< 3 MPN per 4 grams, dry wt. basis	TMECC 7.02

3.0 EXECUTION

3.1 PLACEMENT AND COMPACTION

The Erosion Control Layer shall be a uniformly spread lift of soil. Compaction shall be limited to tracking equipment. Surface roughen the final layer. The material shall be placed and spread in such that equipment will not operate directly on the synthetic cap. The material layer shall be installed in one lift without compaction so that the placement of the material shall not damage the synthetic cap.

The Vegetative Support Layer soil shall be a uniformly spread lift. Compaction shall be limited to tracking equipment. Surface roughen the top.

Spreading of the soil layers shall be accomplished using wide track equipment such as a Caterpillar D5 or D3, Low Ground Pressure bulldozer or equivalent.

Pumping and rutting of the material will not be permitted. Where required, haul roads shall be constructed on the cap of sufficient depths for the operation of pans or other earth moving equipment without rutting or pumping.

When placing the soil on slopes, placement shall begin at the bottom of the slope and worked up. Under no circumstances shall the material be pushed down the slopes.

3.2 THICKNESS VERIFICATION

The thickness of the Erosion Control and Vegetative Cover Layers as shown on the Drawings are minimum requirements. The thicknesses will be confirmed by QA survey points on a 100-foot by 100-foot grid over the cap surface area, before and after the installation of the soil layers. Alternatively, the CONTRACTOR may verify the erosion control and vegetative cover thickness by excavating test pits on a 100-foot by 100-foot grid over the cap surface area. The test pits will be excavated by the CONTRACTOR, and the QAO will observe and measure the test pit depths. The CONTRACTOR will backfill test pits with soil that meets the specifications for the erosion control and vegetative cover layers.

END OF SECTION 31 05 13

SECTION 31 05 16

AGGREGATES

1.0 GENERAL

1.1 SUMMARY

The requirements for riprap, pipe bedding aggregates, road base course, leachate collection layer, construction entrance, and other miscellaneous as shown in the PLANS, and are specified herein and General Conditions.

Related Work Specified Elsewhere:

- Section 01 45 00 Construction Quality Control
- Section 31 00 00 Earthwork
- Section 31 05 19.13 Geotextile Fabrics
- Section 31 05 19.16 LLDPE Geomembrane Liner
- Section 31 15 40 Crushed Stone Surfacing

1.2 REFERENCE SPECIFICATIONS

The publications listed below form a part of this specification to the extent referenced in the text. The publications are referenced to in the text by basic designation only.

1.2.1 State Of Virginia

- Virginia Department of Transportation (VDOT) Road and Bridge Specifications (VDOTRBS), April 2020
- Virginia Erosion and Sediment Control Handbook (VESCH), latest edition

1.2.2 American Society for Testing and Materials (ASTM) Standard Test Methods/Practice

- ASTM C 88 Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- ASTM C 131 Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- ASTM D 75 Sampling Aggregates

- ASTM C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- ASTM D 698 Laboratory Compaction Characteristics Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
- ASTM D 1556 Density and Unit Weight of Soil in Place by the Sand Cone Method
- ASTM D 2487 Classification of Soils for Engineering Purposes
- ASTM D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
- ASTM D 4373 Calcium Carbonate Content of Soils
- ASTM D5856 Standard Test Method for Measurement of Hydraulic Conductivity of Porous Material Using a Rigid-Wall, Compaction-Mold Permeameter
- ASTM E 11 Wire Cloth Sieves for Testing Purposes
- ASTM E329 Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

1.3 SUBMITTALS

1.3.1 Prequalification

Submit the material source, descriptions, and material specifications certified by the supplier to the ENGINEER for approval.

1.3.2 Approval of Material Sources

The sources of the material to be used for producing aggregates shall be selected not less than thirty (30) days prior to the time the material will be required in the work. Any changes in the source of materials shall be reported to the ENGINEER immediately. The new source shall be approved by the ENGINEER. Allow a minimum of 10 days for review and approval. The CONTRACTOR shall be fully responsible for any delays in construction due to changes in material sources.

1.3.3 Certificate of Compliance

The CONTRACTOR shall submit to the ENGINEER for approval at least 15 days before procurement Certificate of Compliance from the manufacturer that the supplied materials meet the specifications herein.

2.0 PRODUCTS

2.1 GENERAL

2.1.1 Quality

Aggregates shall consist of clean, sound, durable particles of crushed stone, or gravel, and screenings. Slag shall not be used.

2.1.1.1

CONTRACTOR shall obtain materials that meet the specifications and can be used to meet the grade and smoothness requirements specified herein, after all compaction and proof rolling operations have been completed.

2.1.1.2

Aggregates shall be free of silt and clay (as defined by ASTM D 2487), vegetable matter, and other objectionable materials or coatings.

2.1.1.3

Aggregate surrounding perforated landfill gas collection pipe shall contain less than 15% by weight of calcium carbonate as measured by ASTM D4373.

2.1.2 Fine Aggregate

Fine aggregate refers to the portion passing the No. 4 sieve. Fine aggregate may contain angular particles produced by crushing stone, or gravel that meets the requirements for wear and soundness specified by VDOTRBS Section 202. Material designations for the various fine aggregates used on the project shall be as specified on the PLANS.

2.1.3 Coarse Aggregate

2.1.3.1

Coarse aggregate refers to the portion retained on the No. 4 sieve, and shall be angular or rounded particles of uniform density. Coarse aggregate may contain angular particles produced by crushing stone, or gravel that meets the requirements for wear and soundness specified by the VDOTRBS Section 203.

2.1.3.2

The coarse aggregate shall have a loss of density not greater than 10 percent of the weighted average at five cycles when tested for soundness. The coarse aggregate shall have a percentage of wear not exceeding 40 percent after 500 revolutions as determined by the requirements of VDOTRBS Section 203.

2.1.3.3

Material designations for the various coarse aggregates used for the project shall be as specified on the PLANS.

2.1.3.4

The percentage of flat and/or elongated particles shall not exceed 20 in the fraction retained on the 1/2 inch sieve and in the fraction passing the 1/2 inch sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width

greater than 3. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the requirements set forth herein.

2.2 MATERIALS

2.2.1 VDOT Aggregates

All specified aggregates shall be in accordance with VDOTRBS Section 206.

2.2.2 Horizontal Collector and Vertical Caisson Aggregate

2.2.2.1

Material shall be composed of sub-rounded to rounded particles, or such that it will not damage or puncture any underlying geotextile and/or HDPE geomembrane layers.

2.2.2.2

Shall be non-calcareous, with a maximum carbonate content of 15% by weight as measured by ASTM Method D4373

2.2.2.3

Shall consist of VDOT Size Number 3 coarse aggregate, or equivalent AASHTO-designated material with the following gradation:

Sieve/Particle Size (inches)	Percentage Finer by Weight
2-1/2	100%
2	90-100
1-1/2	35-70
1	0-15
1/2	0-5

2.2.3 RIPRAP

Riprap shall be supplied and installed in accordance with VDOTRBS Section 204 and the VESCH. Riprap shall be sized as indicated on the PLANS. Geotextile filter fabric shall be in accordance with 31 05 19.13.

3.0 EXECUTION

3.1 EQUIPMENT

3.1.1 Weather Limitation

Aggregates shall be placed in accordance with VDOTRBS Section 309. Areas of completed work that are damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

3.2 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in a manner and at locations approved by the ENGINEER. Aggregates shall be stockpiled on the cleared and leveled areas designated by the OWNER so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.2.1 STOCKPILE CLEANUP

Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

3.3 PREPARATION OF UNDERLYING COURSE

Prior to placing aggregate, the underlying course shall be cleaned of all foreign substances. At the time of construction of the course, the underlying course shall contain no frozen material. The underlying course shall conform to Section 31 00 00 - EARTHWORK.

3.4 GRADE CONTROL

During construction, the lines and grades shall be maintained by the CONTRACTOR.

3.5 PLACING

3.5.1 Roadway

Roadway crushed stone base material shall be placed in accordance with VDOT RBS Section 308 subbase course.

3.5.2 Coarse Aggregate

Coarse aggregate bedding and backfill material shall be placed in accordance with VDOT RBS Section 303 earthwork.

3.5.3 Horizontal Collector Aggregate

Horizontal Collector Aggregate shall not be compacted. Placement to the lines and grades shown on the Plans shall be performed in a manner that will prevent damage to any underlying geotextile and LLDPE geomembrane layers, and meet equipment ground pressure/minimum thickness criteria in Section 31 05 19.16- LLDPE GEOMEMBRANE LINER.

3.6 RIPRAP INSTALLATION

Place filter fabric over areas to receive riprap and anchor the fabric. Fill void spaces between large stones with stone of suitable size to leave the surface evenly conforming to the required contour. Place riprap with a minimum average thickness of 18 inches or as indicated on the Contract Drawings. Grout riprap in place as indicated in the Contract Drawings.

3.7 QUALITY CONTROL

Refer to Section 31 00 00 - EARTHWORK for quality control testing requirements for Drainage Layer and Type 1 aggregates.

END OF SECTION 31 05 16

SECTION 31 05 19.13

GEOTEXTILE FABRICS

1.0 GENERAL

1.1 SUMMARY

1.1.1 Scope

This section covers the material, installation, and testing of the nonwoven geotextile for the final cover system (if AGRU MicroDrain Liner is used), road underlayment, and/or riprap bedding underlayment. The nonwoven geotextile fabric shall be furnished by the CONTRACTOR unless otherwise specified. The nonwoven geotextile shall be prepared and installed per these specifications, referenced specifications and as detailed on drawings. CONTRACTOR shall provide all labor, materials, equipment, and services necessary for the placement of the nonwoven geotextile.

1.1.2 Related Work Specified Elsewhere

- Section 31 00 00 Earthwork (Bedding Layer requirements)
- Section 31 05 19.17 Agru MicroDrain Geomembrane
- Section 01 45 00 Construction Quality Control (Interface shear testing)

1.2 REFERENCES

Comply with applicable codes and regulations as required by regulatory agencies having jurisdiction over this work. Comply with the pertinent sections of the following standards:

American Society for Testing and Materials (ASTM)

American Association of State Highway and Transportation Officials (AASHTO)

Geosynthetic Research Institute (GRI) Test Methods and Standards

Virginia Department of Transportation (VDOT) Standard Specifications, latest edition

1.3 SUBMITTALS

1.3.1 Product Information

Submit the following product information to the ENGINEER for approval at least 30 days (unless otherwise specified) prior to procurement of the product:

1.3.1.1 Material Data

Complete manufacturer's specifications, descriptive drawings, and literature, including the product identification and suppliers of the polymer resin and recommended methods for handling and

storage of all materials prior to installation. Describe the manufacturer's methodology to comply with the requirements specified for manufacturing quality control.

1.3.1.1 Quality Control Manual (for Geotextile over MicroDrain only)

CONTRACTOR shall provide a Quality Control Manual.

1.3.1.2 Installation Instructions

Samples of the geotextile with a complete set of specifications, and manufacturer's complete written instructions for storage, handling, installation, and joining.

1.3.1.3 Qualifications

Manufacturer's qualifications for the geotextile. Manufacturer shall be a specialist in the manufacture of nonwoven geotextile material and shall have at least 3 years' experience in the manufacture of nonwoven geotextile material. Manufacturer shall have manufactured and have installed, successfully, at least 5 million square feet nonwoven geotextile material during the last 3 years

1.3.1.4 Resin

The name of the resin supplier, the production plant, the brand name, and name of resin used to manufacture the product.

1.3.1.5 Certification (for Geotextile over MicroDrain only)

Certification that the geotextile meets the property values listed in *Table 31 0519.13 - 2, Geotextile to be installed over AGRU MicroDrain Liner*.

1.3.2 Manufacturing Quality Control (for Geotextile over MicroDrain only)

The Contractor shall submit quality control test reports within 48 hours of completion of tests. Submit the following manufacturing quality control information to the ENGINEER prior to material shipment:

1.3.2.1 Production Dates:

Submit statement of production dates for the geotextile.

1.3.2.2 Manufacturer's Quality Control Certificates:

Submit for each batch of resin and each shift's production. Certificates shall identify the origin of the resin and the manufacturer of the resin. Certificates must be signed by responsible parties employed by the manufacturer and include:

- Roll numbers and identification
- Sampling procedures
- Results of quality control tests, including a description of the test methods used.

1.3.3 Proof of Installer's Qualifications (for Geotextile over MicroDrain only):

Installer shall be a specialist in the installation of nonwoven geotextile material and shall have at least 3 years' experience in the installation of nonwoven geotextile material. Installer shall have installed at least 5 million square feet of nonwoven geotextile material during the last 3 years. Installer shall submit a list of similar projects (preferably in Virginia). At a minimum the list shall include installation type, completion date, contact person name, address and telephone number. Installer shall provide continuous on-site supervision; a complete resume of the on-site supervisor shall be included as part of the Bid package..

1.4 QUALITY ASSURANCE (FOR GEOTEXTILE OVER MICRODRAIN)

1.4.1 Single Source

All nonwoven geotextile material provided by the contractor shall be obtained from a single material supplier and all nonwoven geotextile sheets shall be manufactured by a single manufacturer unless approved by the ENGINEER.

1.4.2 Installer's Qualification and Experience

CONTRACTOR shall adhere to the experience levels outlined in Paragraph 1.3.3 when installing the nonwoven geotextile material.

1.4.3 Installer's Filed Services and Reports

Retain services of a nonwoven geotextile material installer's factory trained representative with demonstrated ability and experience in field seaming or tying, testing and all other pertinent aspects of the installation to perform the services listed below:

1.4.3.1 Inspection/Supervision

Inspect the nonwoven geotextile material and supervise any corrective work required. Prepare an inspection report to be submitted to CQA Consultant and ENGINEER weekly.

1.4.3.2 Handling

Supervise the unloading, handling, and storage of all nonwoven geotextile material.

1.4.3.3 Placement

Supervise the handling, unrolling, and placement of all nonwoven geotextile material.

1.4.3.4 Seaming/Tying

Perform all seaming or tying of all nonwoven geotextile material.

1.4.3.5 Repairs

Perform all repairs to damaged nonwoven geotextile material.

1.4.3.6 Project Report

Prepare a written report at the completion of the Project which includes the following:

1.4.3.6.1

Complete identification of nonwoven geotextile material, including but not limited to, material type, physical properties and other pertinent data.

1.4.3.6.2

Complete description of field seaming/tying system used including material, method, seam overlap width and seaming/tying material.

1.4.3.6.3

"As-built" Drawings showing actual layout of nonwoven geotextile sheets, pipe penetration details and anchor trench/material run-out details.

1.4.3.6.4

An affidavit of compliance from the nonwoven geotextile material installer containing the following wording:

"I (name and title), as the duly authorized representative of (Company Name), hereby certify that the installation of the nonwoven geotextile material has been completed in accordance with the terms and conditions of the Contract Documents.

By: _____

(signature)

Witness:_____

(signature)

Date: _____

1.4.4 Independent Testing

OWNER and/or ENGINEER may employ and pay for an independent Testing Laboratory to perform additional testing of the nonwoven geotextile material. CONTRACTOR, shall, at no additional cost, provide samples to ENGINEER and/or Independent Testing Laboratory for the quality of the material provided.

1.4.5 Acknowledgement

CONTRACTOR shall be solely responsible to the OWNER for the quality of the material provided. Should any of the tests performed on the material yield unsatisfactory results, CONTRACTOR will be responsible for replacing the material with satisfactory material without delaying the total Project time and without any cost to OWNER.

1.5 DELIVERY, STROAGE, AND HANDLING

1.5.1 General

Manufacturer and CONTRACTOR shall follow the guidelines stated in ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.

1.5.2 Labeling

Each roll of nonwoven geotextile material delivered to the site shall be labeled by the manufacturer per paragraph 2.1.4.

1.5.3 Protection

Filter fabric and/or geonet/filter fabric composite shall be protected from ultraviolet light exposure, precipitation, or other damage from the natural elements, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. Nonwoven geotextile rolls shall be shipped and stored in relatively opaque and watertight wrappings.

1.5.4 Delivery Inspection

CONTRACTOR shall provide all labor and equipment required to assist OWNER and ENGINEER in inspection of materials upon deliver to the site.

2.0 PRODUCTS

2.1 NONWOVEN GEOTEXTILES

2.1.1 Materials

All geotextile shall be a continuous filament needle punched or needle punched with staple fabric, or nonwoven fabric composed of synthetic filaments which are formed into a stable network such that the filaments retain their relative position. They shall be inert to biological degradation and naturally encountered chemicals, alkalis and acids.

2.1.1.1 Geotextile for Road and Riprap Underlayment

Geotextile used for road and riprap underlayment shall conform to the following minimum average roll values (MARV):

Table 1. Geotextile for Road and Riprap Underlayment

Test Method	Property	Geotextile Values[1]	Unit
ASTM D4533	Trapezoidal Tear Strength	56	lbs
ASTM D4632	Grab Tensile Strength	158	lbs
ASTM D4632	Grab Tensile Elongation	50	%
ASTM D5261	Mass per unit area	8	oz/yd²
ASTM D6241	Puncture Strength	320	lbs
ASTM D7238	UV resistance[2]	70	%
ASTM D4751	AOS (MaxARV)	#70	Sieve #
ASTM D4491	Permittivity	0.02	sec^{-1}

2.1.1.2 Geotextile Installed over MicroDrain Geomembrane

Geotextile used for the final cover system (AGRUTex 081) with AGRU MicroDrain shall be manufactured by AGRU or approved equal conforming to the following minimum average roll values (MARV):

Table 2. Geotextile to be installed over AGRU MicroDrain Liner

Test Method	Property	Geotextile Values[3]	Unit	MQC Testing Frequency	Conformance Testing Frequency
ASTM D4533	Trapezoidal Tear Strength	95	lbs	100,000 ft²	200,000 ft²
ASTM D4632	Grab Tensile Strength	220	lbs	100,000 ft²	200,000 ft²
ASTM D4632	Grab Tensile Elongation	50	%	100,000 ft²	200,000 ft²
ASTM D5261	Mass per unit area	8	oz/yd²	100,000 ft²	200,000 ft²
ASTM D6241	CBR Puncture Strength	600	lbs	200,000 ft²	200,000 ft²
ASTM D7238	UV resistance[4]	70	%	Per Formulation	-
ASTM D4751	AOS (MaxARV)	#80	Sieve #	200,000 ft²	200,000 ft²
ASTM D4491	Permittivity	1.3	sec^{-1}	200,000 ft²	200,000 ft²

1 All values are MARV except UV resistance (minimum value) and AOS (MaxARV).
2 Evaluation to be on 2.0 inch strip tensile specimens per ASTM D 5035 after 500 lt. hrs. exposure.
3 All values are MARV except UV resistance (minimum value) and AOS (MaxARV).
4 Evaluation to be on 2.0 inch strip tensile specimens per ASTM D 5035 after 500 lt. hrs. exposure.

2.1.2 Manufacturing Quality Control

The final cover system geotextile shall be subjected to MQC testing for the characteristics listed in the corresponding properties table. The MQC tests shall be performed according to the test methods and frequencies listed in the table. Test results shall be compared to the values and qualifiers listed in the table for purposes of evaluating acceptable products.

2.1.3 Conformance Testing

At the direction of the CQA Representative, the Geosynthetic INSTALLER shall take samples from the delivered lot of the final cover system geotextile and send to the CQA Geosynthetic Laboratory for conformance testing. The cost for laboratory conformance testing shall be paid by the OWNER. The conformance tests, minimum frequency, and required properties are outlined in *Table 31 05 19.13 - 2* are required prior to installation.

2.1.4 Packaging

The geotextile shall be uniformly rolled onto a core, and shall be wrapped in plastic to protect the material from moisture and damage during shipment. Protective wrapping shall be left on the geotextile until installation. Rolls shall be externally tagged for easy field identification. External tagging shall include the following:

- Name of Manufacturer
- Product Type
- Product Grade
- Lot Number
- Physical Dimensions (length, width & weight)

2.1.5 Storage

The geotextile shall not be exposed to precipitation prior to being installed. The geotextile shall not be exposed to sunlight for more than 15 days unless otherwise specified and guaranteed in writing by the geotextile manufacturer.

3.0 EXECUTION

3.1 INSTALLING NONWOVEN GEOTEXTILE OVER AGRU MICRODRAIN GEOMEMBRANE

3.1.1 Preparation

Prepare the geomembrane liner surface to receive the nonwoven geotextile material in accordance with manufacturer's recommendations and Section 31 00 00 Earthwork (Bedding Layer requirements.

3.1.2 Inspection

The geomembrane liner surface shall be inspected and approved by the ENGINEER and CQA Consultant and Installer prior to placement of the nonwoven geotextile material.

3.1.3 Placement

Care should be taken when placing geotextile on textured liner. Excessive shifting of the material when trying to place on textured liner could result in rejection of the material. Tears shall not be acceptable even when patched.

3.1.4 Joining

Geotextile shall be joined by sewing and in accordance with manufacturer's recommendations.

Sewing shall be accomplished by a chain-stitching sewing machine.

The thread shall be polymeric thread which complies with geotextile manufacturer's recommendations and is a color which contrasts with the color of the geotextile.

There shall be no horizontal seams on slopes greater than five (5) horizontal to one (1) vertical.

Heat bonding geotextile layers together during construction may be used provided that the heating process does not result in holes, burning or other physical damage to the heat-bonded materials, or underlying layers, that would impact their performance.

3.1.5 Anchor Trench

Prepare anchor trenches per Section 31 05 19.16, Paragraph 3.3.5.

3.1.6 Placement of Cover Materials

Cover material placement shall begin at the toe and proceed up the slope. Material shall not be dropped onto the geotextile from a height exceeding three (3) feet. Any geotextile which is damaged during placement shall be replaced.

Cover Materials shall be placed on the geotextile in a manner which prevents damage to the geotextile material, as well as the underlying geomembranes. Refer to Section 31 05 19.16 for ground pressure and minimum thickness requirements during placement.

The CONTRACTOR shall place all cover materials in such a manner to prevent damage to the materials, slippage of the underlying layers, and excessive tensile stresses in the materials

3.2 NONWOVEN GEOTEXTILE PLACEMENT

3.2.1 Installation-General

CONTRACTOR shall meet all manufacturer's Specifications and comply with the following unless approved in writing by CQA Consultant, ENGINEER, and manufacturer.

3.2.1.1 Placement

Geotextile shall be placed smoothly and in direct contact with the underlying medium. Excessive wrinkles shall not be acceptable. Equipment shall never be run directly on the geotextile.

3.2.1.2 Ballasting

All nonwoven geotextile shall be weighted with sandbags or the equivalent when required. Such sandbags shall be installed during placement and shall remain until removed and replaced with cover material or adjoining nonwoven geotextile.

3.2.1.3 Projections/Debris

Prior to placing the nonwoven geotextile, care shall be taken not to entrap stone, excessive dust, or moisture that could damage the nonwoven geotextile, generate clogging, or hamper subsequent seaming or tying of the nonwoven geotextile.

3.2.1.4 Protection

Nonwoven geotextile shall not be exposed to precipitation prior to being installed, and shall not be exposed to direct sunlight for more than 30 days.

3.2.2 Protection from Damage

Geotextiles should be secured from the wind until final cover is placed. Geotextiles shall be covered within two weeks of installation. The CONTRACTOR is responsible for damage that occurs to the geotextile during installation and will replace the damaged geotextile at no additional cost. The CONTRACTOR shall replace geotextile that is left exposed for more than two weeks.

3.2.3 Geotextile Repair

CONTRACTOR shall repair any damage, as follows:

3.2.3.1 Holes/Tears

Any holes or tears in the fabric shall be repaired as follows:

a. On slopes: A fabric patch shall be sewn into place using a double sewn lock stitch (1/4 in. to 3/4 in. apart and no closer than 1 inch from any edge) with a minimum of 24 inches of overlap in all directions. Should any tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced.

b. Non-slopes: A fabric patch shall be spot-seamed in place with a minimum of 24 inches of overlap in all directions.

3.2.3.2 Penetrations

Care shall be taken to remove any soil, granular material, or material which may have penetrated through the torn nonwoven geotextile.

3.2.3.3 Daily Placement

The amount of nonwoven geotextile unrolled and laid daily shall be limited to the amount of nonwoven geotextile that can be properly seamed during a 1 day operation. Tack or spot seaming does not constitute a completed seam.

3.3 INSPECTION

3.3.1 Initial Inspection

The nonwoven geotextile material shall be placed after the receiving surface has been property prepared and inspected and approved by the CQA Consultant. No nonwoven geotextile material shall be placed in the absence of the CQA Consultant.

3.3.2 Inspection

Any nonwoven geotextile material placed without CQA Consultant inspection and approval prior to the installation shall be removed in a manner to avoid damage or disturbance to the existing approved work, and nonwoven geotextile material shall be replaced as specified herein, at no additional cost to OWNER.

If an acceptable nonwoven geotextile layer is not obtained because of improper control of placement or seaming/tying procedures, or because of inadequate or improperly functioning equipment, CONTRACTOR shall perform whatever work is required to provide an acceptable nonwoven geotextile layer at no additional cost to O'WNER. This WORK shall include complete removal of unacceptable material area and replacement until an acceptable nonwoven geotextile layer is provided.

END OF SECTION 31 05 19.13

SECTION 31 05 19.16

TEXTURED LLDPE GEOMEMBRANE LINER

1.0 GENERAL

1.1 SCOPE

The work covered in this Section includes the manufacturing, fabrication, testing, supply and installation of Textured Linear Low-Density Polyethylene (LLDPE) geomembrane for the final cover system. The CONTRACTOR shall furnish all labor, materials, transportation, handling, storage, supervision, tools, equipment and other incidentals necessary to install, test, and quality control the geomembrane as required by the Contract Documents.

1.1.1 Related Work Specified Elsewhere

- Section 01 45 00 Construction Quality Control (Interface shear testing)
- Section 31 00 00 Earthwork (Bedding Layer requirements)
- Section 31 05 19.26 Drainage Geocomposite

1.2 DEFINITIONS

1.2.1 Owner

The Owner or his designated representative.

1.2.2 Engineer

The Engineer who is acting as the Design Engineer and Owner's designated representative.

1.2.3 CQA Representative

The CQA Representative (also referred to as the Quality Assurance Officer) who is the on-site project representative.

1.2.4 CQA Engineer

The CQA Engineer (also referred to as the Quality Assurance Engineer), who is in direct supervision of the QAO.

1.3 QUALITY ASSURANCE AND CONTROL DURING INSTALLATION

The ENGINEER or OWNER third party Construction Quality Assurance (CQA) Consultant will observe geomembrane installation and construction and certify that construction is in accordance with Contract Documents. All tests and test frequencies specified in this section are Construction Quality Control (CQC) tests, and these tests are the responsibility of the CONTRACTOR or his representative unless otherwise noted.

1.4 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARD TEST METHODS/PRACTICE:

- ASTM D 792 Specific Gravity (Relative Density) and Density of Plastics by Displacement
- ASTM D 1004 Initial Tear Resistance of Plastic Film and Sheeting
- ASTM D 1238 Flow Rates of Thermoplastics by Extrusion Plastometer
- ASTM D 1505 Density of Plastics by the Density-Gradient Technique
- ASTM D 1603 Carbon Black in Olefin Plastics
- ASTM D 4218 Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
- ASTM D 4833 Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
- ASTM D 5321 Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
- ASTM D 5323 Practice for Determination of 2% Secant Modulus for Polyethylene Geomembranes
- ASTM D 5596 Standard Test Method For Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
- ASTM D 5617 Test Method for Multi-Axial Tension Test for Geosynthetics
- ASTM D 5721 Practice for Air-Oven Aging of Polyolefin Geomembranes
- ASTM D 5885 Test method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry
- ASTM D 5994 Standard Test Method for Measuring Core Thickness of Textured Geomembranes
- ASTM D 6392 Standard Test Method for Determining the Integrity of Non-reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
- ASTM D 6693 Test Method for Determining Tensile Properties of Non-reinforced Polyethylene and Non-reinforced Flexible Polypropylene Geomembranes

- ASTM D 7238 Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent Condensation Device
- ASTM D 7466 Test Method for Measuring the Asperity Height of Textured Geomembranes
- ASTM D 8117 Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by Differential Scanning Calorimetry

GEOSYNTHETICS RESEARCH INSTITUTE (GRI) STANDARD PRACTICE FOR:

- GRI GM-6 Pressurized Air Channel Test for Dual Seamed Geomembranes
- GRI GM-17 Test Methods, Test Properties and Testing Frequency for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes
- GRI GM-19a Specification for Seam Strength and Related Properties of Thermally Bonded Homogeneous Polyolefin Geomembranes/Barriers

1.5 SUBMITTALS

The CONTRACTOR or Geosynthetic INSTALLER shall submit the following information to the ENGINEER for approval at least 30 days (unless otherwise specified) prior to procurement of the geomembrane:

1.5.1 Proof of Manufacturer's Qualifications:

- The Manufacturer must have at least two (2) years documented experience in the manufacture of the geomembrane and/or documented experience totaling 10,000,000 ft^2 of the manufactured geomembrane for at least ten (10) completed facilities.
- Manufacturer's Brochure: Submit complete manufacturer's specifications, descriptive drawings, and literature for the geomembrane, including the product identification and supplier of the polymer resin and recommended method for handling and storage of all materials prior to installation. Include information on plant size, equipment, personnel, number of shifts per day and capacity per shift.
- Manufacturer Quality Control (MQC) Program: Submit a complete description of the geomembrane manufacturer's formal quality control programs for manufacturing, fabricating, testing, quality control, defects repair, handling, and shipping. The description shall include, but not be limited to, polymer resin supplier(s) and product identification, acceptance testing, production sampling and testing, installation testing, documentation of changes, alterations, repairs, retests, and acceptance.
- Prior to purchasing material the following conformance testing is required: Submit independent quality control laboratory test results demonstrating compliance with material properties listed herein, including *Table 31 05 19.16 – 2* Resin Properties (Without Carbon Black) and *Table 31 05 19.16 - 3*. The independent laboratory tests are to be performed once by an approved laboratory independent of the manufacturer. In addition, the manufacturer must provide a certificate of compliance which states that the

material to be installed will use the same resin type and formulation as that for which test results are submitted.

1.5.1.1 Manufacturer Quality Control Certificates:

The Geosynthetic Installer shall submit test reports to the ENGINEER prior to geomembrane shipment. The tests and frequencies are specified in Part 2 - "Manufacturer Quality Control Tests" and material properties.

The following information must be submitted for approval prior to shipping the material:

Resin:

- Origin (resin suppliers name, resin production plant), batch number, lot number, or identification number and production date(s).
- A certification by a qualified individual employed by the manufacturer that the quality of the resin used to manufacture the geomembrane rolls assigned to this project meets specified properties measured using test methods indicated in the specifications, or equivalent.
- Copy of quality control certificates issued by the Resin Supplier.
- Certified statement that no reclaimed polymer was added to the resin during the manufacture of the actual geomembrane to be used in this project. However, the use of polymer recycled during the manufacturing process may be permitted if done with appropriate cleanliness and if recycled polymer is the same LLDPE as the parent material and does not exceed ten (10) percent by weight.

Geomembrane:

- Roll numbers, production dates, and identification.
- A certification by a qualified individual employed by the manufacturer that the geomembrane roll assigned to this project meets specified properties measured using test methods indicated in the specifications, or equivalent.
- A list of quantities and descriptions of materials other than the base polymer which comprise the geomembrane.

Factory Visit:

At the request of the OWNER or the ENGINEER, submit contact names, telephone numbers, addresses, and production schedule information for purposes of scheduling an OWNER or ENGINEER'S plant visit during production.

1.5.2 Proof of Geosynthetic INSTALLER'S Qualifications:

- Show a minimum of two years continuous experience and list completed facilities for which the Geosynthetic Installer has installed geomembrane, totaling a minimum of 10,000,000 ft^2.

- The name or names of the field superintendents who will be proposed for the project and a list of completed facilities for which the field superintendent has installed the selected geomembrane totaling a minimum of 10,000,000 ft^2.

- The name or names of the Master Seamer(s) who will be proposed for the project and a list of completed facilities for which the Master Seamer(s) has installed the selected geomembrane totaling a minimum of 2,000,000 ft^2.

- Construction Quality Control Program: Submit a complete description of the Geosynthetic Installer's formal quality control programs for handling, installing, testing, quality control, and defect repair. The description shall include, but not be limited to installation testing, documentation of changes, alterations, repairs, retests, and acceptance. The document shall include a complete description of seaming by extrusion welding and hot wedge welding.

- Proposed schedule of installation showing the critical path of installation.

- Licensed Installer: The Geosynthetic Installer shall be approved and/or licensed by the geomembrane manufacturer.

- Warranty: Submit an advance (sample) copy of the warranty.

1.5.3 Instructions and Drawings:

1.5.3.1 Storage, Handling, Installation, and Seaming

The Contractor shall furnish complete written instructions to the Engineer for the storage, handling, installation, and seaming of the membrane in compliance with this specification and the condition of his warranty.

1.5.3.2 Repairs

The material supplier shall furnish complete written instructions for the repair of geomembrane material to the Engineer no less than 30 days prior to installation.

1.5.3.3 Layouts

The Contractor shall furnish panel layouts and seam details as required for the membrane installation. The goal of the plan will be to minimize the required number of seams. Care should be taken to reduce areas of stress concentration. Horizontal seams are not allowed unless the slope length exceeds roll lengths. In that event, the horizontal seam will be installed on a 45 degree diagonal across the slope. Details of placement around penetrations, if any, such as pipes shall be provided. The above details must be approved by the Engineer prior to liner installation. Material left outside shall not be exposed to sunlight for more than 30 days.

1.5.4 Shop Drawing Submittals

1.5.4.1 Samples and Specifications

In order to qualify as an approved lining material, the Contractor shall submit material samples and minimum specifications to the Engineer. The specification sheet shall give full details of minimum

physical properties and test methods used, site seaming methods, and a certificate confirming compliance of the material with the minimum specifications. A list of similar projects completed in which the manufactured material has been successfully used shall be submitted.

1.5.4.2 Certification Delivery

Upon delivery of the rolls of geomembrane, provide a copy of the certification from the manufacturer certifying the batch delivered to the site meets the minimum specifications and was QC inspected. The certificate shall be signed by a person with authority to bind the manufacturer.

1.5.4.3 Test Results

The Contractor shall submit results of confirmation testing showing that the material lot of the resin used in the membrane supplied meets the material requirements for the resin. A description of the quality control steps used during manufacture shall also be provided.

1.5.5 During Construction Conformance Test Results:

Submit conformance test results to the ENGINEER for approval within 3 days of completed testings. See Part 1.5.C. for conformance testing requirements and frequency.

1.5.6 List of Personnel:

The CONTRACTOR or Geosynthetic Installer shall submit a list of proposed seaming personnel and their experience records. All personnel shall be approved by the ENGINEER before they perform seaming operations.

1.5.7 Submittals Required for Project Closeout

1.5.7.1 Record Drawings:

Submit geomembrane record drawings to the ENGINEER.

1.5.7.2 Geomembrane Warranty

Submit geomembrane warranty to the ENGINEER.

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Handling

The Geosynthetic Installer's personnel shall handle the material with care, shall use adequate equipment and shall take all precautions necessary to prevent damaging the geomembrane.

1.6.2 Inspection upon Delivery

Upon delivery at the site, the Geosynthetic Installer, in the presence of a CQA Representative, conduct a visual inspection of rolls or factory panels for defects and for damage. This inspection shall be conducted without unrolling rolls or unfolding factory panels unless, in the Geosynthetic Installer's or CQA Representative's opinion, defects or damages are found or suspected.

Defects or flaws in the materials shall be brought to the attention of the CQA Representative. Rolls, factory panels, or portions thereof, which have unacceptable flaws shall be recorded by the CQA Representatives and Geosynthetic Installer, rejected and shall be removed from the site.

Rejected materials shall be replaced by the CONTRACTOR at no additional cost to the OWNER. No time extension will be allowed in the case of rejected materials.

1.6.3 During Construction Conformance Testing

At the direction of the CQA Representative, the Geosynthetic INSTALLER shall take samples from the delivered lot and sent to the CQA Geosynthetic Laboratory for conformance testing. The cost for laboratory conformance testing shall be paid by the OWNER. The conformance tests and minimum frequency outlined in *Table 31 05 19.16 - 1* are required prior to installation. Results must meet property requirements in *Table 31 05.19.16 – 3*.

Table 31 05 19.16 - 1 Conformance Testing Requirements

Properties	**Test Method**	**Testing Frequency (minimum)**
Thickness (min. ave.) – mils • lowest individual for 8 out of 10 values - % • lowest individual for any of the 10 values - %	D 5994	1 per 100,000 ft^2
Asperity Height (min. ave.) – mils	D 7466	
Formulated Density (max.) – g/cc	D 1505/ D 792	
Tensile Properties • break strength – lb/in. • break elongation - %	D 6693 Type IV	
Puncture Resistance (min. ave.) - lb	D 4833	
Tear Resistance (min. ave.) - lb	D 1004	
Carbon Black Content (range)	D 4218	
Carbon Black Dispersion	D 5596	

All conformance test results shall be reviewed and approved by the ENGINEER prior to any placement. If a conformance test result fails the specifications, at least two additional conformance tests shall be performed on samples taken immediately from adjacent numbered rolls. If both additional conformance test results pass the specifications, the entire lot shall be accepted except that roll from which the failed sample is taken. If any of the conformance test results fails for the two (minimum) additional samples, the entire lot shall be rejected by the ENGINEER.

1.6.4 Storage

The Geosynthetic Installer shall be responsible for ensuring that the stored materials are protected from rain, snow, ice, dirt, ultra violet light, shock, theft, vandalism, passage of vehicles, and other sources of damage. The CONTRACTOR is responsible for clearing, grubbing, and grading necessary to prepare the storage area. Provide for surface water control, access and storage area surfacing, and lighting necessary for adequate unloading of highway transport vehicles and access by construction equipment.

1.7 Warranty

Provide a twenty (20) year material warranty and workmanship defects for a period of one (1) year following the date of final completion of the work under this contract. The warranty required herein shall be provided in addition to any warranty required by the General Conditions.

1.8 INTERFACE SHEAR TESTING

1.8.1 Friction Angle Testing Method

Contractor shall conduct interface testing by direct shear in accordance with ASTM D5321 to confirm a minimum interface friction angle of 24 degrees (peak value), or equivalent shear strength when considering adhesion value, for the interfaces listed in 1.8.2. Soil samples will be prepared by compacting to 90% maximum dry density at ±3% of optimum moisture. Test samples shall be wetted at the soil and geosynthetic contact surface by spraying during shear box assembling. For capping, soil samples will be consolidated under normal loads, applied incrementally at least 24 hours prior to testing, of 200 psf, 400 psf, and 600 psf with a minimum displacement of 3 inches.

1.8.2 Interfaces

Test each interface individually to be used on this Project using representative samples of materials to be supplied under normal loads indicated and using test parameters as specified by Engineer. For capping, interfaces to be tested are (top layer against bottom layer):

- LLDPE geomembrane against cap bedding layer
- Drainage geocomposite against LLDPE geomembrane
- Erosion control soil layer against drainage geocomposite

2.0 PRODUCTS

2.1 MANUFACTURING PLANT VISIT

The Manufacturer shall allow the ENGINEER, CQA Representative, OWNER, or designated alternates to visit the manufacturing plant for a project specific visit. The ENGINEER, OWNER or designated alternate shall be allowed to review the manufacturing process, quality control, laboratory facilities and testing procedures as necessary to verify that:

- Properties guaranteed by the Manufacturer meet all specifications;
- Measurements of properties by the Manufacturer are properly documented and test methods used are acceptable;
- Rolls of geomembrane are free of holes, blisters, or any sign of contamination by foreign matter;
- Packaging and transportation procedures do not damage the geomembrane;
- Roll packages are labeled to indicate the name of the manufacturer, the type of geomembrane, the roll thickness and the roll number; and

- That extrusion rods and/or beads are derived from the same base resin type as the geomembrane.

2.2 GEOMEMBRANES

2.2.1 Single Source

All geomembrane sheets and extrudate material for the construction of the project shall be obtained from a single material supplier and manufacturer. It must be certified and warranted that the sheets, extrudate, and pipe boots are compatible with one another. The Geosynthetic Installer shall provide manufacturer's warranties for the sheets, extrudate material, and pipe boots.

2.3 MATERIAL PROPERTIES

2.3.1 Geomembrane

The membrane shall have a minimum thickness required by the plans. The raw polymer shall meet or surpass the minimum standards as set forth in the Geosynthetic Research Institute's (GRI) Test Method GM17 "Test Methods, Test Properties, and Testing Frequency for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes" and GRI Test Method GM19 "Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes".

The membrane shall meet or exceed the requirements of Table 31 05 19.16 - 2. Geomembrane shall meet or exceed the requirements of *Table 31 05 19.16 - 3*. Equivalent test methods are subject to the approval of the ENGINEER.

Table 31 05 19.16 - 2 Resin Properties (without Carbon Black)

Properties	Test Method	Test Value
Minimum Polymer Composition (% polyethylene)	Thermal Gravimetric Analysis (TGA)	95
Geomembrane sheet density (g/cc)	D 1505 / D 792 Method B	≤0.939
Maximum Polymer Melt Index (g/10 min)	D 1238 Condition E	<1.0

2.3.2 Extrudate

Extrudate shall be the same resin as the geomembrane. The manufacturer shall provide documentation and shall certify that the extrudate meets this requirement.

2.3.3 Material Composition

The geomembrane shall consist of new, first-quality products designed and manufactured specifically for the purpose of this project, as satisfactorily demonstrated by prior use. The geomembrane shall be unmodified containing no plasticizer, fillers, chemical additives, reclaimed polymers, or extenders. Approximately 2 percent carbon black shall be added to the resin for ultraviolet resistance. The only other allowable compound elements shall be anti-oxidants and heat stabilizers, of which up to 1.5 percent total, as required for manufacturing, may be added.

2.3.4 Textured Surface

Textured-surface geomembrane shall be manufactured so that the surface irregularities that produce the specified friction are on both sides of the sheet. The LLDPE geomembrane thickness required shall not include the high points of the textured surface.

2.3.5 Defects

The membrane material shall be so produced as to be free of holes, blisters, undispersed raw materials, or sign of contamination by foreign matter. Defects discovered in the field shall be repaired by cutting out the defect and welding a new piece of membrane material in its place. The weld shall be placed in accordance with the requirements for field welded seams. Seams for repairs shall be tested in accordance with the required field seam test procedures.

2.3.6 Labels

Labels on each roll shall identify the thickness, length, width, and manufacturer's mark number. The roll shall also indicate the date, lot, and batch number of the roll, the square feet in the roll, and the total roll weight as measured after manufacture. Should the total weight not meet the minimum weight based upon the minimum material density of 0.93 g/cc, the material thickness, and square footage provided, then the delivered material will be rejected for use.

2.3.7 Transportation, Handling, and Storage

Transportation, handling, and storage of the membrane shall be in accordance with written instructions from the manufacturer. These instructions shall be supplied prior to delivery of the material. In general, equipment used shall be adequate to handle the rolls of membrane without risk of damage to the material. Extreme care will be taken whenever handling the material. The rolls of membrane shall be stored on a surface free of sticks, rocks, roots, or other matter that may damage the material. Upon delivery, QC and QA personnel shall inspect each roll of material for damage. This inspection shall be recorded and included in the QA/QC reports.

2.3.8 Seams

There shall be no factory seams. Seams shall be welded in the field by factory trained technicians using a non-destructive hot-wedge fusion or extrusion process. Edges of rolled material shall be trimmed at the factory to remove non-conforming material. The first three feet of material on selected rolls shall be used for confirmation testing of the characteristics of the membrane material.

2.4 MANUFACTURER QUALITY CONTROL TESTS

2.4.1 Test Reports

Submit all test reports to the ENGINEER for review and approval.

2.4.2 Manufacturer Quality Control (MQC) Tests:

2.4.2.1 Resin

Resin shall be tested at a frequency of one test per resin batch. One batch is defined as one rail car load of resin. As a minimum perform tests for Density and Melt Index. Compliance with the Polymer Composition test requirement shall be established with a manufacturer's certificate of compliance. The finished rolls shall be identified by a roll number corresponding to the resin batch used.

2.4.2.2 Geomembrane

Geomembrane shall be tested for properties required by *Table 31 05 19.16 - 3*. The minimum test frequencies in *Table 31 05 19.16 - 3* shall be observed.

Table 31 05 19.16 - 3 Manufacturer Quality Control Testing Requirements

Properties	Test Method	Test Value	Testing Frequency (minimum)
Thickness (min. ave.) – 40 mils • lowest individual for 8 out of 10 values - % • lowest individual for any of the 10 values - %	D 5994	nom -5% (38) -10% (36) -15% (34)	per roll
Asperity Height (min. ave.) – mils	D 7466	16	Every 2nd roll[1]
Formulated Density (max.) – g/cc	D 1505 / D 792	0.939	200,000 lb
Tensile Properties[2] (min. ave.) • break strength – lb/in. • break elongation[3] - %	D 6693 Type IV	60 250	20,000 lb
2% Modulus – lb/in. (max.)	D 5323	2400	per formulation
Puncture Resistance (min. ave.) - lb	D 4833	44	45,000 lb
Tear Resistance (min. ave.) - lb	D 1004	22	45,000 lb
Axi-Symmetric Break Resistance Strain (min.) - %	D5617	30	per formulation
Carbon Black Content, %	D 4218[4]	2.0 - 3.0	45,000 lb
Carbon Black Dispersion	D 5596	[5]	45,000 lb
Oxidative Induction Time[6] (OIT) (min. ave.) Standard OIT – min. - or – High Pressure OIT – min.	D 8117 D 5885	100 400	200,000 lb

[1] Alternate the measurement side for double sided textured sheet.
[2] Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
[3] Break elongation is calculated using a gage length of 2.0 in. at 2.0 in./min.
[4] Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.
[5] Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3
[6] The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

Oven Aging at 85°C[7] Standard OIT (min. ave.) - % retained after 90 days - or – High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 8117 D 5885	 35 60	per formulation
UV Resistance[8] High Pressure OIT (min. ave.) - % retained after 1600 hrs[9]	D 7238 D5885	 35	per formulation

3.0 INSTALLATION

3.1 GENERAL REQUIREMENTS

3.1.1 Superintendent

Installation shall be performed under the direction of a qualified field superintendent who shall remain on site and be in charge throughout the entire geomembrane installation (including subbase acceptance, geomembrane layout, panel placement, seaming, testing and repairs) and all other activities performed by the Geosynthetic Installer.

3.1.2 Seaming Personnel

All personnel performing seaming operations shall be qualified by experience and by successfully passing trial seam tests and shall be approved by the CQA Representative prior to installing the geomembrane.

3.1.3 Master Seamer

Actual seaming shall be performed under the direction of a "Master Seamer" who may be the same person as the field superintendent,. The Master Seamer must be on site whenever installation and/or seaming is being performed.

3.1.4 Wind

The CONTRACTOR shall provide sufficient ballast and temporary anchorage to protect the material from wind damage or displacement. The CONTRACTOR is responsible for protecting the material from damage due to weather at all times.

3.2 INSTALLATION EQUIPMENT

3.2.1 Seaming Methods

Approved processes for field seaming are extrusion welding and fusion (wedge) welding. Solvent or adhesive welding is prohibited unless approved by the ENGINEER. Proposed alternate processes shall be documented and submitted to the ENGINEER for approval PRIOR to installation. Only apparatus which have been specifically approved by make and model shall be used.

[7] It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
[8] The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C
[9] UV resistance is based on percent retained value regardless of the original HP-OIT value.

3.2.2 Welding Equipment

The Geosynthetic Installer shall provide welding equipment with gauges showing temperatures at the nozzle or barrel (extrusion welder) and at the wedge (fusion welder). The fusion-welding apparatus must be automated self-propelled devices, and shall be equipped with gauges giving the important temperatures and pressures. Equipment shall be maintained in good condition and in adequate number to avoid delaying work in the event of equipment failure or malfunction, and shall be supplied by a power source capable of providing constant voltage under a combined line load. At least one spare operable seaming apparatus of each type used shall be maintained on-site. Equipment used for seaming shall be handled so as to avoid damaging the geomembrane. The welding apparatus shall be able to produce a "double hot wedge" with void for non-destructive testing.

3.2.3 Field Tensiometer

The Geosynthetic Installer shall provide a field tensiometer for on-site peel and shear testing of geomembrane seams. The tensiometer shall be calibrated prior to arrival at the site, capable of performing testing according to ASTM D 6392, and be accompanied by evidence of current valid calibration. The tensiometer shall be motor driven and have jaws capable of traveling at a maximum measured rate of 2 inches per minute. The tensiometer shall be equipped with a gauge that measures the force exerted between the jaws in pounds and have a digital readout.

3.2.4 Punch Press

The Geosynthetic Installer shall provide a punch press for the on site preparation of specimens for testing. The press shall be capable of cutting specimens in accordance with ASTM D 6392.

3.3 PREPARATION

3.3.1 Surface Preparation

Prior to geomembrane panel deployment, the Geosynthetic Installer shall inspect the surface upon which the geomembrane will be placed. The surface shall be smooth, free of rocks, soil particles greater than 3/8-inch, protrusions, sharp objects, and deleterious material that could puncture or abrade the geomembrane. Edges of excavations and grade breaks shall be rounded to preclude sharp corners. As necessary, the surface shall be groomed by hand to bring the surface up to the desired smoothness. The surface should provide a firm, unyielding foundation to provide continuous contact between the surface and the membrane with no sudden, sharp or abrupt changes or break in grade. No standing water or excessive moisture shall be allowed.

3.3.2 Certification of Subgrade Acceptance

The CONTRACTOR shall be responsible for preparing the subgrade soil according to the Contract Documents and geomembrane manufacturer's recommendations. Prior to geomembrane installation the Geosynthetic Installer shall certify in writing that the surface upon which the geomembrane will be installed is acceptable. The Certificate of Acceptance shall be given by the Geosynthetic Installer to the CQA Representative prior to commencement of geomembrane installation in the area under consideration (an example certificate is provided in this section). Commencement of geomembrane installation by the Geosynthetic Installer shall mean acceptance and approval was accomplished.

After the subgrade soil has been accepted by the Geosynthetic Installer, it shall be the Geosynthetic Installer's responsibility to indicate to the CONTRACTOR changes in the subgrade soil condition that require repair work. The CONTRACTOR shall ensure that the subgrade soil is repaired.

3.3.3 Installation

The installation of the membrane shall be done with labor and equipment provided by the installer of the membrane material. The installer shall provide the proper extrusion or hot-wedge fusion welding equipment for the installation. Only installation methods approved by the manufacturer and the QAO shall be used.

3.3.4 Damaged Subgrade

Prior to geomembrane panel deployment, the CONTRACTOR shall repair damage to the subgrade which has occurred due to his or the Geosynthetic Installer's activities.

3.3.5 Anchor trench

Geomembrane anchor trenches shall be constructed to the lines and grades shown on the PLANS. The geomembrane in the anchor trench shall be constructed as shown on the PLANS, and backfilled as indicated with care not to damage the geomembrane. When the anchor trench will be excavated in soil susceptible to desiccation, no more than the amount of trench required for geomembrane to be anchored in one day shall be excavated. The anchor trench shall be maintained clean and dry prior to backfilling.

3.4 PANEL DEPLOYMENT

3.4.1 Identification

Each field panel shall be given a unique "identification code" (numbers or letters and numbers) consistent with the layout plan.

3.4.2 Installation Sequence

The Geosynthetic Installer shall be responsible for the final installation sequence of geomembrane panels. Geomembrane panels shall not be deployed unless they can be seamed within 8 hours of deployment or earlier.

3.4.3 Orientation

Panels shall be oriented perpendicular to the line of the slope crest. Seams parallel to or less than a 45 degree angle from any crest or toe of slope are defined as horizontal seams. Horizontal seams are prohibited on slopes greater than 10:1 (H:V) and shall be at least 5 feet from the crest or toe of slopes greater than 10:1.

3.4.4 Wrinkles

Geomembrane panels shall be unrolled using methods that will minimize wrinkles and will not damage, stretch, or crimp the geomembrane and shall protect the underlying subsurface from damage. All wrinkles higher than they are wide (across their base) shall be removed by repair methods. The CONTRACTOR and/or Geosynthetic Installer shall also remedy wrinkles which develop during subsequent placement of overlying layers.

3.4.5 Bridging

Material shall be installed to allow for temperature related shrinkage and to avoid bridging of the geomembrane.

3.4.6 Seam Layout

Panels shall be placed such that the seam layout conforms as closely as practicable to the approved panel layout drawing. No panels may be seamed in the field without the CQA Representative's approval. In addition, panels not specifically shown on the seam layout drawing may not be used without the CQA Representative's prior approval. Seams shall be identified using the identification codes shown on the panel and seam layout drawing.

3.5 FIELD SEAMS

3.5.1 Seam Strength

All field seams shall meet or exceed the requirements of *Table 31 05 19.16 - 4* for Geomembrane Seam Properties.

Table 31 05 19.16 - 4 LLDPE Geomembrane Seam Properties

Properties	Test Value[10]
Hot Wedge Seams[11] • shear strength, lb/in. • shear elongation at break[12], % • peel strength, lb/in. • peel separation, %	 60 50 50 25
Extrusion Fillet Seams • shear strength, lb/in. • shear elongation at break[13],% • peel strength, lb/in. • peel separation, %	 60 50 44 25

3.5.2 Installation Rate

Contractor shall install membrane at a rate that does not exceed his capacity for patching and testing all field welds each day. Patches and repairs shall be completed and tested (including visual, air pressure and vacuum) each day on the geomembrane material installed. Destructive test samples shall be obtained daily on the LLDPE material installed.

[10] Test Values are provided for 40 mil LLDPE geomembrane. For all other material thicknesses refer to GRI-GM19a.
[11] Also for hot air and ultrasonic seaming methods.
[12] Elongation measurements should be omitted for field testing
[13] Elongation measurements should be omitted for field testing

3.5.3 Overlapping

Panels of geomembrane must have a finished overlap of a minimum of three (3) inches for extrusion welding and four (4) inches for fusion welding, but in any event, sufficient overlap shall be provided to allow peel tests to be performed on the seam.

Field seams shall have a minimum width of one (1) inch.

The procedure used to temporarily bond adjacent panels together shall not damage the geomembrane; in particular, the temperature of hot air at the nozzle of any spot welding apparatus shall be controlled such that the geomembrane is not damaged.

3.5.4 Weather Conditions for Seaming

Unless authorized in writing by the ENGINEER or CQA Representative, no seaming shall be attempted at ambient temperatures below 32°F (0°C) or above 95°F (35°C). If seaming is authorized at temperatures below 32°F (0°C), pre-heating devices shall be placed on all welding machines, and seaming shall be performed in accordance with Geosynthetic Research Institute (GRI) Test Method GM9 Standard Practice "Cold Weather Seaming of Geomembranes." Trial seams shall be prepared and tested every two to three hours. Additionally, if the air temperature drops more than 10°F from the time the trial seam(s) were produced, additional trial seams shall be performed as required by the QA Representative.

3.5.4.1 Cold Weather Seaming

Between ambient temperatures of 32°F (0°C) and 50°F (10°C), seaming may be carried out if the geomembrane is preheated by either the sun or a hot air device, and if there is not excessive cooling resulting from the wind.

3.5.4.2 Warm Weather Seaming

Above an ambient temperature of 50°F (10°C), no preheating is required.

3.5.4.3 Inclement Weather Seaming

In all cases, the geomembrane shall be dry and protected from wind damage. Seaming shall not proceed during precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, in an area of saturated soil, in the presence of wind speeds exceeding 20 mph (32 km/hr), or in an area of free water.

3.5.5 General Seaming Procedures

Prior to seaming, the seam area shall be clean and free of moisture, dust, dirt, debris of any kind, and foreign material.

Seams shall be aligned with the fewest possible number of wrinkles and "fishmouths." Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same geomembrane extending a minimum of six (6) inches (150 mm) beyond the cut in all directions.

As deemed necessary by the Geosynthetic Installer, CONTRACTOR, or CQA Representative, a movable protective layer shall be used below each overlap of geomembrane that is to be seamed to

prevent buildup of moisture between the sheets. Upon completion of welding, the movable protective layer shall be removed entirely.

For seams which are to be extrusion welded, and as necessary for fusion welds, the seam overlap shall be grinded in accordance with the Manufacturer's instructions, within one hour of the seaming operation and in a way that does not damage the geomembrane. The grind shall not extend more than 0.25 inches past the weld and shall not be excessively deep. The composition of the extrudate used shall be identical to the membrane material.

Welding speed and pressure, preheating temperature, nozzle (die) temperature, ambient air and sheet temperatures, and extrudate bead thickness shall not deviate from the Manufacturer's recommendations or welding criteria established during start-up operations unless approved by the ENGINEER and approved and certified in writing by the Fabricator that such deviation will not result in any short or long term damage to the geomembrane.

The edge of cross seams shall be grinded to a smooth incline (top and bottom) prior to welding.

For extrudate seams, the extrusion welding device shall be purged prior to beginning a seam and until all heat-degraded extrudate has been removed from the barrel.

In locations where a firm substrate does not exist, a flat board, or a similar hard surface shall be provided directly under the seam overlap to achieve proper support.

Seaming shall extend to the outside edge of panels to be placed in anchor trenches.

3.6 PROTECTION

3.6.1 Protection of the Geomembrane

INSTALLER shall protect the geomembrane by:

- Providing a smooth insulating plate or fabric beneath hot welding apparatus before and after usage.
- Providing additional protection over the geomembrane in heavily trafficked areas.
- Protecting the geomembrane from ultraviolet exposure.
- Positioning overlaps of panels to facilitate drainage prior to seaming.
- Preventing damage to the geomembrane by scraping, scarring, scuffing, scratching, gouging, handling, trafficking, excessive heat, vibration, leakage of hydrocarbons or any other means.
- Assuring that the prepared surface underlying the geomembrane has not deteriorated or changed significantly since acceptance, and is still acceptable at the time of geomembrane placement.
- Assuring that the surfaces underlying the geomembrane are clean and free of debris.

- Preventing personnel working on the geomembrane from smoking, wearing damaging shoes, or engaging in other activities which could damage the geomembrane.

- Using methods to unroll the panels that do not cause scratches or crimps in the geomembrane and do not damage the underlying surfaces.

- Using methods to place the panels that minimize wrinkles (especially differential wrinkles between adjacent panels). Temperature changes should be considered in scheduling of panel deployment and seaming to minimize shrinkage and expansion problems.

- Adequately anchoring the geomembranes before and after deployment to prevent wind damage.

- Minimizing direct contact with geomembrane; (i.e., protecting the geomembrane with geotextiles, extra geomembrane, or other suitable materials) in areas where excessive traffic may be expected.

- Preventing all wheeled and tracked equipment from driving directly on the geomembrane. See Section 3.11 "PLACEMENT OF GEOCOMPOSITE DRAINAGE NET AND VEGETATIVE SUPPORT LAYER MATERIALS" for required minimum protective cover to allow use of equipment.

- Not allowing the geomembrane surface to be used as a work area for preparing patches, storing tools and supplies, etc.

- Ensuring that sharp objects are not left on the surface of the geomembrane.

- Preventing the use of torches on or near any geosynthetics.

3.7 FIELD QUALITY CONTROL TRIAL SEAMS

Trial seams shall be performed in the presence of the CQA Representative. Trial seams shall be made on scrap pieces of geomembrane under the same conditions that production seaming will be performed to verify that seaming conditions are satisfactory. Trial seams shall be made, at a minimum, at the beginning, middle, and end of each work day, and at least once every four hours or as directed by the CQA Representative for each seaming apparatus used that day. Also, each seamer shall make at least one trial seam each day. (Note extra requirements for seaming in cold weather)

The trial seam sample shall be at least three (3) feet long by one (1) foot wide (after seaming) with the seam centered lengthwise. The sample shall be marked with date, ambient temperature, and welding machine number. Four adjoining specimens, each one (1) inch (25 mm) wide, shall be cut from the trial seam sample by the Geosynthetic Installer at locations selected randomly by the CQA Representative. Two of the specimens shall be tested in peel and two tested in shear; none should fail in the seam. If a specimen fails in the seam, the entire trial seam procedure shall be repeated. If an additional specimen fails, the seaming apparatus or seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two (2) consecutive successful full trial seams are achieved.

3.8 FIELD NONDESTRUCTIVE SEAM TESTING

To check for seam continuity, the Geosynthetic Installer shall nondestructively test 100 percent of field seams over their entire length using a vacuum test unit, air pressure test, or other approved method. Air pressure testing is only applicable to those processes which produce a double seam with an enclosed space, and shall follow GRI GM6, Pressurized Air Channel Test for Dual Seamed Geomembranes. Tests must include visual inspection of seams. A detailed test protocol must be submitted for approval a minimum of 30 days prior to installation of the liner.

Continuity testing shall be performed as the seaming work progresses, not at the completion of all field seaming.

3.8.1 Vacuum Testing Equipment

Test equipment, including but not limited to the following shall be furnished by the Geosynthetic Installer:

- The vacuum box (1 to 3 feet long by 1 foot wide) shall have a transparent viewing window on top and a soft, closed cell neoprene gasket attached to the bottom. The housing shall be rigid and equipped with a bleed valve and vacuum gauge. A separate vacuum source shall be connected to the vacuum box. The equipment shall be capable of inducing and holding a vacuum of 5 psig (10 in of Hg vacuum). The viewing window shall be replaced if it becomes excessively scratched.

- A steel vacuum tank and pump assembly equipped with a pressure controller and pipe connections; mounted on a cushion to protect the geomembrane.

- A rubber pressure/vacuum hose with fittings and connections.

- A bucket and wide paint brush.

- A soapy solution.

3.8.2 Vacuum Test Procedure

- Energize the vacuum pump and adjust the tank vacuum to approximately 5 psig (10 in. of Hg vacuum) (35 kPa absolute).

- Apply soapy solution to wet a strip of geomembrane approximately 12 inches by 48 inches (0.3 m by 1.2 m).

- Place the box over the wetted area.

- Close the bleed valve and open the vacuum valve.

- Ensure that a leak tight seal is created by the gasket.

- For a period of not less than 10 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.

- If no bubbles appear after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 inches (75 mm) overlap, and repeat the process.

- All areas where soap bubbles appear indicate leaks or poor seam continuity and shall be marked, repaired and retested.

3.8.3 Air Pressure Test Equipment (GRI GM-6)

- An air pump (manual or motor driven) equipped with pressure gauge capable of generating and sustaining a pressure between 25 and 30 psi (160 and 200 kPa) and mounted on a cushion to protect the geomembrane.

- A rubber hose with fittings and connections.

- A sharp hollow needle, or other approved pressure feed device.

3.8.4 Air Pressure Test Procedure

- Seal both ends of the seam to be tested (to a maximum length of 500 feet unless other approved by the ENGINEER).

- Insert needle or other approved pressure feed device into the channel created by the dual track fusion weld.

- Energize the air pump to a pressure between 25 and 30 psi (160 and 200 kPa), close valve, and sustain pressure for a minimum of 5 minutes.

- If pressure drop exceeds 2 psi (15 kPa), or does not stabilize, locate the faulty area, repair and retest.

- Remove needle or other approved pressure feed device and seal ends and needle puncture with extrudate.

3.9 FIELD DESTRUCTIVE SEAM TESTING

3.9.1 Test Location

To establish that there is adequate seam strength, destructive seam tests shall be performed at selected locations. Test locations shall be determined after seaming, at the CQA Representative's discretion, and may be prompted by suspicion of excess crystallinity, contamination, offset welds, or any other potential cause of inadequate welding. The Geosynthetic Installer shall not be informed in advance of the locations where the seam samples will be taken.

3.9.2 Test Frequency

As a minimum, one test location shall be selected per 500 feet of seam length produced by each welding machine. (This minimum frequency is to be determined as an average taken throughout the entire facility.) Seam strength testing shall be performed as the seaming work progresses, not at the completion of the seaming.

3.9.3 Test Procedure

A three foot minimum sample is taken by the Geosynthetic Installer from the seam and cut into three individual one foot samples. Individual samples go to the Installer CQC Organization, the CQA Representative and the OWNER. The Installer CQC Organization and CQA Representative each cut their respective samples into 5 shear and 5 peel (alternating adjacent) test specimens and conduct the tests in accordance with ASTM D 4437. The remaining sample is archived by the OWNER. The OWNER will be responsible for storing the archive samples.

All holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired in accordance with specified repair procedures. The continuity of the new seams in the repaired area shall be tested and repaired if necessary.

3.9.4 Geosynthetic Laboratory Testing

If destructive seam testing is to be performed off-site, packaging and shipping of destructive test samples shall be conducted in a manner which will not damage the test sample. The CQA Representative shall verify that packaging and shipping conditions are acceptable. This procedure shall be fully outlined prior to construction.

Testing shall include "Shear Testing" and "Peel Testing" (ASTM Designation D 6392). The minimum acceptable values to be obtained in these tests are those indicated in *Table 31 05 19.16 - 4*. At least 5 specimens shall be tested for each test method. Specimens shall be selected alternately by test from the samples (i.e., peel, shear, peel, shear). Five of 5 specimens tested shall meet or exceed the requirements indicated in *Table 31 05 19.16 - 4*.

The Geosynthetic Installer's laboratory test results shall be presented in writing to the CQA Representative, ENGINEER and the OWNER as required by ASTM D 6392.

3.9.5 Procedures for Destructive Test Failures

All failed seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken. In cases exceeding 150 feet (50 m) of reconstructed seam, a sample taken from the zone in which the seam has been reconstructed must pass destructive testing.

The CONTRACTOR is responsible for providing quality seams. For all QA retests due to destructive failures exceeding 10% of all tests, the CONTRACTOR shall be charged to QA time and lab costs.

The following procedures shall apply whenever a sample fails a destructive test, whether that test is conducted by the CQA Representative, the Geosynthetic Installer, the CONTRACTORS independent CQC laboratory, or by field tensiometer. The Geosynthetic Installer has two options:

- The Geosynthetic Installer can reconstruct the seam between any two passing test locations;

- The Geosynthetic Installer can trace the welding path to an intermediate location (at 3 m (10 feet) minimum from the point of the failed test in each direction) and take a single specimen for an additional field test at each location. If these additional specimens pass the test, then full samples are taken. If these samples pass the tests, then the seam is reconstructed between these locations. If either sample fails, then the process is

repeated, in that direction, to establish the zone in which the seam should be reconstructed.

3.10 DEFECTS AND REPAIRS

3.10.1 Identification

The entire geomembrane, including seams, shall be visually examined by the CQA Representative for identification of visual defects, holes, blisters, undispersed raw materials and signs of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of examination. The geomembrane surface shall be swept or washed by the Geosynthetic Installer if dust, mud or other matter inhibits examination. All areas having defects and/or requiring repairs shall be repaired at no additional cost to the OWNER.

Work shall not proceed with any materials which will cover locations which have been repaired until the CQA Representative has re-examined the repaired area and applicable laboratory test results with passing values are available. Panels or portions or panels which, in the opinion of the CQA Representative, are damaged beyond repair shall be removed from the site and replaced.

3.10.2 Repair Procedures

Any portion of the geomembrane exhibiting a flaw or failing a destructive or nondestructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the QA Representative, Geosynthetic Installer, and ENGINEER. The procedures available include:

3.10.2.1 Patching

Patching will be used to repair large holes, tears, areas of undispersed raw materials, and contamination by foreign matter.

3.10.2.2 Grinding and Rewelding

Grinding and rewilding will be used to repair small defective sections of extruded seams less than one foot in length.

3.10.2.3 Spot Welding

Spot Welding will be used to repair small tears, pinholes, or other minor, localized flaws.

3.10.2.4 Capping

Capping will be used to repair large lengths of failed seams; maximum allowable cap width is three feet.

3.10.2.5 Removal

Removing a bad seam and replacing with a strip of new material welded into place -- used with large lengths of fusion seams.

3.10.2.6 Other methods

Other methods approved by the ENGINEER.

3.10.2.7 Repair Provisions

In addition, the following provisions shall be satisfied:

Surfaces of the geomembrane which are to be repaired by extrusion welding shall be abraded no more than one hour prior to the repair.

- All surfaces must be clean and dry at the time of the repair.
- All seaming equipment used in repairing procedures must be approved.
- The repair procedures, materials, and techniques shall be approved in advance of the specific repair by the CQA Representative.
- Patches or caps shall extend at least six (6) inches (150 mm) beyond the edge of the defect, and all corners of the patches shall be rounded with a radius of at least three (3) inches (75 mm).
- The geomembrane below large caps should be appropriately cut or removed to avoid water or gas collection between the two sheets.

3.10.3 Labeling

Repaired field defects, patches, reworked seams, repaired fishmouths and other non-standard field seams shall have the following information marked on the liner with a marker suitable for the purpose:

- Initials of Welder
- Date of Weld
- Initials of QC Technician
- Date of QC Test
- Indication of Pass/Fail

3.10.4 Verification of Repairs

Each repair shall be nondestructively tested. Repairs which pass the non-destructive test shall be taken as an indication of an adequate repair. At the discretion of the QA Representative, large repairs may require destructive test sampling. In the case of failed tests, the repair shall be redone and retested until a passing test result is obtained. The CQA Representative shall observe all non-destructive testing of repairs and shall record the identification of each repair, date, technician, and test outcome. The liner may not be covered until defects, patches, etc. have been properly tested, logged, and marked.

3.10.5 Wrinkles

When seaming of the geomembrane is completed (or when seaming of a large area of the geomembrane is completed) and prior to placing overlying materials, the CQA Representative shall indicate which wrinkles shall be cut and reseamed by the Geosynthetic Installer. The seam thus produced shall be tested like any other seam. Wrinkle size shall be evaluated during the time of day and under conditions similar to those expected when overlying protective cover/drainage layer material is to be placed. All wrinkles higher than they are wide (across their base) shall be removed by repair methods.

3.10.6 Bridging

The geomembrane shall be continuously supported on the accepted subgrade. Bridging (unsupported geomembrane) is not permissible. Geosynthetic Installer shall take necessary steps to prevent bridging and repair or replace any geomembrane so affected.

3.11 PLACEMENT OF GEOCOMPOSITE DRAINAGE NET AND VEGETATIVE COVER LAYER MATERIALS

3.11.1 Weather Conditions

Placement of the geocomposite drainage net and overlying vegetative cover layer soils on the geomembrane shall not proceed at an ambient temperature below 40°F (5°C) nor above 95°F (35°C) unless otherwise approved by the CQA Representative.

3.11.2 Material Exposure

The geomembrane shall not be left exposed (uncovered) to the elements including UV light, for any period more than sixty (60) days.

3.11.3 Soils

All soils installed in direct contact with the geomembrane shall have a maximum particle size of 3/8 inches.

3.11.4 Equipment

All materials placed over geomembrane (and other geosynthetics) shall be installed without damaging the geosynthetics. Equipment used for placing soil shall not be driven directly on the geomembrane. A minimum thickness of one (1) foot of soil is required between a light dozer (such as a low ground pressure Caterpillar D-3 or lighter) and the geomembrane. Placement of material overlying the geosynthetics shall be in conformance with the guidelines for equipment ground pressure in

Table 31 05 19.16 - 5 Soil Thickness for Equipment Operating over Geomembrane

Equipment Ground Pressure (psi)	Minimum Soil Thickness (inches)
<4	12
4-6	15
6-8	18
8-11	24

3.11.5 Heavily Trafficked Areas

In heavily trafficked areas such as access ramps, soil cover thickness shall be at least three (3) feet.

3.12 DOCUMENTATION OF CONSTRUCTION

3.12.1 Report

- Upon project completion, the CQA Representative shall prepare a Construction Certification/Documentation Report. This report will document that the work was accomplished according to the Construction Contract Documents, and summarize quality control and quality assurance tests and inspection. If appropriate, supplementary information such as modifications approved by the ENGINEER shall be included to justify deviations from the original contract documents. Justification for all such deviations must be fully documented in the Report. The Geosynthetic Installer shall provide necessary signatures, test results, record drawings, and inspection results as needed for the CQA Representative. At a minimum, the report shall contain the following information:

- Identification of parties and their roles and responsibilities with signatures of key personnel and an officer of their employer's company.

- Scope of work.

- Summary of the project construction activities.

- Construction Quality Assurance methodology.

- Test and inspection results.

  – Results of prequalification testing (including extrudate);

  – The results of all non-destructive seam tests.

  – Subgrade acceptance forms.

- Construction Quality Assurance certification statement, sealed and signed by a licensed professional ENGINEER.

- Geomembrane record drawings.

- Panel and seam layout record drawing.

- Sample location drawing.

- Sample tags with duplicates.

- Inventory of amount of material used versus amount delivered to the site.

- CQA and CQC records regarding panel deployment, seaming, and repairs.

- The results of the test and monitoring reports shall be turned over to the ENGINEER for review on a daily basis. Reports shall be complete within 24 hours of the installation of the panel, seam, repair, etc. Test results and corrections shall be completed prior to placement of cover material.

3.13 LANDFILL GAS CONTROL DURING INSTALLATION

The CONTRACTOR shall be responsible for temporary control and extraction of landfill gas during installation of the geomembrane to avoid formation of "bubbles" underneath the geomembrane.

3.14 SANDBAGS

Liner shall be adequately weighted down with sand bags to limit wind uplift. Unless otherwise noted, sandbags shall remain the property of the Owner upon completion.

3.15 PAYMENT

Payment by the Owner for installation of the membrane shall not be made until testing is completed and the test results reviewed and approved.

3.16 CERTIFICATE

CERTIFICATE OF ACCEPTANCE OF SOIL SUBGRADE BY GEOSYNTHETIC INSTALLER	
INSTRUCTIONS: This part of the certificate should be completed by the CONTRACTOR.	
Contractor	Project
Name:	Location:
Address:	Project:
Location of Soil Subgrade Surface to be Utilized (Include Sketch, if Needed):	
Contractor Authorized Representative:	
Name:	
Title:	
Signature/Date:	
INSTRUCTIONS: This part of the certificate should be completed by the Geomembrane Geosynthetic Installer.	
I the undersigned, duly authorized representative of:	
	(Geomembrane Installation Company)
Do hereby accept the soil subgrade (soil supporting the geomembrane) and shall be responsible for its integrity and suitability, in accordance with the specifications from this date to completion of the installation.	
Geosynthetic Installer Authorized Representative:	
Name:	
Title:	
Signature/Date:	

END OF SECTION 31 05 19.16

SECTION 31 05 19.17

AGRU MICRODRAIN GEOMEMBRANE

1.0 GENERAL

1.1 SCOPE

The work covered in this Section includes the manufacturing, fabrication, testing, supply and installation of 50 mil Structured Linear Low-Density Polyethylene (LLDPE) geomembrane (MicroDrain®) for the final cover system. The CONTRACTOR shall furnish all labor, materials, transportation, handling, storage, supervision, tools, equipment and other incidentals necessary to install, test, and quality control the geomembrane as required by the Contract Documents.

1.1.1 Related Work Specified Elsewhere

- Section 01 45 00 Construction Quality Control
- Section 31 00 00 Earthwork (Bedding Layer requirements)
- Section 31 05 19.13 Geotextile Fabrics
- Section 31 05 19.16 Textured LLDPE Geomembrane Liner

1.2 DEFINITIONS

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 1.2.

1.3 QUALITY ASSURANCE AND CONTROL DURING INSTALLATION

The ENGINEER or OWNER third party Construction Quality Assurance (CQA) Consultant will observe geomembrane installation and construction and certify that construction is in accordance with Contract Documents. All tests and test frequencies specified in this section are Construction Quality Control (CQC) tests, and these tests are the responsibility of the CONTRACTOR or his representative unless otherwise noted.

1.4 REFERENCES

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 1.4.

1.5 SUBMITTALS

The CONTRACTOR or Geosynthetic INSTALLER shall submit the following information to the ENGINEER for approval at least 30 days (unless otherwise specified) prior to procurement of the geomembrane:

1.5.1 Proof of Manufacturer's Qualifications:

- The Manufacturer must have at least two (2) years documented experience in the manufacture of the geomembrane and/or documented experience totaling 10,000,000 ft^2 of the manufactured geomembrane for at least ten (10) completed facilities.

- Manufacturer's Brochure: Submit complete manufacturer's specifications, descriptive drawings, and literature for the geomembrane, including the product identification and supplier of the polymer resin and recommended method for handling and storage of all materials prior to installation. Include information on plant size, equipment, personnel, number of shifts per day and capacity per shift.

- Manufacturer Quality Control (MQC) Program: Submit a complete description of the geomembrane manufacturer's formal quality control programs for manufacturing, fabricating, testing, quality control, defects repair, handling, and shipping. The description shall include, but not be limited to, polymer resin supplier(s) and product identification, acceptance testing, production sampling and testing, installation testing, documentation of changes, alterations, repairs, retests, and acceptance.

- Prior to purchasing material the following conformance testing is required: Submit independent quality control laboratory test results demonstrating compliance with material properties listed herein, including *Table 31 05 19.17 – 2* Resin Properties (Without Carbon Black) and *Table 31 05 19.16 - 3*. The independent laboratory tests are to be performed once by an approved laboratory independent of the manufacturer. In addition, the manufacturer must provide a certificate of compliance which states that the material to be installed will use the same resin type and formulation as that for which test results are submitted.

1.5.1.1 Manufacturer Quality Control Certificates:

The Geosynthetic Installer shall submit test reports to the ENGINEER prior to geomembrane shipment. The tests and frequencies are specified in Part 2 - "Manufacturer Quality Control Tests" and material properties.

The following information must be submitted for approval prior to shipping the material:

Resin:

- Origin (resin suppliers name, resin production plant), batch number, lot number, or identification number and production date(s).

- A certification by a qualified individual employed by the manufacturer that the quality of the resin used to manufacture the geomembrane rolls assigned to this project meets specified properties measured using test methods indicated in the specifications, or equivalent.

- Copy of quality control certificates issued by the Resin Supplier.

- Certified statement that no reclaimed polymer was added to the resin during the manufacture of the actual geomembrane to be used in this project. However, the use of polymer recycled during the manufacturing process may be permitted if done with appropriate cleanliness and if recycled polymer is the same LLDPE as the parent material and does not exceed ten (10) percent by weight.

Geomembrane:

- Roll numbers, production dates, and identification.

- A certification by a qualified individual employed by the manufacturer that the geomembrane roll assigned to this project meets specified properties measured using test methods indicated in the specifications, or equivalent.

- A list of quantities and descriptions of materials other than the base polymer which comprise the geomembrane.

Factory Visit:

At the request of the OWNER or the ENGINEER, submit contact names, telephone numbers, addresses, and production schedule information for purposes of scheduling an OWNER or ENGINEER'S plant visit during production.

1.5.2 Proof of Geosynthetic INSTALLER'S Qualifications:

- Show a minimum of two years continuous experience and list completed facilities for which the Geosynthetic Installer has installed geomembrane, totaling a minimum of 10,000,000 ft^2.

- The name or names of the field superintendents who will be proposed for the project and a list of completed facilities for which the field superintendent has installed the selected geomembrane totaling a minimum of 10,000,000 ft^2.

- The name or names of the Master Seamer(s) who will be proposed for the project and a list of completed facilities for which the Master Seamer(s) has installed the selected geomembrane totaling a minimum of 2,000,000 ft^2.

- Construction Quality Control Program: Submit a complete description of the Geosynthetic Installer's formal quality control programs for handling, installing, testing, quality control, and defect repair. The description shall include, but not be limited to installation testing, documentation of changes, alterations, repairs, retests, and acceptance. The document shall include a complete description of seaming by extrusion welding and hot wedge welding.

- Proposed schedule of installation showing the critical path of installation.

- Licensed Installer: The Geosynthetic Installer shall be approved and/or licensed by the geomembrane manufacturer.

- Warranty: Submit an advance (sample) copy of the warranty.

1.5.3 Instructions and Drawings:

1.5.3.1 Storage, Handling, Installation, and Seaming

The Contractor shall furnish complete written instructions to the Engineer for the storage, handling, installation, and seaming of the membrane in compliance with this specification and the condition of his warranty.

1.5.3.2 Repairs

The material supplier shall furnish complete written instructions for the repair of geomembrane material to the Engineer no less than 30 days prior to installation.

1.5.3.3 Layouts

The Contractor shall furnish panel layouts and seam details as required for the membrane installation. The goal of the plan will be to minimize the required number of seams. Care should be taken to reduce areas of stress concentration. Horizontal seams are not allowed unless the slope length exceeds roll lengths. In that event, the horizontal seam will be installed on a 45 degree diagonal across the slope. Details of placement around penetrations, if any, such as pipes shall be provided. The above details must be approved by the Engineer prior to liner installation. Material left outside shall not be exposed to sunlight for more than 30 days.

1.5.4 Shop Drawing Submittals

1.5.4.1 Samples and Specifications

In order to qualify as an approved lining material, the Contractor shall submit material samples and minimum specifications to the Engineer. The specification sheet shall give full details of minimum physical properties and test methods used, site seaming methods, and a certificate confirming compliance of the material with the minimum specifications. A list of similar projects completed in which the manufactured material has been successfully used shall be submitted.

1.5.4.2 Certification Delivery

Upon delivery of the rolls of geomembrane, provide a copy of the certification from the manufacturer certifying the batch delivered to the site meets the minimum specifications and was QC inspected. The certificate shall be signed by a person with authority to bind the manufacturer.

1.5.4.3 Test Results

The Contractor shall submit results of confirmation testing showing that the material lot of the resin used in the membrane supplied meets the material requirements for the resin. A description of the quality control steps used during manufacture shall also be provided.

1.5.5 During Construction Conformance Test Results:

Submit conformance test results to the ENGINEER for approval within 3 days of completed testings. See Part 1.5.C. for conformance testing requirements and frequency.

1.5.6 List of Personnel:

The CONTRACTOR or Geosynthetic Installer shall submit a list of proposed seaming personnel and their experience records. All personnel shall be approved by the ENGINEER before they perform seaming operations.

1.5.7 Submittals Required for Project Closeout

Record Drawings:

Submit geomembrane record drawings to the ENGINEER.

Geomembrane Warranty

Submit geomembrane warranty to the ENGINEER.

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Handling

The Geosynthetic Installer's personnel shall handle the material with care, shall use adequate equipment and shall take all precautions necessary to prevent damaging the geomembrane.

1.6.2 Inspection upon Delivery

Upon delivery at the site, the Geosynthetic Installer, in the presence of a CQA Representative, conduct a visual inspection of rolls or factory panels for defects and for damage. This inspection shall be conducted without unrolling rolls or unfolding factory panels unless, in the Geosynthetic Installer's or CQA Representative's opinion, defects or damages are found or suspected.

Defects or flaws in the materials shall be brought to the attention of the CQA Representative. Rolls, factory panels, or portions thereof, which have unacceptable flaws shall be recorded by the CQA Representatives and Geosynthetic Installer, rejected and shall be removed from the site.

Rejected materials shall be replaced by the CONTRACTOR at no additional cost to the OWNER. No time extension will be allowed in the case of rejected materials.

1.6.3 During Construction Conformance Testing

At the direction of the CQA Representative, the Geosynthetic INSTALLER shall take samples from the delivered lot and sent to the CQA Geosynthetic Laboratory for conformance testing. The cost for laboratory conformance testing shall be paid by the OWNER. The conformance tests and minimum frequency outlined in *Table 31 05 19.17 - 1* are required prior to installation. Results must meet property requirements in *Table 31 05.19.17 – 3*.

Table 31 05 19.17 - 1 Conformance Testing Requirements

Properties	Test Method	Testing Frequency (minimum)
Thickness (min. ave.) – mils • lowest individual for 8 out of 10 values - % • lowest individual for any of the 10 values - %	D 5994	1 per 100,000 ft^2
Asperity Height (min. ave.) – mils	D 7466	
Formulated Density (max.) – g/cc	D 1505/ D 792	
Tensile Properties	D 6693	

Properties	Test Method	Testing Frequency (minimum)
• break strength – lb/in. • break elongation - %	Type IV	
Puncture Resistance (min. ave.) - lb	D 4833	
Tear Resistance (min. ave.) - lb	D 1004	
Carbon Black Content (range)	D 4218	
Carbon Black Dispersion	D 5596	
Index Transmissivity, m^2/sec[1]	D 4716	100,000 ft^2

NOTES:

[1] Transmissivity at a temp of 21˚ C, gradient of 0.33, seating time of 15 min, 100-hr testing duration, MicroDrain and AT081 geotextile with Bedding layer and erosion control layer.

All conformance test results shall be reviewed and approved by the ENGINEER prior to any placement. If a conformance test result fails the specifications, at least two additional conformance tests shall be performed on samples taken immediately from adjacent numbered rolls. If both additional conformance test results pass the specifications, the entire lot shall be accepted except that roll from which the failed sample is taken. If any of the conformance test results fails for the two (minimum) additional samples, the entire lot shall be rejected by the ENGINEER.

1.6.4 Storage

The Geosynthetic Installer shall be responsible for ensuring that the stored materials are protected from rain, snow, ice, dirt, ultra violet light, shock, theft, vandalism, passage of vehicles, and other sources of damage. The CONTRACTOR is responsible for clearing, grubbing, and grading necessary to prepare the storage area. Provide for surface water control, access and storage area surfacing, and lighting necessary for adequate unloading of highway transport vehicles and access by construction equipment.

1.7 Warranty

Provide a twenty (20) year material warranty and workmanship defects for a period of one (1) year following the date of final completion of the work under this contract. The warranty required herein shall be provided in addition to any warranty required by the General Conditions.

1.8 INTERFACE SHEAR TESTING

1.8.1 Friction Angle Testing Method

Contractor shall conduct interface testing by direct shear in accordance with ASTM D5321 to confirm a minimum interface friction angle of 24 degrees (peak value), or equivalent shear strength when considering adhesion value, for the interfaces listed in 1.8.2. Soil samples will be prepared by compacting to 90% maximum dry density at ±3% of optimum moisture. Test samples shall be wetted at the soil and geosynthetic contact surface by spraying during shear box assembling. For capping, soil samples will be consolidated under normal loads, applied incrementally at least 24 hours prior to testing, of 200 psf, 400 psf, and 600 psf with a minimum displacement of 3 inches.

1.8.2 Interfaces

Test each interface individually to be used on this Project using representative samples of materials to be supplied under normal loads indicated and using test parameters as specified by Engineer. For capping, interfaces to be tested are (top layer against bottom layer):

- MicroDrain Liner against cap Bedding Layer
- AGRUTex Geotextile against the MicroDrain Liner
- Erosion Control Layer Soil against the AGRUTex Geotextile

1.9 GEOTEXTILE

The AGRU MicroDrain Liner will be used in conjunction with the AGRUTex AT081 geotextile as recommended by the manufacturer.

2.0 PRODUCTS

2.1 MANUFACTURING PLANT VISIT

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 2.1.

2.2 GEOMEMBRANES

2.2.1 Single Source

All geomembrane sheets and extrudate material for the construction of the project shall be obtained from a single material supplier and manufacturer. It must be certified and warranted that the sheets, extrudate, and pipe boots are compatible with one another. The Geosynthetic Installer shall provide manufacturer's warranties for the sheets, extrudate material, and pipe boots.

2.3 MATERIAL PROPERTIES

2.3.1 Geomembrane

The membrane shall have a minimum thickness required by the plans. The raw polymer shall meet or surpass the minimum standards as set forth in the Geosynthetic Research Institute's (GRI) Test Method GM17 "Test Methods, Test Properties, and Testing Frequency for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes" and GRI Test Method GM19 "Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes".

Geomembrane shall meet or exceed the requirements of *Table 31 05 19.17 - 2*. Equivalent test methods are subject to the approval of the ENGINEER.

Table 31 05 19.17 - 2 Resin Properties (without Carbon Black)

Property	Test Method	LLPE
Density (g/cc)	ASTM D792, Method B	≥0.915
Melt Flow Index (g/10 min)	ASTM D (190/2.16)	≤1.0

2.3.2 Extrudate

Extrudate shall be the same resin as the geomembrane. The manufacturer shall provide documentation and shall certify that the extrudate meets this requirement.

2.3.3 Material Composition

The geomembrane shall consist of new, first-quality products designed and manufactured specifically for the purpose of this project, as satisfactorily demonstrated by prior use. The geomembrane shall be unmodified containing no plasticizer, fillers, chemical additives, reclaimed polymers, or extenders. Approximately 2 percent carbon black shall be added to the resin for ultraviolet resistance. The only other allowable compound elements shall be anti-oxidants and heat stabilizers, of which up to 1.5 percent total, as required for manufacturing, may be added.

2.3.4 Structured Geomembrane Surface

The geomembrane shall be produced using a flat cast manufacturing process to create a structured geomembrane with integrated drainage layer.

2.3.5 Defects

The membrane material shall be so produced as to be free of holes, blisters, undispersed raw materials, or sign of contamination by foreign matter. Defects discovered in the field shall be repaired by cutting out the defect and welding a new piece of membrane material in its place. The weld shall be placed in accordance with the requirements for field welded seams. Seams for repairs shall be tested in accordance with the required field seam test procedures.

2.3.6 Labels

Labels on each roll shall identify the thickness, length, width, and manufacturer's mark number. The roll shall also indicate the date, lot, and batch number of the roll, the square feet in the roll, and the total roll weight as measured after manufacture. Should the total weight not meet the minimum weight based upon the minimum material density of 0.93 g/cc, the material thickness, and square footage provided, then the delivered material will be rejected for use.

2.3.7 Transportation, Handling, and Storage

Transportation, handling, and storage of the membrane shall be in accordance with written instructions from the manufacturer. These instructions shall be supplied prior to delivery of the material. In general, equipment used shall be adequate to handle the rolls of membrane without risk of damage to the material. Extreme care will be taken whenever handling the material. The rolls of membrane shall be stored on a surface free of sticks, rocks, roots, or other matter that may damage the material. Upon delivery, QC and QA personnel shall inspect each roll of material for damage. This inspection shall be recorded and included in the QA/QC reports.

2.3.8 Seams

There shall be no factory seams. Seams shall be welded in the field by factory trained technicians using a non-destructive hot-wedge fusion or extrusion process. Edges of rolled material shall be trimmed at the factory to remove non-conforming material. The first three feet of material on selected rolls shall be used for confirmation testing of the characteristics of the membrane material.

2.4 MANUFACTURER QUALITY CONTROL TESTS

2.4.1 Test Reports

Submit all test reports to the ENGINEER for review and approval.

2.4.2 Manufacturer Quality Control (MQC) Tests:

2.4.2.1 Resin

Resin shall be tested at a frequency of one test per resin batch. One batch is defined as one rail car load of resin. As a minimum perform tests for Density and Melt Index. Compliance with the Polymer Composition test requirement shall be established with a manufacturer's certificate of compliance. The finished rolls shall be identified by a roll number corresponding to the resin batch used.

2.4.2.2 Geomembrane

Geomembrane shall be tested for properties required by *Table 31 05 19.17 - 3*. The minimum test frequencies in *Table 31 05 19.17 - 3* shall be observed.

Table 31 05 19.17 - 3 AGRU LLDPE MicroDrain® Liner

Property	Test Method	Frequency	50 mil
Thickness, (Nominal) mil Thickness, (average) mil Lowest individual reading 8 of 10 (-10%) Lowest Individual 2 of 10	ASTM D5994	Every Roll	50 47.5 45 42.5
Drainage Stud Height (min. ave.), mil	ASTM D7466	Second Roll	130
Friction Stud Height (min. ave.), mil	ASTM D7466	Second roll	175
Density, g/cm^3 – maximum	ASTM D792, Method B	200,000 lb	0.939
Tensile Properties (each direction) Strength at Break (min. ave.), lb/in-width Elongation at Break (min. ave.), %	ASTM D6693, Type IV Dumbell, 2 ipm G.L. 2.0 in (51 mm)	20,000 lb	105 300
Tear Resistance, lb	ASTM D1004	45,000 lb	30
Puncture Resistance, lb	ASTM D4833	45,000 lb	55
Carbon Black Content, % (Range)	ASTM D4218	45,000 lb	2.0 - 3.0
Carbon Black Dispersion (Rating)	ASTM D5596	45,000 lb	Note(1)
Oxidative Induction Time, min. ave.	ASTM D3895, 200°C; O2, 1 atm	200,000 lb	140

Property	Test Method	Frequency	50 mil
Stress Crack Resistance (NCTL), min. ave.	ASTM D5397	200,000 lb	500
Index Transmissivity, m^2/sec[2]	ASTM D4716	100,000 SF	4×10^{-3}
Index Transmissivity, m^2/sec[3]	ASTM D4716	100,000 SF	5×10^{-4}

NOTES:

[1] Dispersion only applies to near spherical agglomerates. 10 views shall be Category 1 or 2.
[2] Transmissivity at a temp of 21˚ C, gradient of 0.1, seating time of 15 min, MicroDrain between steel plates
[3] Transmissivity at a temp of 21˚ C, gradient of 0.33, seating time of 15 min, 100-hr testing duration, MicroDrain and AT081 geotextile with Ottawa sand

3.0 INSTALLATION

3.1 GENERAL REQUIREMENTS

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.1.

3.2 INSTALLATION EQUIPMENT

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.2.

3.3 PREPARATION

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.3.

3.4 PANEL DEPLOYMENT

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.4.

3.5 FIELD STEAMING

3.5.1 Seam Strength

All field seams shall meet or exceed the requirements of *Table 31 05 19.17 - 4* for Geomembrane Seam Properties.

Table 31 05 19.17 - 4 LLDPE Geomembrane Seam Properties

Properties	Test Value[1]
Hot Wedge Seams[2] • shear strength, lb/in. • shear elongation at break[3], % • peel strength, lb/in. • peel separation, %	 75 50 63 25
Extrusion Fillet Seams • shear strength, lb/in. • shear elongation at break[4],% • peel strength, lb/in. • peel separation, %	 75 50 57 25

3.5.2 Installation Rate

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.5.2.

3.5.3 Overlapping

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.5.3.

3.5.4 Weather Conditions for Seaming

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.5.4.

3.5.5 General Seaming Procedures

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.5.5.

3.6 PROTECTION

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.6.

3.7 FIELD QUALITY CONTROL TRIAL SEAMS

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.7.

3.8 FIELD NONDESTRUCTIVE SEAM TESTING

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.8.

[1] Test Values are provided for 50 mil LLDPE geomembrane. For all other material thicknesses refer to GRI-GM19a.
[2] Also for hot air and ultrasonic seaming methods.
[3] Elongation measurements should be omitted for field testing
[4] Elongation measurements should be omitted for field testing

3.9 FIELD DESTRUCTIVE SEAM TESTING

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.9.

3.10 DEFECTS AND REPAIRS

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.10.

3.11 PLACEMENT OF GEOTEXTILE AND VEGETATIVE COVER LAYER MATERIALS

3.11.1 Weather Conditions

Placement of the geotextile and overlying vegetative cover layer soils on the geomembrane shall not proceed at an ambient temperature below 40°F (5°C) nor above 95°F (35°C) unless otherwise approved by the CQA Representative.

3.11.2 Material Exposure

The geomembrane shall not be left exposed (uncovered) to the elements including UV light, for any period more than sixty (60) days.

3.11.3 Soils

All soils installed in direct contact with the geomembrane shall have a maximum particle size of 3/8 inches.

3.11.4 Equipment

All materials placed over geomembrane (and other geosynthetics) shall be installed without damaging the geosynthetics. Equipment used for placing soil shall not be driven directly on the geomembrane. A minimum thickness of one (1) foot of soil is required between a light dozer (such as a low ground pressure Caterpillar D-3 or lighter) and the geomembrane. Placement of material overlying the geosynthetics shall be in conformance with the guidelines for equipment ground pressure in

Table 31 05 19.16 - 5 Soil Thickness for Equipment Operating over Geomembrane

Equipment Ground Pressure (psi)	Minimum Soil Thickness (inches)
<4	12
4-6	15
6-8	18
8-11	24

3.11.5 Heavily Trafficked Areas

In heavily trafficked areas such as access ramps, soil cover thickness shall be at least three (3) feet.

3.12 DOCUMENTATION OF CONSTRUCTION

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.12.

3.13 LANDFILL GAS CONTROL DURING INSTALLATION

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.13.

3.14 SANDBAGS

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.14.

3.15 PAYMENT

See Section 31 05 19.16 Textured LLDPE Geomembrane Liner, Paragraph 3.15.

END OF SECTION 31 05 19.17

SECTION 31 05 19.26

DRAINAGE GEOCOMPOSITE

1.0 GENERAL

1.1 SUMMARY

The work covered in this Section includes the manufacture, fabrication, testing, supply and installation of the drainage geocomposite, which consists of a core geonet layer with geotextile bonded to both sides. The CONTRACTOR shall furnish all labor, materials, transportation, handling, storage, supervision, tools, incidentals and other equipment that may be necessary install and test the drainage geocomposite as specified by the Contract Documents. All testing specified in this section is quality control (QC) testing and is the CONTRACTOR's responsibility unless otherwise noted.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARD TEST METHODS/PRACTICE:

ASTM D 792	Test Methods for Density and Specific Gravity of Plastics by Displacement
ASTM D 1505	Density of Plastics by the Density-Gradient Technique
ASTM D 1603	Carbon Black in Olefin Plastics
ASTM D 4218	Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
ASTM D 4354	Practice for Sampling of Geosynthetics and Rolled Erosion Control (RECPs)
ASTM D 4355	Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4491	Water Permeability of Geotextiles by Permittivity
ASTM D 4533	Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	Grab Breaking Load and Elongation of Geotextiles
ASTM D 4716	Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products
ASTM D 4751	Determining the Apparent Opening Size of a Geotextile
ASTM D 4873	Guide for Identification, Storage and Handling of Geosynthetic Rolls and Samples
ASTM D 5035	Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
ASTM D 5199	Measuring Nominal Thickness of Geotextiles and Geomembranes

ASTM D 5261 Measuring Mass per Unit Area of Geotextiles

ASTM D 5321 Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method

ASTM D 6241 Standard Test Method for Static Puncture Strengths of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

ASTM D 6364 Standard Test Method for Determining Short-Term Compression Behavior of Geosynthetics

ASTM D 7005 Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposite

ASTM D 7179 Standard Test Method for Determining Geonet Breaking Force

ASTM D 7238 Standard Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembranes Using Fluorescent UV Condensation Apparatus

Geosynthetic Research Institute Guide GC8 – Determination of Allowable Flow Rate of a Drainage Geocomposite.

1.3 SUBMITTALS

1.3.1 Product Information

The CONTRACTOR or drainage geocomposite installer shall submit the following product information to the ENGINEER for approval at least 30 days (unless otherwise specified) prior to procurement of the product:

1.3.1.1 Prequalification

Independent laboratory test results demonstrating compliance with the material properties listed in Table 31 05 19.26 - 2; Table 31 05 19.26 - 3; and Table 31 05 19.26 - 4. The independent laboratory tests are to be performed once for each material. In addition, the manufacturer must provide a certificate of compliance which states that the material to be installed will use the same manufacturing techniques, resin type, and formulation as that for which test results are submitted.

1.3.1.2 Roll Layout Drawings

As a minimum, include a roll layout drawing and installation details. The roll layout drawing shall be drawn to scale, and shall be coordinated with the geomembrane panel layout. Installation details shall include cross sections of toe drains, temporary anchorage, key trench and other terminations, and pipe penetrations.

1.3.1.3 Protection from Wind and Weather

Submit plans to protect the drainage geocomposite from wind, dirt, and direct sunlight.

1.3.1.4 Material Data

Complete manufacturer's specifications, descriptive drawings, and literature for the geocomposite, including the product identification and suppliers of the polymer resin and recommended methods for handling and storage of all materials prior to installation. Describe the manufacturer's methodology to comply with the requirements specified for manufacturing quality control.

1.3.1.5 Manufacturing Quality Control (MQC)

Complete description of the manufacturer's formal quality control/quality assurance programs for manufacturing, fabricating, handling, installing, and testing. The description shall include, but not be limited to, polymer resin supplier and product identification, acceptance testing, production testing, installation inspection, installation techniques, repairs, and acceptance. The document shall include a complete description of methods for both roll end and roll side joining.

1.3.1.6 Installation Instructions

Samples of the drainage geocomposite with a complete set of specifications, and manufacturer's complete written instructions for storage, handling, installation, and joining.

1.3.1.7 Qualifications

Manufacturer's qualifications for the drainage geocomposite, geotextile, and geocomposite.

1.3.1.8 Resin

The name of the resin supplier, the production plant, the brand name, and name of resin used to manufacture the product.

1.3.1.9 Factory Visit

Upon request, arrange with the geocomposite manufacturer to allow the OWNER or representative to visit to the manufacturing plant during the manufacture of material for this project, for the purpose of observing the manufacturing process and quality control procedures. Submit contact names, telephone numbers, addressed, and production schedule information.

1.3.1.10 Compatibility

Suppliers and/or manufacturers shall certify that geonet and geotextile are compatible with one another when bonded into the drainage geocomposite.

1.3.2 Manufacturing Quality Control

The CONTRACTOR shall submit quality control test reports within 48 hours of completion of tests. Submit the following manufacturing quality control information to the ENGINEER prior to material shipment:

1.3.2.1 Production Dates

Submit statement of production dates for the drainage geocomposite.

1.3.2.2 Test Reports

See Part 2 for tests and test frequencies.

1.3.3 Proof of INSTALLER'S Qualifications

The name or names of the field superintendents who will be proposed for the project and a list of completed facilities for which the field superintendent has installed drainage geocomposite totaling a minimum of 2,000,000 ft^2.

1.4 INTERFACE SHEAR TESTING

Refer to SECTION 01 45 00 - CONSTRUCTION QUALITY CONTROL for interface shear testing requirements.

2.0 PRODUCTS

2.1 MANUFACTURER'S QUALIFICATIONS

Manufacturer shall have manufactured a minimum of 5,000,000 ft^2 of drainage geocomposite. The manufacturer of the drainage material described hereunder shall have previously demonstrated his ability to produce this geonet by having successfully manufactured similar material for hydraulic conductance installations.

2.1.1 Single Source

All HDPE drainage net (geonet) used for construction of the drainage geocomposite must be obtained from a single material supplier or manufacturer. All nonwoven geotextile fused to the geonet and used for the construction must be obtained from a single material supplier. All fusion of HDPE drainage net to non-woven geotextile must be accomplished by a single material supplier or manufacturer. Suppliers and/or manufacturers shall certify that the geonet and geotextile will be compatible with one another.

2.2 HDPE DRAINAGE NET

The HDPE drainage net component of the drainage geocomposite shall be manufactured by extruding strands of material into a counter-rotating die to form a three dimensional structure to provide planar water flow.

2.2.1 Material Properties

HDPE drainage net shall meet the requirements of Table 31 05 19.26 - 2.

2.2.2 Material Composition

The HDPE drainage net shall consist of new, first-quality products designed and manufactured specifically for the intended purpose designated in this contract, as satisfactorily demonstrated by prior use. The drainage net shall contain stabilizers to prevent ultraviolet light degradation. The HDPE shall be unmodified HDPE containing no plasticizer, fillers, chemical additives, reclaimed polymers, or extenders. Carbon black shall be added to the resin for ultraviolet resistance. The only other allowable compound elements shall be anti-oxidants and heat stabilizers, of which up to one (1) percent total, as required for manufacturing, may be added.

2.2.3 Defects

The net strands shall be so produced as to be free of holes, blisters, undispersed raw materials, or sign of contamination by foreign matter. Defects discovered in the field shall be repaired by cutting out the defect and joining a new piece of net material in its place. The joint shall be placed in accordance with the requirements for field joints.

2.2.4 Labels

Labels on each roll shall identify the thickness, length, width, and manufacturer's mark number. The roll shall also indicate the date, lot and batch number of the roll, the square feet in the roll, and the total roll weight as measured after manufacture.

2.2.5 Joints

Joints shall be made in the field by factory-trained technicians using approved methods. Edges of rolled material shall be trimmed at the factory to remove nonconforming material.

2.2.6 Warranty

The net material shall meet the specification values according to the specification sheet for HDPE geonet. It shall have a warranty of a minimum 20 years relative to materials, and 1 year on installation.

2.3 GEOTEXTILE

2.3.1 General

Geotextile shall be of the type specified on the drawings or an approved equal. Manufacturer shall submit a certificate to the Engineer stating the name of the manufacturer, the chemical composition of the filaments or yarns, and other pertinent information so as to fully describe the geotextiles. At a minimum the other pertinent data shall include Grab Strength, Elongation, Puncture Strength, and Apparent Opening Size.

2.3.2 Material Properties

The geotextile component of the composite geonet shall meet the requirements of Table 31 05 19.26 - 3.

2.4 DRAINAGE GEOCOMPOSITE

The material shall meet the requirements of Table 31 05 19.26 - 4. It is comprised of three layers: a lower geotextile, a middle HDPE drainage net (geonet), and an upper geotextile. The lower and upper geotextiles shall be heat bonded to the middle HDPE drainage net.

2.4.1 Manufacture

The drainage geocomposite shall be fabricated by heat bonding the geotextile to both sides of the HDPE drainage net. Heat bonding shall prevent flattening of filter fabric and surface. Glues and adhesives shall not be permitted to bond materials. No burn through of geotextiles will be permitted. No glue or adhesive shall be permitted. The bond between the geotextile and the HDPE drainage net shall meet the requirements of Table 31 05 19.26 - 4.

2.4.2 Labels

Drainage geocomposite shall be supplied in rolls, marked or tagged with the following information:

- Manufacturer's name
- Product identification

- Lot number
- Roll number
- Roll dimensions

2.4.3 Certification

Contractor shall provide the manufacturer's certificate prior to delivery of the material. The manufacturer shall certify in writing that the material supplied meets the minimum specifications. The certificate shall be signed by a person with authority to bind the manufacturer and shall be notarized.

2.4.4 Roll Dimensions

The HDPE drainage net shall be supplied as a continuous sheet with no factory seams. During installation, the roll length shall be maximized to provide the largest manageable roll for the fewest field seams. Rolls shall be wound on a core which shall be stable enough to support the rolls during handling and shipping.

2.5 MANUFACTURING QUALITY CONTROL TESTING

All of the specified tests are the CONTRACTOR's responsibility. Testing during manufacturing shall be accomplished by the manufacturer's laboratory.

HDPE resin shall be tested at a frequency of one test per resin batch for compliance with Table 31 05 19.26 - 1, HDPE Drainage Net Properties. One batch is defined as one rail car load of resin. The finished rolls of the drainage net shall be identified by a roll number corresponding to the resin batch used. The following minimum test frequencies shall be observed:

Table 31 05 19.26 - 1 HDPE Drainage Net Resin Properties

Properties	Test Method	Test Value	Testing Frequency (minimum)
Minimum Polymer Density, g/cm^3	D 1505 / D 792 Method B	0.940	per batch
Maximum Polymer Melt Index, g/10 max	D 1238, Condition E	1.0	per batch

HDPE drainage net shall be tested during manufacturing for compliance with Table 31 05 19.26 - 2. The minimum test frequencies in Table 31 05 19.26 - 2 shall be observed.

Table 31 05 19.26 - 2 HDPE Drainage Net Properties (before lamination)

Properties	Test Method	Test Value	Testing Frequency (minimum)
Thickness, mils (min. ave.)	D 5199	270	50,000 lb.
Density[1], g/cc (min. ave.)	D 1505 / D 792 Method B	0.95	50,000 lb.

[1] Density is of the formulated material; the base resin will be slightly lower.

Properties	Test Method	Test Value	Testing Frequency (minimum)
Carbon Black Content, % (range)	D 1603 / D 4218	1.5 to 3.0	100,000 lb.
Tensile Strength[2], lb. (min. ave.)	D 7179	60	50,000 lb.
Compressive Strength[3], lb/in.^{2} (min. ave.)	D 6364	120	100,000 lb.

Geotextile shall be tested during manufacturing for the compliance with Table 31 05 19.26 - 3. The minimum test frequencies in Table 31 05 19.26 - 3 shall be observed.

Table 31 05 19.26 - 3 Geotextile Properties (before lamination)

Properties	Test Method	Test Value	Testing Frequency (minimum)
Mass/Unit Area, oz/sy (MARV)	D 5261	8	200,000 lb.
Grab Strength, lb. (MARV)	D 4632	200	200,000 lb.
Grab Elongation, % (MARV)	D 4632	50	200,000 lb.
Tear Strength, lb. (MARV)	D 4533	80	200,000 lb.
Puncture Strength, lb. (MARV)	D 6241	430	200,000 lb.
Permittivity, sec^{-1} (MARV)	D 4491	0.2	200,000 lb.
AOS, mm (MaxARV)	D 4751	0.25	200,000 lb.
UV Stability, % ret. (500 hr.)	D 4355	50	200,000 lb.

Drainage geocomposite shall be tested during manufacturing for compliance with Table 31 05 19.26 - 4. The minimum test frequencies in Table 31 05 19.26 - 4 shall be observed:

Table 31 05 19.26 - 4 Geocomposite Properties

Properties	Test Method	Test Value	Testing Frequency (minimum)
Transmissivity[4], m^2/sec (min.-ave.)	D 4716 (GRI-GC8)	4.5×10^{-4}	200,000 lb.
Ply Adhesion[5], lb./in. (min. ave.)	D 7005	1.0	100,000 lb.

[2] This is the average peak value for five equally spaced machine direction tests across the roll width.
[3] Test to be conducted using the movable plate method.
[4] Drainage geocomposite should be tested using flexible boundaries at a hydraulic gradient of 0.33; a pressure of 1,000 lb./ft^2, a seating dwell time of 15 min, and 100-hr testing duration. Test values are for machine direction only. Testing will include drainage geocomposite and representative soil (such as Ottawa sand) within the testing plates.
[5] This is the average of five equally spaced machine direction tests across the roll width per side of the geocomposite.

The CONTRACTOR shall inspect every roll for bonding integrity between the HDPE drainage net and the geotextile. All poorly bonded and/or delaminated material shall be rejected.

2.6 INTERFACE SHEAR TESTING

2.6.1 Friction Angle Testing Method

Contractor shall conduct interface testing by direct shear in accordance with ASTM D5321 to confirm a minimum interface friction angle of 24 degrees (peak value), or equivalent shear strength when considering adhesion value, for the interfaces listed in 4.1.2. Soil samples will be prepared by compacting to 90% maximum dry density at ±3% of optimum moisture. Test samples shall be wetted at the soil and geosynthetic contact surface by spraying during shear box assembling. For capping, soil samples will be consolidated under normal loads, applied incrementally at least 24 hours prior to testing, of 200 psf, 400 psf, and 600 psf with a minimum displacement of 3 inches.

2.6.2 Interfaces

Test each interface individually to be used on this Project using representative samples of materials to be supplied under normal loads indicated and using test parameters as specified by Engineer. For capping, interfaces to be tested are (top layer against bottom layer):

- Drainage geocomposite against LLDPE geomembrane
- Erosion control soil layer against drainage geocomposite

2.7 SHOP DRAWINGS SUBMITALS

2.7.1 Material Properties

In order to qualify as an approved drainage material, the Contractor shall submit material samples, minimum specifications and warranty to the Engineer. The specification sheet shall give full details of minimum physical properties and test methods used, joining methods, and a certificate confirming compliance of the material with the minimum specifications. A list of similar projects completed in which the manufactured material has been successfully used shall be submitted to the Engineer.

2.7.2 Physical Requirements

The Contractor shall submit a certification from the manufacturer of the geonet, stating that the geonet meets physical property requirements for the intended application, and that the geonet meets the physical requirements for the manufacture and installation of HDPE landfill drainage media.

2.7.3 Minimum Specifications

At the time of delivery, the manufacturer shall certify in writing that the material supplied meets the minimum specifications. The certificate shall be signed by a person with authority to bind the manufacturer and shall be notarized.

2.7.4 Resin

The manufacturer shall submit results of confirmation testing showing that the material lot of the resin used in the geonet supplied meets the material requirements for the resin. A description of the quality control steps used during manufacture shall also be provided.

2.8 INSTRUCTIONS AND DRAWINGS REQUIRED AFTER CONTRACT AWARD

2.8.1 Storage, Handling, Installation, and Joining

The Contractor shall furnish complete written instructions for the storage, handling, installation, and joining of the net in compliance with this specification and the condition of his warranty.

2.8.2 Repair

The manufacturer shall furnish complete written instructions for the repair of HDPE geonet material.

2.8.3 Layouts

The manufacturer or his designated representative shall furnish layouts and details as required for the net installation. Details of placement around net penetrations such as pipes shall be provided as well. The above details must be approved by the CQA Engineer prior to net installation. Material left outside shall be covered to reduce accumulation of dust in the net and to protect it from ultraviolet light.

3.0 INSTALLATION

3.1 DURING CONSTRUCTION CONFORMANCE TESTING

At the direction of the CQA Representative, the Geosynthetic INSTALLER shall take samples from the delivered lot and sent to the CQA Geosynthetic Laboratory for conformance testing. The cost for laboratory conformance testing shall be paid by the OWNER. The conformance tests and minimum frequency outlined in *Table 31 05 19.16 - 5* are required prior to installation. Results must meet property requirements in *Tables 31 05.19.16 – 2 and 31 05.19.16 – 4*.

Table 31 05 19.16 - 5 Conformance Testing Requirements

Properties	Test Method	Testing Frequency (minimum)
Thickness, mils (min. ave.)	D 5199	1 per 100,000 ft^2
Transmissivity[6], m^2/sec (min.-ave.)	D 4716 (GRI-GC8)	
Ply Adhesion[7], lb./in. (min. ave.)	D 7005	

All conformance test results shall be reviewed and approved by the ENGINEER prior to any placement. If a conformance test result fails the specifications, at least two additional conformance tests shall be performed on samples taken immediately from adjacent numbered rolls. If both additional conformance test results pass the specifications, the entire lot shall be accepted except that roll from which the failed sample is taken. If any of the conformance test results fails for the two (minimum) additional samples, the entire lot shall be rejected by the ENGINEER.

3.2 STORAGE

3.2.1 Storage Area

Storage of the rolls shall be the responsibility of the installer. A dedicated storage area shall be selected at the job site that is away from high traffic areas and is level, dry, and well drained. The Owner shall approve the storage area.

3.2.2 Stability

Rolls shall be stored in a manner that prevents sliding or rolling from the stacks and may be accomplished by the use of chock blocks or by use of the dunnage shipped between rolls. Rolls shall be stacked at a height no higher than that at which the lifting apparatus can be safely handled (typically no higher than four).

3.2.3 Protection

Stored materials must be off of the ground and be covered with a plastic sheet or tarpaulin until their installation.

3.2.4 Labels

The integrity and legibility of the labels shall be preserved during storage.

[6] Drainage geocomposite should be tested using flexible boundaries at a hydraulic gradient of 0.33; a pressure of 1,000 lb./ft^2, a seating dwell time of 15 min, and 100-hr testing duration. Test values are for machine direction only. Testing will include drainage geocomposite and representative soil (such as Ottawa sand) within the testing plates.

[7] This is the average of five equally spaced machine direction tests across the roll width per side of the geocomposite.

3.3 FIELD QUALITY CONTROL

3.3.1 Field Joining

The CONTRACTOR shall inspect all roll end joints and roll edges. The results of these inspections shall be documented in the daily reports. Field joints shall comply with the requirements of Table 31 05 19.26 - 5.

Table 31 05 19.26 - 5 Drainage Geocomposite Joining Methods

Location	Layer	Joining Method	Minimum Overlap	Tying Frequency
Roll End	Upper Geotextile Geonet Lower Geotextile	Machine Sewing Nylon Ties Overlap	4" 12" 6"	N/A 2' on Center N/A
Roll Side	Upper Geotextile Geonet Lower Geotextile	Machine Sewing Nylon Ties Overlap	4" 4" 6"	N/A 5' on Center N/A
Repair of Minor Damage[8]	Upper Geotextile Geonet	Machine Sewing N/A	4" N/A	N/A N/A

3.3.2 Quality Control Reporting Procedures

All information regarding the installation of the drainage geocomposite shall be recorded in the CONTRACTOR's daily report. This information shall include:

- Reference to product submittals, certifications, substitutions and approvals;
- Dates of installation;
- Location and quantity of materials installed;
- Statement whether materials were installed in accordance with the Technical Specifications;
- All product certifications, filed appropriately for future reference; and
- Additional information as required.

3.4 CLEANLINESS

Both drainage geocomposite and the underlying Geomembrane shall be clean, dry, and free of dirt and dust during installation. If dirt, dust, or water is present, the CONTRACTOR shall clean the work area. Drainage geocomposite which is wet, dirty or muddy shall be discarded and shall not be installed.

[8] Minor damage is defined in paragraph 123.6.2

3.5 ROLL JOINING METHODS

Table 31 05 19.26 - 5 summarizes acceptable roll joining methods.

3.5.1 Lap Seams

The bottom layer of geotextile shall be lap seamed. Lap seaming is accomplished by overlapping adjacent geotextile a minimum of 6 inches.

3.5.2 Nylon Ties

The GDN material shall be overlapped and fastened with nylon ties. Nylon ties shall be yellow or white in color to facilitate inspection.

3.5.3 Machine Sewn Seams

Sewing shall be accomplished with a chain-stitching sewing machine. The thread shall be polymeric thread which complies with geotextile manufacturer's recommendations and is a color which contrasts with the color of the geotextile. The seam shall be placed a minimum of 4 inches from the geotextile edges. The finished seam shall be folded to one side ("J" seam) and be secured with a double row of stitches. There shall be no horizontal seams except at roll ends on slopes greater than 5 (horizontal) to 1 (vertical).

3.5.4 Roll Ends

At roll ends the material shall be overlapped a minimum of 1 foot. Roll ends shall be shingled; the uphill roll end shall be overlapped one foot over the downhill roll end. At roll ends, the drainage net shall be tied every 2 feet (on centers) at a minimum. The bottom layer of geotextile shall be overlapped a minimum of six (6) inches. The upper layer of geotextile shall be machine sewn.

3.5.5 Adjacent Roll Sides

At roll sides the material shall be overlapped a minimum of 4 inches. The bottom geotextile shall be lap seamed. The HDPE drainage net shall be overlapped and tied a minimum of 5 feet on center. The upper layer of geotextile shall be machine sewn.

3.6 INSTALLATION

The Drainage geocomposite shall be installed in accordance with the manufacturer’s recommendations and as specified herein. In case of a conflict between requirements, the more stringent shall apply.

3.6.1 Methods

The installation of the HDPE geonet shall be done with labor and equipment provided by an approved Contractor. The manufacturer shall provide the proper cutting equipment for the installation. Only installation methods approved by the manufacturer and the Engineer in accordance with this specification shall be used.

3.6.2 Instructions

The drainage geocomposite shall be installed in accordance with manufacturer's instructions.

3.6.3 Cleanliness

Drainage geocomposite shall be free of dirt and dust when installed. If dirt or dust is present, the Contractor shall wash the geonet until clean as directed by the QAO.

3.6.4 Grading

Drainage geocomposite shall be unrolled and installed to the lines and grades shown on the Drawings.

3.6.5 Anchoring

Drainage geocomposite shall be anchored at the top of slopes in an anchor trench as shown on the drawings. Care shall be taken not to entrap small stones, from the anchor trench excavation, in the net channels.

3.6.6 Wrinkles

After being secured in the anchor trench, the drainage geocomposite shall be stretched to minimize wrinkle formation.

3.6.7 Orientation

Drainage geocomposite shall be rolled down the slope in such a manner as to continually keep the material in tension. If necessary, the material shall be positioned by hand after unrolling to minimize wrinkles. The material shall not be unrolled horizontally (i.e., across the slope).

3.6.8 Wind

The CONTRACTOR shall provide sufficient ballast and temporary anchorage to protect the material from wind damage or displacement. The CONTRACTOR is responsible for protecting the material from damage due to weather at all times.

3.6.9 Physical Damage

3.6.9.1 Personnel Traffic

Personnel walking on the material shall not engage in activities or wear footwear that could damage the material. Smoking shall not be permitted on or near the geosynthetics.

3.6.9.2 Vehicular Traffic

Vehicular traffic shall not be permitted on the geosynthetics. Equipment shall not damage the material by handling, trafficking, or leakage of hydrocarbons. The surface shall not be used as a work area for preparing patches, storing tools and supplies, or other uses.

3.6.10 Bridging

The material shall be installed to avoid bridging.

3.6.11 Corners

In corners, where overlaps between rolls are staggered, an extra roll shall be installed from the top to the bottom of the slope to provide a smooth, protected surface.

3.6.12 Weather Protection

Drainage geocomposite shall be protected from direct sunlight or precipitation prior to installation. After installation this material shall have minimal exposure to direct sunlight and shall be completely protected from direct sunlight within 30 days of installation. Material which is exposed to direct sunlight for 30 days or more shall be replaced at the CONTRACTOR's expense.

It is the CONTRACTOR's responsibility to provide all labor and materials for protection of the drainage geocomposite during the period of time prior to installation of overlying materials. The CONTRACTOR's protection method is subject to the approval of the ENGINEER.

3.7 REPAIRS

3.7.1 Limitations

Damaged, soiled, or delaminated drainage geocomposite shall be removed and discarded.

3.7.2 Minor Damage

Minor damage is defined as a defect or hole in the material that is smaller than 2 inches in its lesser dimension. Minor damage may be repaired by snipping out any protruding drainage net and machine sewing a geotextile patch over the hole. The patch shall be a minimum of 24 inches larger that the damaged area in all directions.

3.7.3 Major Damage

Major damage is defined as a defect or hole in the material that is 2 inches or larger in its lesser dimension. Major damage shall be repaired by replacing the entire drainage geocomposite panel width. Geotextile fabric shall be continuously sewn on large repairs.

3.8 FIELD DAMAGE

3.8.1 Protection

The Contractor shall take every precaution to protect the net from damage due to natural and field conditions. As the panels are placed, they shall be secured to limit excessive movement.

3.8.2 Wind Damage

Panels moved by the wind shall be inspected and, if damaged, shall be replaced or repaired as required in the judgment of the QAO. Similarly, panels that have developed excessive wrinkles, particularly at the toe of slopes shall be inspected and repaired or replaced as necessary.

3.9 PLACEMENT OF COVER MATERIAL

3.9.1 Protection

Cover material such as soil, stone, or geomembrane liners that is placed over geonets shall be placed in such a manner as to verify that the geonet is not damaged.

3.9.2 Slippage

Care shall be taken to minimize slippage of the geonet and to verify that no tensile stress is induced in the geonet.

3.10 RECORDS AND QUALITY ASSURANCE

3.10.1 Records

The installation of the geocomposite shall be monitored by QAO provided by the Owner. The purpose of the third-party monitoring shall be to document the installation of the geonet. The following records shall be kept by the installer as part of the installation process:

- Panel Placement Checklist
- Repair and Patching Checklist

3.10.2 Documentation of Defects

The geocomposite may not be covered until defects, patched, etc. have been properly logged.

3.10.3 Report Submission

The reports shall be turned over to the QAO for review on a daily basis. Reports shall be complete within 24 hours of the installation of the panel, joint, repair, etc.

3.10.4 Warranty

The manufacturer/installer shall provide a written warranty for materials for a period of no less than 10 years. A written warranty for 1 year shall also be provided for quality of workmanship.

END OF SECTION 31 05 19.26

SECTION 31 10 00

CLEARING, GRUBBING, AND STRIPPING

1.0 GENERAL

1.1 SUMMARY

1.1.1 Scope

The CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required for site clearing work.

1.1.2 Section Includes:

- Removing surface debris.
- Removing designated trees, shrubs, and other plant life.
- Removing abandoned utilities.
- Excavating topsoil.

1.1.3 Work Specified Elsewhere

- Section 31 00 00 Earthwork
- Section 31 23 33 Trenching, Backfilling, and Compacting
- Section 31 25 00 Erosion and Sediment Control

1.2 DEFINITIONS

1.2.1 Clearing

Clearing shall consist of removing vegetation, including trees and brush, and debris that exists within the construction limits.

1.2.2 Grubbing

Grubbing shall consist of removing and disposing of stumps, roots larger than 1 inch in diameter, and matted roots from within the construction limits.

1.2.3 Topsoil

Topsoil shall consist of fertile natural, friable soil obtained or salvaged or manufactured from the surface of the site and which is suitable for support of vegetative growth. Topsoil shall have an organic content of between 1.5 and 10 percent by weight and be free from large stones, roots,

sticks, clay peat, weeds and sod. It shall not be excessively acid or alkaline nor contain toxic material harmful to plant growth.

1.3 QUALITY ASSURANCE

1.3.1

All materials and labor furnished under this section shall comply with ASTM, AA, NEC, ANSI and all other applicable Federal, State and County codes and regulations including revisions to date of contract.

1.3.2

Perform Work in accordance with Virginia Department of Transportation Road and Bridge Specifications (2020) where applicable.

1.3.3

Conform to applicable Virginia code for environmental requirements, disposal of debris, and burning debris on site.

1.3.4

Coordinate Clearing Work with utility companies.

1.4 REQUIREMENTS INCLUDED

Provide personnel, equipment, materials and supplies to clear and grub necessary areas of the project site.

2.0 PRODUCTS

Not used.

3.0 EXECUTION

3.1 EXAMINATION

3.1.1

Verify existing plant life designated to remain is tagged or identified.

3.1.2

Identify waste area for placing removed materials. The waste/salvage area shall be approved by the ENGINEER or OWNER prior to placement of materials.

3.2 PROTECTION

3.2.1

Locate, identify, and protect utilities indicated to remain, from damage.

3.2.2

Protect bench marks, survey control points, wells, probes, and existing structures from damage or displacement.

3.3 REMOVAL

3.3.1

Clearing and grubbing of vegetative cover shall be performed in the required areas only. Required areas include the earthwork areas, stockpiles, and other areas as noted on the Contract Drawings. Vegetation in other areas shall be undisturbed.

3.3.2

Grassy vegetation and topsoil shall be stockpiled for later use by the landfill operator. The stockpile shall be located in a safe area identified by the landfill staff and be adequately protected by temporary seeding and mulching.

3.3.3

Trees and brush shall be taken down and stumps pulled. The wood shall be hauled to a permitted disposal or processing facility. Stumps and roots shall be removed with a root rake or similar equipment in such a manner that maximizes the separation of roots and topsoil or subsoil. Open burning of cleared debris is prohibited.

3.3.4

Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform to the original adjacent surface of the ground.

3.4 DUST CONTROL

The CONTRACTOR shall be responsible for controlling objectionable dust by his operation of vehicles and equipment during all land disturbing activities. The CONTRACTOR shall use methods, subject to the ENGINEER'S approval, that keep dust in the air to a minimum and to the satisfaction of the ENGINEER.

END OF SECTION 31 10 00

SECTION 31 23 33

TRENCHING, BACKFILLING AND COMPACTING

1.0 GENERAL

1.1 DESCRIPTION

The work in this section includes all labor, materials, equipment and incidentals required to perform all trenching-related earthwork including trench excavation, backfilling, compaction, grading, stockpiling, and disposing of earth and waste materials required for the purpose of erosion control, site grading, drainage pipe trenches and bedding, stormwater drainage structures, sediment basins and related structures, landfill gas system and appurtenances as shown on the PLANS, specified herein and General Conditions.

1.1.1 Related Work Specified Elsewhere

- Section 31 00 00 Earthwork
- Section 31 05 16 Aggregates

1.2 REQUIREMENT INCLUDED

Provide personnel, equipment, and materials to excavate and backfill trenches for all underground pipelines and related structures only.

1.3 REFERENCE SPECIFICATIONS

Reference specifications applicable to work under this section are referred to by abbreviation as follows:

1.3.1 American Society for Testing and Materials (ASTM)

- ASTM E11 Wire Cloth Sieves for Testing Purposes
- ASTM C88 Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- ASTM C131 Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- ASTM D75 Sampling Aggregates
- ASTM D698 Laboratory Compaction Characteristics Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

- ASTM D1556 Density and Unit Weight of Soil in Place by the Sand Cone Method
- ASTM D2434 Permeability of Granular Soils (Constant Head)
- ASTM D2487 Classification of Soils for Engineering Purposes
- ASTM D3740 Standard Practice for Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
- ASTM D5084 Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
- ASTM D6913 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
- ASTM D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- ASTM D7928 Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis
- ASTM E329 Standard Practice for Use in Evaluation of Testing and Inspection Agencies as Used in Construction

1.4 GENERAL NOTES

1.4.1 OSHA

The CONTRACTOR shall perform all construction operations in accordance with the U.S. "Occupational Safety and Health Act of 1970," the Standards of the U.S. Department of Labor, Occupational Safety and Health Administration and the latest amendments thereto.

1.4.2 DOLI

The CONTRACTOR shall perform all construction operations in accordance with the "Rules and Regulations Governing the Safety and Health of Employees Engaged in Construction" as adopted by the Safety and Health Codes Commission of the Commonwealth of Virginia and all latest revisions thereto and issued by the Department of Labor and Industry.

1.4.3 Explosives

Use of explosives is not permitted unless authorized in writing by the Engineer. Store and use explosives in accordance with Federal, State and local regulations. The CONTRACTOR shall be responsible for and shall satisfactorily correct all damage resulting from use of explosives.

1.4.4 Existing Structures

Protect structures, roadways, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by trenching operations.

1.4.5 Subsurface Materials

All excavation is unclassified and no additional payment will be allowed regardless of materials encountered.

1.4.6 Owners Operations

The CONTRACTOR recognizes that this construction is adjacent to an existing municipal solid waste landfill. As such, there is the potential for methane gas and other gases to migrate from the landfill and concentrates in confined spaces such as trenches. The CONTRACTOR shall take all appropriate precautions and measures to protect his workforce from the dangers of this environment.

1.5 DEFINITIONS

1.5.1 General Fill Material

Soil materials obtained from on-site and off-site borrow sources having unspecified soil classification suitable for filling, backfilling, and grading within designated locations.

1.5.2 Select Backfill Material

Granular commercial sources having specified characteristics and designated or reserved for use for specified purposes.

1.5.3 Topsoil

A fertile, natural or amended soil, typical of locality, free from large stones, roots, sticks, clay, weeds, and sod, and suitable for use as a growing medium for vegetation.

1.5.4 Maximum Dry Density

Maximum Dry Density: Maximum dry weight in pounds per cubic foot (pcf) of a specific soil material as determined by ASTM D698 (Standard Proctor).

1.5.5 Optimum Moisture Content

The moisture content at which the maximum dry density of a soil material is determined by ASTM D698 (Standard Proctor).

1.6 QUALITY CONTROL

1.6.1 Qualifications

1.6.1.1

Products used in the work of this section shall be produced by those who are regularly engaged in the production and/or supply of similar items for at least five (5) years and which have a history of successful production, acceptable to the Engineer.

1.6.1.2

Use adequate number of skilled workmen who are thoroughly trained and experienced in the specified requirements and the methods needed for proper performance of the work in this Section.

1.7 SUBMITTALS

1.7.1 Compaction Equipment

The CONTRACTOR shall supply data on the compaction equipment to the ENGINEER not less than five (5) days prior to the intended use of this equipment and the equipment shall be approved by the ENGINEER prior to commencing compaction operations. The approval of the ENGINEER shall be construed merely to mean that at the time the ENGINEER knows of no good reason for objecting thereto; and no such approval shall release the CONTRACTOR from his full responsibility for the accurate and complete performance of the Work in accordance with the Contract Documents.

1.7.2 Materials

Refer to individual specification sections for material requirements.

1.7.3 Shop Drawings

Refer to individual specification sections for shop drawings requirements.

1.8 PROJECT CONDITIONS

1.8.1 Existing Structures

Shown on the PLANS are surface and underground structures adjacent to the work. Included, but not limited to, the active landfill area leachate manholes and trunk lines, groundwater monitoring well locations, utilities, and drainage culverts. This information has been obtained from existing records and is shown for the convenience of the CONTRACTOR. The CONTRACTOR shall explore ahead of the work to determine the exact location of all structures. They shall be supported and protected from injury by the CONTRACTOR. If they are broken or injured, they shall be restored immediately by the CONTRACTOR at his expense.

1.8.2 Dust Control

The CONTRACTOR shall conduct all operations and maintain the area of his activities, including sweeping and sprinkling of roadways, so as to minimize the creation and dispersion of dust.

1.8.3 Traffic

Traffic inside the site is anticipated. The CONTRACTOR shall coordinate with the OWNER regarding traffic control during construction. CONTRACTOR shall be responsible to maintain accessibility to the working face of the active landfill and for all landfill operations.

2.0 PRODUCTS

2.1 PIPE BEDDING FILL

Granular backfill shall meet requirements for coarse aggregates, Section 203 Virginia Department of Transportation (VDOT) Specification, Size No. 3, or other Size No. as indicated in the PLANS.

2.2 SELECT BACKFILL

Clean earth fill shall be approved material free from debris, frozen materials, organic materials, rock or gravel larger than one inch in any dimension, or other harmful matter.

2.3 GENERAL FILL

Refer to Section 31 00 00 (Earthwork).

2.4 OTHER MATERIALS

All other materials, not specifically described, but required for proper completion of the work shall be selected by the CONTRACTOR and approved by the ENGINEER.

3.0 EXECUTION

3.1 EXAMINATION

Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected and approved by the ENGINEER.

3.2 UTILITIES

Locate existing utilities, culverts, and structures above or below ground before any excavation starts. Coordinate work with Miss Utility and individual utility companies. Protect, maintain service, and prevent damage to utilities not designated to be removed. When utilities are encountered and are not shown on the Contract Drawings, or when locations differ from those shown on the Contract Drawings, notify ENGINEER for instructions before proceeding.

3.3 HIGHWAY RIGHTS-OF-WAY

Work within existing or proposed Virginia State Rights-of-Way shall meet requirements of the Virginia Department of Transportation.

3.4 PREPARATION

Remove water to prevent softening of foundation bottom, and soil changes detrimental to stability of subgrades and foundations. Subgrade soils which become soft, loose, "quick", or otherwise unsatisfactory for support of structure as a result of inadequate dewatering or other construction

methods shall be removed, replaced, and compacted to a density equal to or greater than the requirements for the subsequent fill material at the CONTRACTOR's expense.

3.5 UNAUTHORIZED EXCAVATION

Where unauthorized excavations have been carried beyond points required, restore these areas to the elevations and dimensions shown on the plans with clean earth fill. Work shall be performed at no additional cost to the OWNER.

3.6 UNSATISFACTORY MATERIAL

Where removal of unsatisfactory material is due to fault or negligence of the CONTRACTOR, by inadequate shoring or bracing, dewatering, material storage or other failure to meet specified requirements, work shall be performed at no additional cost to the OWNER.

3.7 TRENCH EXCAVATION

3.7.1

Excavate to the dimensions and elevations shown on the plans.

Open trenches only so far in advance of pipe laying as permitted by ENGINEER. In no case shall more than 200 feet of trench be opened at one time. Trenches shall be backfilled at the end of each working day except where otherwise permitted.

3.7.2

Unless otherwise depicted on the plans, the width of the trench at and below the top of the pipe shall not exceed the outside diameter of the pipe plus 18 inches except that for pipe 12 inches or less in diameter, the trench width shall not exceed 33 inches. Where this width is exceeded, CONTRACTOR shall provide for increased pipe loading as directed by the ENGINEER. The minimum clear width of the trench, sheeted or unsheeted measured at the springline of the pipe should be one foot greater than the outside diameter of the pipe.

3.7.3

The trench walls above the top of the pipe may be sloped or the trench, above the top of the pipe, may be widened as necessary for bracing, sheeting and shoring. All trenching, bracing, shoring, and sheeting shall be performed in accordance with OSHA requirements.

3.7.4

Excavate trenches for gravity lines to elevations shown on Contract Drawings. Excavate trenches for pressure lines to elevations shown on Contract Drawings or to depths specified in other sections of this Division.

3.7.5

The bottom of the trench for gravity lines shall be as specified herein under "Pipe Bedding."

3.7.6

The bottom of the trench for pressure lines shall be shaped to fit the bottom of the pipe as specified herein under "Pipe Bedding."

- Excavate for bell holes at each joint.
- Where rock is encountered, excavate a minimum of 6 inches below the bottom of the pipe for bedding.

3.7.7

Dewater excavation as necessary to provide proper protection. If deemed necessary, the ENGINEER may require continuous dewatering 24 hours per day by adequate pumping or well-points until backfilling is completed. The method and equipment used for dewatering shall be subject to the approval of the ENGINEER.

3.7.8

Where unsuitable soil is encountered, excavate to depth determined by ENGINEER and replace with select backfill thoroughly and uniformly compacted. Material such as clay mass, frozen materials, cinders, ashes, refuse, and vegetable or organic material shall be construed as unsuitable material for backfill.

3.7.9

Where underground streams or springs are found, provide temporary drainage and notify ENGINEER.

3.7.10

Continuously remove from the project site and dispose of material unsatisfactory for backfill and all excess material with the progress of the Work.

3.7.11

Remove shoring and all form materials unless ordered to remain.

3.7.12

Where rock is encountered so that a manhole, vault, or other structure will bear on rock, it shall be used to support the foundation. Where only a part of the foundation will be on rock, at least 8 inches of compacted granular material shall be provided below bottom of footings.

3.7.13

Blasting for the excavation of trenches shall require prior written approval by the ENGINEER.

3.7.14

Provide a minimum of 8 inches between rock excavation and sides of structures.

3.8 TRENCH EXCAVATION FOR AIR, LANDFILL GAS AND FORCEMAIN PIPES, AND LIQUIDS MANAGEMENT STRUCTURES

3.8.1

Trench width shall be minimized to greatest extent practical but shall conform to the following:

- Sufficient to provide room for installing, jointing, and inspecting piping, but in no case wider at top of pipe than pipe barrel outside diameter plus 18 inches unless otherwise depicted on the plans or approved by the ENGINEER.
- Trench enlargements at pipe joints.
- Sufficient for sheeting, bracing, sloping, and dewatering.
- Sufficient to allow thorough compacting of backfill adjacent to bottom half of pipe.

3.8.2

Excavate trenches to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil.

3.8.2.1

For pipes less than 6 inches in nominal size, do not excavate beyond indicated depths. Excavate bottom cut to accurate elevations and support pipe on undisturbed soil.

3.8.2.2

For pipes 6 inches or larger in nominal size, shape bottom of trench to fit bottom of pipe. At each pipe joint, dig bell holes to relieve pipe bell of loads and ensure continuous bearing of pipe barrel on bearing surface.

3.8.3

No more than 200 feet of trench within landfill area may be opened in advance of pipe laying operations at one time unless approved by the ENGINEER.

3.8.4

All trenches shall be constructed in a uniform grade, and free of standing water. The CONTRACTOR shall be responsible for maintaining these conditions. Subgrade soils that become soft, loose, or unsatisfactory as a result of inadequate dewatering and cannot be stabilized or recompacted shall be removed and replaced by VDOT Size No. 3 stone or approved equal at the CONTRACTOR'S expense.

3.8.5

Excavation for appurtenances shall maintain a minimum clearance of 12 inches between their outer surfaces and the face of the excavation, or sheeting, if used.

3.8.6

Document the location, elevation, size, material type and function of all new subsurface installations, and utilities encountered during the course of construction and include this information as part of the Record Plans prior to the ENGINEER'S approval of payment for that work.

3.9 SHEETING

3.9.1

Maintain trench walls in a safe condition at all times. Provide sheeting, shoring, and bracing as necessary to prevent cave-in of excavation or damage to existing structures on or adjoining the site.

3.9.2

Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

3.9.3

All costs of providing sheeting and shoring shall be borne by the CONTRACTOR.

3.9.4

Maintain sheeting, shoring and bracing in excavations regardless of time period excavation will be open. Carry down sheeting, shoring, and bracing as excavation progresses in accordance with the proper authority.

3.9.5

Sheeting, shoring and bracing left in-place shall be cut off to a depth of not less than 18 -inches below grade.

3.10 PIPE BEDDING

3.10.1

Bed all pipe in accordance with bedding details as shown on the Permit Drawings.

3.10.2

Except where otherwise shown on the Contract Drawings, all gravity lines using rigid pipe such as concrete, etc. shall be Class C bedding as a minimum.

3.10.3

Except where otherwise shown on the Contract Drawings, all gravity lines using flexible pipe such as HDPE, etc. shall be Class B-1 bedding as a minimum.

3.10.4

Compact pipe bedding by tamping or rodding to prevent settlement. Pipe bedding shall be an approved granular material compacted to a minimum 95% of theoretical maximum density as determined by ASTM D698. The bedding shall have a minimum thickness of six inches under the barrel and shall extend to four inches over the crown of the pipe.

3.10.5

Fine aggregate bedding shall meet requirements for fine aggregates, VDOT Road and Bridge Specifications, latest edition.

3.10.6

Coarse aggregate bedding shall meet requirements for coarse aggregates, VDOT Road and Bridge Specifications, latest edition.

3.11 TRENCHING BACKFILL

3.11.1

Backfill trench to a compacted depth of 1 foot over the pipe with select backfill in accordance with the details shown on the Contract Drawings. Backfill shall be placed by hand, uniformly on each side of the pipe and compacted in layers not exceeding 6 inches in compacted thickness. Do not backfill on muddy or frozen soil, or with muddy or frozen soil.

3.11.2

Backfill trench from 1 foot above the pipe to grade with clean earth fill free of stones not larger than 5 inches or 1/2 the layer thickness, whichever is smaller. Layers shall not exceed 12 inches in compacted thickness, except that under road shoulders and under existing or future paved areas, layers shall not exceed 6 inches in compacted thickness. Backfill shall be compacted to the density specified for the areas in which it is located except that minimum compaction in any area shall be to the density of the adjacent soil.

3.11.3

For excavation depressions caused by removal of stumps or other clearing operations to firm subgrade, fill with clean earth fill and compact as specified.

3.11.4

Place backfill materials evenly adjacent to structures. Take care to prevent wedging action of the backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift.

3.11.5

Compact soil materials using equipment suitable for materials to be compacted in the specific work areas locations. Use power-driver hand tampers for compacting materials adjacent to structures.

3.11.6

Compact aggregate fill placed around manholes or other structures to required density.

3.11.7

For horizontal landfill gas trenches, backfill trench to within 12 inches of surface with stone. Backfill by machine.

3.11.8

Trenches for pressure lines shall include inert polyethylene locating tape having a metallic foil core. Tape shall be placed above the centerline of pipes at a depth not exceeding two feet below ground surface.

3.11.9

Do not backfill trenches until tests and inspections have been made. Use care in backfilling to avoid damage or displacement of pipe systems. Work which is covered or concealed without the knowledge and consent of the ENGINEER shall be uncovered or exposed for inspection at no cost to the OWNER. Partial backfill may be made to restrain the pipe during pressure testing if pressure test is required. No more than 50 feet of trench with pipe in place shall be partially backfilled at any time

3.11.10 Open Areas

Fill material for trenches in open areas shall have a maximum density not less than 100 pounds per cubic foot as determined by ASTM D698. The top 12 inches of backfill material shall contain no rocks larger than one inch in the greatest dimension. Material from two feet above pipes to 12 inches below surface shall contain no more than 25 percent rocks, none being larger than four inches in the greatest dimension. Liquid limit shall not exceed 40 and plasticity index shall not exceed 25.

3.12 TRENCHING COMPACTION

Percentage of maximum density requirements.

- Compact each layer of fill or backfill no less than the following percentages of the maximum density at optimum moisture ± 3% content as determined by Standard Proctor ASTM D698 (AASHTO T99).
    - 95% beneath and within 25 feet of buildings and structures, including those shown for future construction.
    - 95% beneath pavements, walks, and road shoulders, including those shown for future construction.
    - 95% for geosynthetic anchor trench
    - 90% in all other unpaved areas unless otherwise indicated on the Contract Drawings.

3.13 GRADING

3.13.1

Uniformly grade all areas within the limits designated on the Contract Drawings, including adjacent transition areas. Finish surfaces within specified tolerances with uniform levels of slopes between points where elevations are shown and existing grades.

3.13.2

Finish all surfaces free from irregular changes. Lumber, earth clods, or rocks larger than four inches and other undesirable materials shall be removed from the site at the completion of construction.

3.13.3

Finish subgrade areas to receive topsoil to within 0.20 foot of required subgrade elevations.

3.13.4

All utility lines not in streets, shall be mulched with hay or straw and seeded within 15 days after backfill.

3.13.5

Any disturbed area not paved, sodded or built upon between within 14 days shall receive temporary seeding.

3.13.6

Protect graded areas from the action of the elements. Settlement or other damage that occurs prior to acceptance of the work shall be repaired and grades satisfactorily reestablished.

3.13.7

Repair after cleanup. Upon completion of construction work and after spoils and debris have been removed, regrade any areas disturbed by operations.

3.13.8

The CONTRACTOR shall return all gates, fences, culverts, lawn areas, paved areas, etc. to the same condition existing prior to construction. Any culverts damaged during construction shall be replaced with new culverts at no cost to the OWNER.

END OF SECTION 31 23 33

SECTION 31 25 00

EROSION AND SEDIMENT CONTROL

1.0 GENERAL

1.1 DESCRIPTION

1.1.1 Scope

The Contractor shall provide sediment and erosion control devices to contain surface drainage from within the construction site, borrow, waste and storage areas where deemed necessary by the ENGINEER.

1.1.2 General Description

This work shall consist of the application of measures throughout out the life of the project to control erosion and to minimize the siltation of rivers, streams and impoundments (lakes reservoirs, etc.). The measures shall include, but not be limited to, the use of berms, dikes, dams sediment basins, sediment traps, filters, silt fence, fiber mats, netting, gravel or crushed stone, mulch, grasses, slope drains and other methods approved by the City of Bristol. Erosion and siltation control measures as described herein shall be applied to erodible material exposed by any activity on the project.

1.1.3 Related Work Specified Elsewhere

- Section 31 00 00 Earthwork
- Section 31 23 33 Trenching, Backfilling, and Compacting
- Section 31 05 16 Aggregates

1.2 REQUIREMENTS INCLUDED

1.2.1

Contractor shall provide personnel, equipment, materials, and supplies to reduce erosion and control sediment during the Project.

1.2.2

Contractor shall comply with local and state erosion control regulations, and comply (at a minimum) with erosion and sediment controls as set forth on the Drawings.

1.2.3

Contractor is solely responsible for control of erosion on site and is responsible for taking measures to reduce and control erosion. Measures may be necessary above and beyond those shown on the Drawings, and Contractor shall implement any additional measures that it deems necessary or as required by the City of Bristol Erosion Control inspection personnel.

1.2.4

Additional compensation will not be paid for measures installed in conjunction with the development and operations of borrow areas. Costs for these efforts are already included in the Contract Price.

1.2.5

Contractor is the Responsible Land Disturber for the project and required to obtain a Land Disturbance Permit from the local authority.

1.2.6

Contractor shall clean out all stormwater and erosion and sediment control BMPs prior to final acceptance and payment by the Owner that are to remain in place after closure or until final stabilization achieved.

1.3 RELATED REQUIREMENTS

- Virginia Erosion and Sediment Control Handbook, latest edition.
- Erosion and Sediment Control Regulations, 9-VAC 25-840.

1.4 PERMITS

1.4.1 Land Disturbance Permit

The Contractor shall be responsible for obtaining a Land Disturbance Permit and payment of the associated erosion and sediment control bond. Copies of all permits or approvals shall be provided to the ENGINEER prior to starting any work covered by the permits or approvals.

1.4.2 Off-Site Work

The Contractor shall be responsible for obtaining all necessary permits and approvals from the appropriate governmental agencies, including those located outside of the locality, for any off-site work as applicable for waste or spoil areas and borrow pits. Copies of all permits or approvals shall be provided to the ENGINEER prior to starting any work covered by the permits or approvals.

1.4.3 Conflicts

In the event of conflict between these requirements and pollution control laws, rules or regulations of other Federal, State or Local agencies, the more restrictive laws, rules or regulations shall apply.

1.4.4 Inspection of Off-Site Area

The ENGINEER shall have the right to inspect erosion control measures in off-site borrow pits and waste areas and to report violations of permit requirements to relevant agencies.

1.5 PROVISIONS

1.5.1 Contractor Compliance

In the event that erosion and pollution control measures are required due to the Contractor's negligence, carelessness or failure to install permanent control as part of the scheduled Work, the ENGINEER may order that Work to be performed by the Contractor at his own expense.

1.5.2 Work Suspension

The Contractor shall comply with the requirements specified herein and as shown on the Plans. Any violation of these requirements may result in the issuance of a written Notice of Suspension of the Work. The suspension of Work will not be lifted until the Contractor has completely corrected the violation. Time extensions requested as a result of delays occasioned by such suspensions will not be considered.

1.5.3 Revisions

Should conditions arise in the field that render the Erosion and Sediment Control Plans inadequate or inappropriate for Work included in the Contract, the Contractor shall immediately notify the ENGINEER and the OWNER. Where necessary, additional plans or modifications will be furnished by the OWNER and will become a condition of the SEDIMENT CONTROL PERMIT and the CONTRACT.

1.6 SUBMITTALS

1.6.1 Prequalification

Submit the material source, descriptions, and material specifications certified by the supplier to the Engineer for approval.

1.6.2 Certificate of Compliance

The CONTRACTOR shall submit to the ENGINEER for approval at least 14 days before procurement a Certificate of Compliance that the supplied materials meet the specifications herein.

2.0 PRODUCTS

2.1 GENERAL

All products used for erosion and sediment control will be as specified by the Virginia Erosion and Sediment Control Handbook unless otherwise listed herein.

2.2 EROSION CONTROL BLANKET AND MATTING

Erosion Control Blanket, Treatment 1 (equivalent to VDOT EC-2) or Treatment 2 (equivalent to VDOT EC-3), shall be in accordance with the Virginia Erosion and Sediment Control Handbook, latest edition. Treatment 1 shall be North American Green C125 or approved equal. Treatment 2 shall be North American Green S150 or approved equal.

3.0 EXECUTION

3.1 GENERAL

3.1.1

All activities shall be performed in accordance with the approved erosion control plan and stormwater pollution prevention plan.

3.1.2

Prior to significant disturbance of the Site, perimeter erosion control shall be established in order to reduce uncontrolled drainage from leaving the limits of construction or from reaching State waters. Sediment barriers shall be constructed as soon as possible.

3.2 INSTALLATION

Contractor shall be responsible for the following activities:

- All measures necessary to provide a continuous siltation barrier shall be down slope from construction activities as indicated on the Drawings or as necessary to reduce sediment runoff. Barriers shall be placed around stockpiled material subject to erosion.
- All other measures as indicated in the approved Erosion and Sediment Control Plan or as otherwise required.
- All measures shall be installed as per the manufacturer's directions and the Virginia Erosion and Sediment Control Handbook.

3.3 WORK SITE

The Engineer will limit the area of excavation and embankment operations in progress commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding and other pollution control measures current in accordance with the accepted schedule. Should seasonal limitations make coordination unrealistic, erosion control measures shall be taken immediately. All construction shall be confined to the minimum area necessary to accommodate the Contractor, equipment and work force engaged in his work.

4.0 INSPECTION AND MAINTENANCE

4.1 GENERAL

Erosion and sediment control measures shall be inspected and maintained in accordance with the approved erosion control plan. At a minimum, erosion and sediment control measures will be checked weekly by the Contractor and after each significant rainfall.

4.2 REPAIRS AND MAINTENANCE

Upon finding that any measure requires repair or maintenance, Contractor shall repair or maintain the measure at no additional cost to Owner in accordance with the approved erosion control plan and the Virginia Erosion and Sediment Control Handbook. All erosion and sediment control devices that are disturbed during the construction operations shall be fully repaired by the end of the day on which they are disturbed. All erosion and sediment control devices shall be maintained when the project is closed down.

4.3 DUST CONTROL

It shall be the sole responsibility of Contractor to adequately control dust that is created as a result of construction on the project. Contractor will control dust, to the Owner's satisfaction, generated by the Contractor's activities internal to the Bristol Integrated Solid Waste Management Facility.

END OF SECTION 31 25 00

SECTION 32 15 40

CRUSHED STONE SURFACING

1.0 GENERAL

1.1 REQUIREMENTS

Provide personnel, equipment, and materials to construct and surface access roads as shown on the Drawings and in accordance with these specifications.

1.2 RELATED REQUIREMENTS

- Section 31 00 00 Earthwork
- Section 31 05 19.13 Geotextile Fabrics

2.0 PRODUCTS

The wearing course shall consist of durable gravel, crushed gravel, crushed stone, or crushed slag, meeting Virginia Department of Transportation Standard Specifications, latest revision. The aggregate shall be VDOT No. 21A or approved alternative for the aggregate wearingcourse.

A geotextile shall be installed prior to placement of the wearing course.

3.0 EXECUTION

Upon completion of construction work and after spoils and debris have been removed, regrade any areas disturbed by the operations. If ruts are created in the wearing course due to construction traffic, they shall be filled with additional material, rather than blading adjacent material into the rut.

3.1 GRAVEL HAUL ROADS

After the subgrade has been properly prepared in accordance with these specifications, the aggregate shall be placed, shaped, and compacted. The grade and alignment shall be controlled during placement. Necessary shaping shall be performed prior to final compaction to ensure a rut- and bump-free surface and adequate drainage slopes. Depths of the aggregate shall be as shown on the Drawings.

For roads on the landfill, the soil shall consist of erosion control/protective cover material compacted to the requirements for that layer. For other roads, the soil shall be general fill material compacted to the requirements of that soil type.

Any deficiency of the total thickness of the wearing course in excess of one-half (1/2) inch shall be corrected. If consistent deficiencies occur, regardless of thickness, the entire deficient section of roadway will be corrected.

Aggregate shall be rolled with one pass immediately with a self-propelled steel wheel roller. The roller weight shall be between 6 and 8 tons for tandem type and between 8 and 10 tons for the three-wheel type.

END OF SECTION 32 15 40

SECTION 32 92 19

SEEDING

1.0 GENERAL

1.1 REQUIREMENT INCLUDED

1.1.1

Provide personnel, equipment, and materials to completely furnish, install, maintain, and guarantee seeding and seeding items shown on the drawings and specified in the specifications. Place mulch as specified. Place fertilizer and lime as required by soil testing. Apply organic soil amendments if required by soil testing.

1.2 RELATED REQUIREMENTS

1.2.1

Section 31 25 00	Erosion and Sediment Control
Section 31 05 13	Erosion Control and Vegetative Support Soil Layers

1.3 GUARANTEE

1.3.1

The CONTRACTOR shall be responsible for seeding as specified up to the final acceptance. Dependent upon the season, the CONTRACTOR may have to provide a temporary winter or summer cover crop that will eventually be incorporated into the soil prior to seeding in the appropriate spring and fall seasons.

1.3.2

Areas that fail to develop a successful stand following seeding will be reseeded at the CONTRACTOR's expense. The CONTRACTOR shall establish a permanent vegetative cover with a 90% uniform stand of specified grasses in seeded areas. Bare areas shall be reseeded every 21 days. Eroded areas shall be repaired prior to reseeding. Once grass has been successfully established, the CONTRACTOR shall maintain the area for 90 days.

1.4 SUBMITTALS

1.4.1

Submit three (3) hard copies or one (1) electronic copy of the following manufacturer's certificates of conformance for review and approval approximately 1 month before placement.

- Seed
- Fertilizer
- Lime
- Mulch

1.4.2

The Contractor shall test soil to be used on the project to determine the proper application of lime and fertilizer. Representative samples shall be taken for existing soil and separate samples for each separate source of new soil to be brought into the job site.

1.4.3

A soil sample analysis report shall be submitted to the Engineer prior to seeding operations. Lime, fertilizer requirements, phosphorus, potassium, calcium, magnesium and pH levels shall be tested for each sample and amendment recommendations provided in the soil analysis report. CONTRACTOR will apply organic soil amendments if necessary to establish vegetation.

1.4.4 Plant and Material Certifications

Seed vendor's certified statement for each seed mixture required, stating botanical and common name, percentages by weight, and percentages of purity, germination, and weed seed for each grass seed species.

1.4.5 Planting Schedule

CONTRACTOR to submit a proposed planting schedule, indicating dates for each type of landscape work and based on normal seasons for such work as outlined in this document. Correlate dates with specified maintenance periods to provide maintenance from date of substantial completion. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.

1.5 QUALITY ASSURANCE

1.5.1 Subcontractor

Subcontract landscape work to a single firm specializing in landscape work. Contracting firm to employ experienced personnel familiar with required work. Provide adequate supervision by qualified foreman.

1.5.2 Analysis and Standards

Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the State of Maryland, wherever applicable.

1.5.3 Inspection

Seed will be inspected upon arrival at the job site by the ENGINEER for conformity to type and quality in accordance with specifications. Other materials will be inspected for meeting specified requirements and unacceptable materials shall be removed from the job site. As applicable before seeding, ENGINEER reserves the right to inspect seed, amendments, topsoil, and application equipment either at the place of origin or at the site for compliance with requirements.

2.0 PRODUCTS

2.1 TEMPORARY SEEDING MIXTURE

Temporary seed mixture shall be in accordance with the latest edition of the Virginia Erosion and Sediment Control Handbook. The actual seed used will vary with the seasons, but shall be certified to be high in percent germination and a variety adapted to Virginia shall be used.

2.2 PERMANENT SEEDING MIXTURE

2.2.1

Permanent seed mixture shall be in accordance with the latest edition of the Virginia Erosion and Sediment Control Handbook. Use the “low-maintenance slope” seeding mixture for Appalachian/Mountain areas, which consist of the following:

- Kentucky 31 Tall fescue 108 lb/acre
- Red Top Grass 2 lb /acre
- Seasonal Nurse Crop 20 lb/acre
- Crownvetch 20 lb/acre

Seeds shall be certified high in percent germination and a variety adapted to Virginia shall be used. Seed shall be of the latest season’s crop with a minimum of 80% germination rate. Mix Seed on site or in the presence of the QAO. Weed seeds and inert matter shall not exceed 1.0% (one percent) of total seed content.

2.2.2

The Owner reserves the right to revise the seed mixture.

2.2.3

Seasonal nurse crop shall be in accordance with the following:

- March, April through May 15th Annual Rye

- May 16th though August 15th — Foxtail Millet
- August 16th through September, October — Annual Rye
- November through February — Winter Rye

2.2.4

Seeds shall be certified high in percent germination and a variety adapted to Virginia shall be used. Seed shall be of the latest season's crop with a minimum of 80% germination rate. Mix Seed on site or in the presence of the QAO. Weed seeds and inert matter shall not exceed 0.25% (one fourth of one percent) of total seed content. Seed should be free of noxious weeds.

2.3 MULCH

2.3.1

Mulch shall be free of noxious weeds, molds, or other deleterious material. Mulch/straw should be cured and mulched from the stalks of oats, wheat, barley, or rice. Furnish in air-dry condition. Do not use rye straw. Other materials may be used with prior written approval by the Engineer. Mulch shall be well seasoned before bailing, free from mature seed-bearing stalks or roots of prohibited or noxious weeds.

2.3.2

Apply mulch at a rate of 2 tons per acre (approximately 89 45-pound bales per acre). Mulch weight shall be dry weight. Fiber mulch applied during hydroseeding operations shall not be considered as part of the 2 tons per acre.

2.3.3

Mulch, fertilizers, lime and inoculating bacteria shall comply with the Virginia Department of Transportation, Road and Bridge Specifications, Section 244.

2.4 FERTILIZER

2.4.1

Fertilizer shall be granular, commercial grade, dry, free flowing, uniform in composition, non-burning product composed of not less than 50% organic slow acting, guaranteed analysis professional fertilizer.

2.4.2

Fertilizer shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis. Fertilizer that becomes caked or otherwise damaged, making it unsuitable for use, will not be accepted. No cyanamide or hydrated lime shall be permitted in mixed fertilizer.

2.4.3

The Contractor shall perform soil tests to determine the quantity and analysis of fertilizer required.

2.5 LIMESTONE

2.5.1

Ground limestone shall contain not less than 85% of total carbonates and shall be pelletized agricultural grade. Calcareous limestone shall contain at least 50% magnesium oxide and dolomitic limestone shall contain at least 40% magnesium oxide. Burned or slaked limestone is not permitted.

2.5.2

The Contractor shall perform soil tests to determine the quantity of lime required.

2.6 WATER

The Contractor shall be responsible for furnishing potable water free from substances harmful to seed growth. Contractor shall furnish related equipment such as hoses, sprinklers, tanks, or other methods of transportation.

3.0 EXECUTION

3.1 DELIVERY, STORAGE, AND HANDLING

3.1.1 Fertilizer and Lime

Deliver materials to the site in the original, unopened containers showing the weight, chemical analysis, and manufacturer's name. In lieu of containers, bulk fertilizer and lime can be used only if appropriate certificates accompany each delivery.

3.1.2 Seed

Deliver seed to the site in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures, purity, germination, weed content, and inert material, year of production, date of packaging, location where packaged. Wet, moldy, outdated, or otherwise damaged seed will be rejected.

3.1.1 Packaged Materials

Deliver packaged materials in sealed containers showing weight, name of manufacturer, year of production, date of packaging, location where packaged. Protect materials from deterioration during delivery, and while stored at site. In lieu of containers, bulk fertilizer and lime can be used only if appropriate certificates accompany each delivery.

3.1.2 Storage

All materials shall be stored and protected in areas designated by the OWNER. Seed, lime and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment materials shall not be stored with other landscape materials. Protect seed from drying out.

3.1.3 Handling Materials

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles. Areas for off-loading bulk materials shall be designated by the CONTRACTOR and approved prior to delivery by the OWNER.

3.2 TEMPORARY SEEDED AREAS

3.2.1

Areas designated on the plans as requiring temporary seeding and areas of the site not to be constructed within 14 consecutive calendar days of final grading shall be seeded as soon as possible after the disturbance in the area is completed. Temporary seeding schedules must also comply with local regulations as applicable. The temporary seeding shall be in accordance with the Virginia Erosion and Sediment Control Handbook.

3.2.2

Prior to seeding, the surface of the area to be seeded shall be prepared by removing depressions and ruts. Care shall be taken to avoid compaction of the surface. The area shall be prepared by breaking up the surface of the soil.

3.2.3

Areas that that fail to establish vegetative cover adequate to limit rill erosion will be reseeded as soon as such areas are identified.

3.3 PERMANENT SEEDED AREAS

3.3.1

Permanent seeding shall be accomplished on final grades, on cut and fill slopes, on access roads, surface water diversion ditches, rough-graded areas that will not be brought to final grade for a year or more and other areas as required. The required seed mixture shall be applied as soon as possible after the area is brought to final grade as per the plans. No seeding shall occur between December 6th and February 1st unless so approved by the Owner.

3.3.2

The area to be seeded shall be prepared by removing large ruts or surface depressions and by breaking up the surface of the soil. The soil shall be tested and lime, fertilizer, and, if necessary, inoculate bacteria and organic soil amendments shall be incorporated into the vegetative support layer.

3.3.3

Areas that fail to establish vegetative cover adequate to limit rill erosion will be reseeded as soon as such areas are identified.

3.4 APPLICATION OF MATERIAL

3.4.1

In general, materials shall be applied by hand or with specialized equipment. If hydroseeding is used, mixing shall be done at the job site and care shall be exercised to avoid damaging the seeds during mixing or application.

3.4.2

Notify QAO at least seven working days prior to start of seeding operations.

3.4.3 Preparation

After areas required to be seeded have been brought to the required grade, thoroughly till to a minimum depth of 2 inches by scarifying, disking, harrowing, or other approved method. Remove debris and stones larger than one inch remaining on the surface after tilling. Tilling will be necessary prior to seeding as well as when the summer or winter species must be eradicated. Limit preparation to areas that will be immediately seeded.

3.4.4 Vegetative Support Layer

Areas shall have Vegetative Support Layer soil uniformly distributed and evenly spread to a thickness of not less than six (6) inches.

3.4.5 Lime

Apply the rate and amount of lime necessary to maintain the areas at a pH level of 6 to 6.8. Soil analysis report of existing conditions and pH level will designate the amount of lime necessary to bring the soil to the acceptable levels.

3.4.6 Fine Grade

Fine grade seed areas to smooth, even surface with loose, uniformly fine texture. Roll, rake, and drag areas, remove ridges and fill depressions, as required to meet finish grades. Moisten prepared areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting seed. Do not create a muddy soil condition.

3.4.7 Fertilizer

Apply fertilizer at a uniform rate as determined by soil testing. Incorporate fertilizer and lime into the soil to a depth of at least 4 inches; this may be done as part of the subgrade tillage operation.

3.4.8 Installation

Seed immediately after preparation of bed. Seed areas disturbed as a result of construction activities. Mix seed on-site or in the presence of the QAO. Sow seed with approved sowing equipment. Cover seed by means of harrow, cultipacker, or other approved device. Perform seeding operations when the soil is dry and when winds do not exceed 5 miles per hour velocity.

3.4.9 Rolling

Immediately after seeding, firm entire area with a roller.

3.4.10 Mulch

Immediately mulch newly seeded areas. Chopped straw shall be evenly applied so as to provide a loose depth of not more than one half (1/2) inch with 75% coverage.

3.4.11 Tack Coat

Immediately following mulching, straw shall be secured in place by an EPA registered tackafier at a uniform applied rate as specified on the label. In lieu of tackafier, crimp straw into soil by mechanical means.

3.4.12 Precautions

Protect existing utilities, structures, pavements, plantings or trees from damage caused by seeding operations. Contractor will be held responsible for damages. Extreme caution must be given when tilling, liming, and fertilizing in the dripline of existing trees. Restrict traffic from seeded areas until grass is established.

3.4.13 Cleaning

Perform cleaning during installation of the work and upon completion of the work. Remove from site excess materials, debris, and equipment.

4.0 MAINTENANCE

4.1.1

Begin maintenance immediately after seeding.

4.1.2

Maintenance shall include, but not be limited to proper watering, refilling of rainwashed gullies and rutted areas, refertilizing, mowing, liming, disease and insect pest control, aerating, protective spraying, and other procedures consistent with good horticultural practice necessary to establish normal, vigorous, healthy lawns.

4.1.3

Ample soil moisture must be maintained during this period. A thorough watering to a minimum depth of 4 inches once every 3-5 days, depending upon soil type and drainage shall be accomplished to maintain ample soil moisture during the growing season.

4.1.4

The Contractor shall maintain seeded areas until final acceptance of the project and shall restore or replace the seeding work that is found defective or that becomes damaged prior to final acceptance. If winter or summer crops are planted, they must be maintained until spring or fall seeding schedules can be met. The Contractor will be responsible for planting, maintaining the temporary cover, eradicating the temporary cover crop by tilling and grading prior to spring or fall seeding seasons, and replanting the project based on the spring or fall planting selections, whichever comes first. The Contractor shall perform supplemental seeding when less than a 90% uniform stand of permanent grass is obtained. Restoration or replacement work shall include the re-establishment of the grade or profile of the area, replacement of topsoil, refertilization, reseeding or remulching as directed by the Engineer. Maintenance must be performed by the Contractor until the final acceptance of the spring or fall season grass is accomplished. There is no time limit in force.

4.1.5

The contractor shall be responsible for mowing of permanently seeded areas during the maintenance period. This shall include at least one mobilization for mowing.

END OF SECTION 32 92 19

SECTION 33 23 00

EXTRACTION WELLS AND MONITORING PROBES

1.0 GENERAL

1.1 DESCRIPTION

The CONTRACTOR shall supply all materials, equipment, and labor needed to install landfill gas (LFG) vertical caissons, soil extraction wells, and LFG monitoring probes (probes) as indicated on the PLANS.

Related Work Described Elsewhere:

Section 31 00 00	Earthwork
Section 33 23 10	Landfill Gas Wellheads
Section 33 51 10	LFG Pipe and Pipe Fittings
Section 33 51 20	LFG System Valves

1.2 SUBMITTALS

1.2.1 Certification

The CONTRACTOR shall prepare and submit to the ENGINEER, for review and approval, catalog cuts on materials furnished and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, and inspection of soil extraction wells, vertical caissons, and other appurtenances furnished. The CONTRACTOR shall submit to the ENGINEER for review and approval samples of all well backfill materials and the name of the vendor(s) and source materials furnished.

1.2.2 Shop Drawings

The CONTRACTOR shall prepare and submit Shop Drawings to the ENGINEER for review and approval. Shop Drawings shall include a schedule showing coordinates and ground surface elevations for soil extraction wells, vertical caissons, and LFG probes as well as proposed boring or excavation depths.

1.2.3 Soil Extraction Well, Vertical Caisson, and LFG Probe Logs

Within 21 days after drilling or vertical caisson installation is complete, the CONTRACTOR shall submit to the ENGINEER soil extraction well, vertical caisson, and LFG probe logs (drilling/excavation and construction) based on information recorded in the field during construction.

2.0 PRODUCTS

2.1 MATERIALS

2.1.1 Backfill Materials

2.1.1.1

Course aggregate used in vertical caissons shall be VDOT No. 3 or other washed crushed stone between 1-inch and 2-inches in diameter, and shall be composed of clean, hard and durable fragments, free of silt, clay, dirt, vegetation and other objectionable matter. Stone backfill shall be non-calcareous rock with a minimum of 90 percent non calcium carbonate material. Non-calcareous washed pea gravel between ¼" to ½" in diameter shall be used to backfill an LFG monitoring probe. Soil extraction wells will be backfilled in accordance with the PLANS.

2.1.1.2

Soil backfill material shall be clean granular fill free of stones larger than 2 inches, construction debris, refuse, muck, soft clay, loam, sponge material, vegetation/organic matter, or angular rock.

2.1.1.3

"Bentonite Plug" as shown on the Drawings, shall refer to a well seal comprised of hydrated sodium bentonite pellets or chips of a thickness indicated on the Drawings. Bentonite material shall consist of clay greater than 85% sodium montmorillonite, without additives.

2.1.2 Perforated PVC Pipe

The piping shall be as specified in Section 33 51 10. The perforations in extraction well piping shall be as shown on the Drawings and may be field-fabricated or supplied by the factory.

2.1.3 Rigid and Flexible PVC Pipe

Rigid and flexible PVC pipe shall be as specified in Section 33 51 10.

2.1.4 Wellhead Assembly

See Section 33 23 10 for Landfill Gas Wellheads.

3.0 EXECUTION

3.1 DRILLING

3.1.1

The CONTRACTOR shall coordinate the start of drilling with the ENGINEER.

3.1.2

The CONTRACTOR shall provide a thoroughly experienced, competent driller during all drilling operations.

3.1.3

The CONTRACTOR shall survey and stake the LFG probe and soil extraction well locations prior to drilling and provide survey data to OWNER and ENGINEER. LFG probe and soil extraction well locations will be approved and may be adjusted by the ENGINEER or the OWNER prior to beginning drilling.

3.1.4

The CONTRACTOR must use dry drilling equipment. Wet rotary drilling equipment may not be used. LFG probe and soil extraction well drilling must be done via air rotary method.

3.1.5

LFG probes and soil extraction wells are to be drilled to the depth and diameter as shown on the Drawings, unless changed during the submittal process. Under no circumstances are the drilling depths from the LFG probe and soil extraction wells shown on the Drawings to be exceeded unless approved by the ENGINEER in advance.

3.1.5.1 Wet Borings

3.1.5.1.1

If water is encountered in a boring, the CONTRACTOR may be directed to drill beyond the point at which it was encountered. If wet conditions remain, the boring may be terminated and the length of perforated pipe adjusted by the ENGINEER. If wet conditions cease (e.g., due to a perched water layer), then drilling will continue to the design depth.

3.1.5.1.2

If water is encountered in a boring at a shallow depth, the ENGINEER may decrease the LFG probe or soil extraction well depth and length of perforated pipe, or relocate probe or well.

3.1.5.2 Abandoned Borings

If, in the opinion of the ENGINEER, the borehole has not reached a sufficient depth to function as an effective LFG probe or soil extraction well, the CONTRACTOR shall abandon this borehole by backfilling it with cuttings removed during drilling. If cuttings are unsuitable as backfill, the CONTRACTOR shall use soil backfill material. A 2-foot thick bentonite plug will be placed in the borehole when the depth is 4 feet below the existing grade. The remaining 2 feet of the borehole will then be filled with soil material and compacted to approximately match the elevation of the existing grade. Compensation for abandoned borings shall be at 1/3 of the pro-rated the lump sum price for this pay item. The price of the boring will be determined based on the depth of the boring as a percentage of the total depth of the borings included in the lump-sum bid item.

3.1.5.3

If the ENGINEER adds or deletes an LFG probe or soil extraction well, or adjusts the depth of a LFG probe or soil extraction well, either less than or greater than the depth shown on the well schedule, the CONTRACTOR will be compensated or will credit the OWNER per foot of variance according to the pro-rated price for this pay item. The price of the boring will be determined based on the depth of the boring as a percentage of the total depth of the borings included in the lump-sum bid item.

3.1.6

The bore for the LFG probe, soil extraction well, or excavation for the vertical caisson shall be straight and the pipe shall be installed in the center of the borehole or excavation. The CONTRACTOR shall take all necessary precautions to maintain the pipe vertically plumbed during the backfill operation to the satisfaction of the ENGINEER. If the pipe installed is out of plumb, as determined by the ENGINEER, the CONTRACTOR, at his own expense, shall correct the alignment.

3.1.7

The CONTRACTOR shall keep detailed construction logs for all soil extraction wells, LFG probes, and vertical caissons, as well as horizontal collectors installed including the total depth and/or length, the static water level, thickness, description of soil or waste strata, and the occurrence of any water bearing zones. The logs shall also include detailed construction diagrams for all wells/LFG probes/vertical caissons installed. These diagrams shall include dimensions that indicate total depth, length of slotted/perforated pipe, length of solid pipe, length of stick-up to the top of the wellhead, thickness of stone, thickness of bentonite plug, and thicknesses of soil material. All logs shall be submitted to the ENGINEER.

3.2 JOINING OF PIPES

Pipes shall be joined as specified in Section 33 51 10. One-inch threaded SCH40 PVC pipe will be used to join sections of LFG probes. High density polyethylene (HDPE) pipe will be used for the construction of the vertical caissons. The connection of the vertical caissons to the horizontal collectors will be as shown in the plans. The existing 6-inch SCH80 PVC vertical extraction wells will be connected to the HDPE horizontal collector via transition fitting.

3.3 BACKFILLING

3.3.1

Backfilling of the soil extraction well/vertical caisson/LFG probe shall commence immediately after drilling/excavation is completed and the respective piping has been installed. Backfill materials shall be placed carefully within the well/vertical caisson/LFG probe to the dimensions shown on the Drawings and as approved by the ENGINEER. The ENGINEER, on the basis of a visual examination, may reject gravel and soil backfill containing foreign material.

3.3.2

The bentonite Plug shall be backfilled in 6-inch lifts. Prior to placing each lift, the CONTRACTOR shall soak the in-place bentonite in accordance with manufacturer recommendations.

3.3.3

Soil backfill shall be rodded in the boring/excavation to provide even distribution and compaction.

3.3.4

The ENGINEER shall inspect the soil extraction well borings/vertical caissons 4 to 8 weeks after completion of the final soil extraction well/vertical caisson. Excessive settlement (6" or more below surrounding grade) in the boring/excavation shall be repaired by the CONTRACTOR by adding compacted fill around the well casing/vertical caisson at no additional cost to the OWNER.

3.4 WASTE DISPOSAL

Refer to Section 31 00 00. Waste is not anticipated to be encountered during installation of the soil extraction wells and LFG monitoring probes.

3.5 WELLHEAD INSTALLATION

3.5.1

Refer to Section 33 23 10

END OF SECTION 33 51 10

SECTION 33 23 10

LANDFILL GAS WELLHEADS

1.0 GENERAL

1.1 DESCRIPTION

1.1.1 Scope of Work:

The CONTRACTOR shall provide all equipment and labor needed to connect horizontal collector wellheads as specified herein and as indicated on the Drawings.

1.1.2 Qualification

All work shall be performed by qualified workers in accordance with the best standards and practices available.

1.1.3 Leachate

The CONTRACTOR shall make provisions for containment of discharged leachate if emitting from excavation of landfill surface.

1.1.4 Housekeeping

The CONTRACTOR shall keep the premises free from accumulation of waste materials or rubbish caused by his operations. Upon completion of each day's work, he shall dispose of all drill tailings at the designated area for waste relocation at the landfill, as well as secure all his tools, construction equipment, machinery and surplus materials from the site.

1.1.5 Odors

CONTRACTOR shall make every attempt to minimize odors from the excavated areas during construction, by backfilling excavation between active operations, and during installation of the horizontal collectors and vertical caissons, by covering or removing any drill tailings and temporarily capping the vertical caisson riser pipe.

1.1.6 Related Work Described Elsewhere

Section 33 23 00	Extraction Wells and Monitoring Probes
Section 33 51 10	LFG Pipe and Pipe Fittings

1.2 SUBMITTALS

1.2.1 Materials

The CONTRACTOR shall prepare and submit to the ENGINEER for review and approval catalog cuts on materials furnished, and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, and inspection of wellhead assemblies and other appurtenances furnished.

1.2.2 Samples

The CONTRACTOR shall submit to the ENGINEER for review and approval samples of all backfill materials and the name of the vendor(s) and source of materials furnished.

1.2.3 Shop Drawings

The CONTRACTOR shall prepare and submit to the ENGINEER for review and approval Shop Drawings showing dimensions, materials, and configuration of the wellhead assembly.

2.0 PRODUCTS

2.1 MATERIALS

2.1.1 Rigid and Flexible PVC Pipe

Rigid and flexible PVC pipe shall be as specified in Section 33 51 10.

2.1.2 Wellhead Assembly

Wellhead Assembly consists of a 2-inch globe valve, 2-inch union disconnect, a quick change orifice plate housing with a collar and set of interchangeable orifice plates suitable for flow measurements, adapter bushing or Fernco reducer fitting, stabilizing well cap with support ring, temperature gauge, multiple barbed hose monitoring ports, and dust caps. Wellhead assembly is mounted to the horizontal collector adaptor and connected to lateral piping located within the waste limits as shown on the Drawings. Wellhead assembly is manufactured by QED Environmental Systems, Dexter, MI (800-810-9908).

The globe valve is constructed of Type 1, Grade 1, PVC with socket fittings stainless steel valve stem and handle. The valve meets the requirements of ASTM D-1784 for rigid PVC compounds. The "globe" is a tapered cylindrical plug design made of PVC, thickly lined with Viton material, flanged, stem with position high visibility indicator.

2.1.3 Well Caps

Well caps shall be dual extraction type with flexible couplings and adapter fittings that allow for connection of pneumatic supply and dewatering force main lines. Dual extraction well caps shall be manufactured by Pump One or approved equal.

2.2 SPARE PARTS

No spare parts are included in this work.

3.0 EXECUTION

3.1 JOINING OF PIPES

Pipes shall be joined as specified in Section 33 51 10. In addition, for PVC pipe, lag screws shall be installed at each coupling to secure vertical piping during placement in well boring. Four sheet metal screws per coupling or two screws per bell fitting shall be installed. The length of the lag screws shall equal the sum of the pipe and coupling (or bell fitting) wall thicknesses.

3.2 BACKFILLING

Backfilling of the vertical caisson shall commence immediately after excavation is completed and the vertical caisson piping has been installed. Backfill materials shall be placed carefully to the dimensions shown on the Drawings and as approved by the ENGINEER. The ENGINEER, on the basis of a visual examination, may reject gravel and soil backfill containing foreign material.

3.3 TEMPORARY CAP

The CONTRACTOR shall temporarily cap the riser pipe of the vertical caisson to prevent direct venting of LFG through the riser pipe. The temporary cap shall be removed during the installation of the wellheads.

3.4 WASTE DISPOSAL

Excavated waste materials, including well cuttings shall be handled as specified in Section 31 00 00.

3.5 WELLHEAD INSTALLATION

3.5.1 Wellhead Assembly

Wellhead assembly shall be installed on the vertical caissons in accordance with the manufacturer's recommendations. Care shall be taken not to damage or impact the orifice plate during installation. If an orifice plate is damaged during installation, CONTRACTOR shall replace it at no cost to the OWNER.

3.5.2 Wellhead Connection

The wellhead shall be connected to the vacuum riser using QED 2" Solarguard flexible tubing or equivalent, as shown on the Drawings. Kanaflex hose shall not be used. Install so that no sags are formed.

END OF SECTION 33 23 10

SECTION 33 49 00

STORMWATER DRAINAGE STRUCTURES, PIPING, AND FITTINGS

1.0 GENERAL

1.1 DESCRIPTION

Scope of Work: The work in this Section includes all the labor, materials, equipment and incidentals required to construct stormwater drainage channels, pipe downchutes, pipe gutters, pipe inlet and outlet structures, riprap, endwalls, and other drainage structures as shown on the PLANS, specified herein and in the General Conditions.

1.2 SUBMITTALS

Supplier information and product specifications shall be submitted to the ENGINEER for review and approval at least 30 days before product procurements. The CONTRACTOR shall be fully responsible for any construction delays due to failure to obtain submittal approval in a timely manner.

1.2.1 Shop Drawings

Shop drawings for the following items shall be submitted for approval at least 15 days before installation.

- Corrugated High Density Polyethylene (HDPE) pipe downchutes and all related details.
- HDPE pipe gutters and all related details.
- HDPE riser structures, manhole inlet structures, and all related details.
- Sediment Basins outlet structures, pipes, and all related details.
- HDPE Compression Release Joints.
- Concrete endwalls, headwalls, and corrugated HDPE pipe to endwall connections.
- Reinforced Concrete Principal Spillway Structures, and all related details.
- Centerline cross-sections/profiles of basin outfall pipes through basin embankments, depicting embankments, principal spillway structures, dewatering pipes, valves, headwalls, endwalls, pipes, pipe cradles, anti-seep collars, riprap aprons, etc., including vertical elevations and pipe slopes and horizontal locations.
- Centerline cross-sections/profiles of HDPE Downchutes, depicting locations of pipes, fittings, risers, headwalls, compression release joints, and riprap outfalls.

1.2.2 Certificate of Compliance

Certificate of Compliance for HDPE and concrete pipes; concrete outlet control structures; pipe cradles, anti-seep collars, valves, HDPE compression release joints, risers, and manhole inlets shall be submitted to the ENGINEER for approval at least 15 days before installation.

1.2.3 Related Work Specified Elsewhere

- Section 35 31 20 Concrete Block Erosion Control Mats
- Section 31 25 00 Erosion and Sediment Control

2.0 PRODUCTS

2.1 MATERIALS

2.1.1 Corrugated Metal Pipe

Corrugated metal pipe, coupling bands, and other special sections shall conform to the requirements of AASHTO M190. The pipe may be of riveted or non-riveted type. Special sections shall be of the same gauge as the conduit to which they are joined and shall conform to the applicable standards of AASHTO M36.

2.1.1.1

Fittings, connecting bands, and special sections shall be from the same manufacturer as the pipe to which they are joined.

2.1.1.2

Corrugated metal pipe furnished, including pipe coupling bands, shall be galvanized steel, bituminous coated, minimum 16 gauge. Corrugations shall have a pitch of 2 inches and a depth of 1/2 inch.

2.1.1.3

If helically formed pipe is used, the ends shall be rerolled a minimum of two angular corrugations where connecting bands or flared end sections are required.

2.1.2 Reinforced Concrete Pipe

Reinforced concrete pipe shall conform to ASTM C-76 Class III, unless otherwise indicated on the plans. The pipe interior shall be smooth and free from roughness, projections, or irregularities. Cracked or flaking pipe shall be rejected. Pipe with exposed reinforcement shall be rejected. Joints on RCP shall be tongue and groove or bell and spigot.

2.1.3 Corrugated HDPE Storm Pipes

Corrugated HDPE storm drain pipes shall conform to the following:

- Shall be of Class 100 or 63 for ring stiffness constant (RSC) as defined in ASTM F 894-89 - "Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe" or approved equivalent.
- Pipe material shall be Type III, Class C, Category 5, Grade P34 according to ASTM D 1248 - "Standard Specification for Polyethylene Plastics Molding and Extrusion Materials" or approved equivalent.
- Joints: Pipes shall be produced with Bell and Spigot end construction. Joints shall be accompanied by rubber gaskets meeting all ASTM F 477 requirements and as shown on the PLANS.
- Perforations shall be per manufacturer's standards.
- Visible defects such as cracks, creases, splits, obstructions to flow in perforations or in tube, uncolored or "pale" tubing, and obvious thin spots are not permissible.

2.1.4 HDPE Pipes, Risers, and Fittings

Shall be as shown on the PLANS.

2.1.5 Polyethylene (PE) Tubing

Shall comply with all requirements in ASTM F 667.

2.1.6 HDPE Manholes and Fittings

Shall be of Class 160 for ring stiffness constant (RSC) as defined in ASTM F 894 - "Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe".

2.1.7 Concrete Manholes, Pipe, Endwalls, and other structures

Manholes, pipe, endwalls, and other concrete structures shall be provided and installed in accordance with VDOT standards and specifications (Section 302) unless otherwise noted on the drawings.

2.1.8 Gaskets

Rubber gaskets shall comply with all ASTM F 477 requirements and shall have a minimum internal and external hydrostatic pressure rating of 10 psi gage.

2.1.9 Lubricants

The lubricant used for assembly shall have no detrimental effect on the gaskets or on the pipes.

2.1.10 Compression Release Joints

Compression Release Joint shall be designed and fabricated by the pipe Manufacturer. The Joint shall be as shown in the PLANS or equal and be capable of withstanding an internal and external hydrostatic pressure of 5 psi gauge. The design of the joint shall be approved by the ENGINEER prior to fabrication.

2.1.11 HDPE Pipe Embedments

HDPE Pipe Embedments for Concrete Headwall Structures: HDPE Embedments shall be a standard product of the pipe manufacture. Installation and casting of HDPE embedment into concrete structures shall be in accordance with pipe manufacturer's installation instructions.

2.2 STORMWATER DIVERSION BERMS

Surface runoff collection and perimeter surface berms shall be promptly seeded following construction.

2.3 RIPRAP

Riprap shall be in accordance with VDOT Road and Bridge Standards Section 204, and shall be sized as indicated on the PLANS.

2.4 CHANNEL LINING

Line stormwater channels and open downchutes as noted on the drawings.

3.0 EXECUTION

3.1 HDPE PIPE INSTALLATION

3.1.1 General

3.1.1.1

Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. Pipe, fittings, and appurtenances shall be lowered carefully into the trench by means of a derrick, rope, or other suitable tools or equipment, in such a manner as to prevent damage to materials and protective coatings and linings. Under no circumstances shall pipe materials be dropped or dumped into the trench. The trench shall be dewatered prior to installation of the pipe.

3.1.1.2

Pipes, risers, fittings and accessories shall be installed in accordance with the Manufacturer's recommendations and with lines and grades and details shown on the PLANS. Manufacturer's recommendations for installation shall be the minimum requirements.

3.1.1.3

Pipe and fittings shall be strung out along the route of construction where it will cause least interference with traffic. Commence at the lowest point in the system. Laying of pipe shall be commenced immediately after the excavation is started and every measure must be used to keep pipe laying closely behind trenching. No more than 10 feet of trench shall remain open at the end of each working day. Required connections to existing lines shall be made in accordance with local

standards and requirements. Observe extreme care to prevent debris from entering lines. Check carefully the invert elevations of existing lines to which connections are to be made and inform the Engineer immediately if there is a discrepancy with the Contract Drawings. Each pipe shall be inspected for defects prior to being lowered into the trench and swabbed or brushed out to verify that no dirt or foreign material gets into the finished line.

3.1.1.4

Where culvert pipe is to be laid on existing ground and on or under fill the CONTRACTOR shall construct the embankment to a height to the top of pipe and then excavate a trench to receive the pipe. Trench shall be no wider than necessary to permit proper compaction of embankment around the pipe.

3.1.1.5

The interior of all pipes, fittings, and accessories shall be thoroughly cleaned of all foreign matter prior to being installed. Before jointing, all joint contact surfaces shall be cleaned, if necessary, and kept clean until jointing is completed.

3.1.1.6 HDPE Manholes

Manholes shall be installed according to the Manufacturer's recommendations and the details shown on the PLANS. Manufacturer's recommendations for installation shall be the minimum requirements.

3.1.1.7

Whenever the pipe laying is discontinued, such as end of workday or weekend, the unfinished work shall be protected from displacement due to caving of the banks, runoff, or other damages.

3.1.2 Examination of Products

Pipe fittings, valves, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Owner, who may prescribe corrective repairs or reject the materials.

3.2 CONCRETE PIPE INSTALLATION

3.2.1 Lines and Grades

All pipes, fittings and accessories shall be installed in accordance with the lines and grades and details shown on the PLANS. Any deviation from the design alignment or grade which would displace the gasket as much as 1/4-inch from the normal position, or which produce a gap exceeding 1/2-inch between sections of pipe for more than 1/3 of the circumference of the inside of the pipe is not acceptable. In case of these unacceptable practices, the CONTRACTOR shall relay the pipe at no cost to the OWNER.

3.2.2 Gasket

The gasket, surface of the pipe joint, and gasket recess shall be thoroughly cleaned of all foreign matter prior to being installed. If necessary, industry accepted lubricant can be used to facilitate joining.

3.2.3 Placement

All pipes shall be laid with bells or grooves uphill. The interior of all pipes, fittings, and accessories shall be thoroughly cleaned of all foreign matters prior to and during installation. Pipe defection per joint shall not exceed 2 degrees.

3.2.4 Embedment

The first length of pipe shall be thoroughly embedded in place. No length of pipe shall be laid until two preceding lengths have been thoroughly embedded in place so as to prevent any movement or disturbance of the finished joint. Whenever the pipe laying is discontinued, such as end of workday or weekend, the unfinished end shall be protected from displacement due to caving of the banks, runoff, or other damages.

3.2.5 Installation of concrete manholes, pipes, endwalls, and other structures

Manholes, pipe, endwalls, and other concrete structures shall be provided and installed in accordance with VDOT standards and specifications (Section 302) unless otherwise noted on the drawings.

END OF SECTION 33 49 00

SECTION 33 51 10

LFG PIPE AND PIPE FITTINGS

1.0 GENERAL

1.1 DESCRIPTION

The CONTRACTOR shall supply all materials, equipment, and labor needed to install complete and ready for use all pipe, pipe fittings, and valves as specified herein and as indicated on the PLANS for the Landfill Gas Collection System.

Related Work Described Elsewhere:

Section 31 00 00	Earthwork
Section 31 05 16	Aggregates (Perforated LFG pipe backfill)
Section 31 23 33	Trenching, Backfilling, and Compacting

1.2 SUBMITTALS

1.2.1 Certification

The CONTRACTOR shall prepare and submit to the ENGINEER, for review and approval, certificates of compliance on materials furnished and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, inspection, maintenance, and repair of each type of pipe and pipe fitting furnished.

1.2.2 Shop Drawings

The CONTRACTOR shall prepare and submit Shop Drawings to the ENGINEER for review and approval. The Shop Drawings shall show all dimensions, slopes, and invert elevations at connections. All tie-ins to the existing system shall be field-verified and shown on the Shop Drawings. The CONTRACTOR shall show coordination between proposed piping and all existing and proposed features.

1.3 REFERENCE

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1.3.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARD TEST METHODS/PRACTICE:

- ASTM D 1248 Specification for Polyethylene Plastics Molding and Extrusion Materials
- ASTM D 1784 Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
- ASTM D 1785 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- ASTM D 2321 Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
- ASTM D 2466 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings Sch 40.
- ASTM D 2467 Specification for Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
- ASTM D 2513 Specification for Thermoplastic Gas Pressure Pipe Tubing and Fittings
- ASTM D 2564 Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
- ASTM D 2774 Practice for Underground Installation of Thermoplastic Pressure Piping
- ASTM D 2855 Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
- ASTM D 3350 Specification for Polyethylene Plastics Pipe and Fittings Materials

1.3.2 AMERICAN NATIONAL STANDARD INSTITUTE (ANSI)

- ANSI B 31.8 Code for Pressure Piping, Appendix N

1.3.3 PLASTICS PIPING INSTITUTE (PPI)

- PPI TR-31/9-79 Technical Report

2.0 PRODUCTS

2.1 PVC PIPE

Pipe and pipe fittings identified in the PLANS as Schedule 80 PVC (SCH 80) shall be Schedule 80 PVC conforming to ASTM D 1784, ASTM D 1785 (for pipe), and ASTM D 2467 (for fittings). Perforated pipe shall be slotted in accordance with the PLANS. Acceptable manufacturers include Plastinetics, Inc. Chemtrol, CertainTeed, ASAHI/America, or approved equal. The schedule 80 PVC will conform to ASTM D 1785, PVC 1120.

Pipe and pipe fittings identified in the PLANS as Schedule 50 PVC (SCH 40) shall be Schedule 40 PVC conforming to ASTM D 1784, ASTM D 1785, and ASTM D 2467.

PVC pipe joints shall be solvent welded.

2.1.1 PVC Fittings

Fittings shall be of the same material and manufacturer as the pipe they are to be attached to. PVC fittings shall conform to ASTM D 2466.

2.1.1.1 Gaskets

Flange gaskets shall be full-face Neoprene. Other elastomers, such as Nitrile or Buna-N may be submitted to the ENGINEER for consideration.

2.1.2 Flexible PVC Pipe

2.1.2.1 Manufacturer

Flexible PVC pipe shall be as manufactured by QED Environmental Systems or approved equal.

2.1.2.2 Fasteners

Fasteners for flexible PVC pipe shall be power lock clamps manufactured by QED Environmental Systems or approved equal.

2.2 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

All HDPE pipe and fittings greater than 4-inch-diameter as indicated on the Drawings shall be at least Standard Dimension Rating (SDR) 17 high density polyethylene pipe using a 4710-type resin, or approved equal, unless otherwise noted. 4-inch pneumatic forcemain supply pipe shall be SDR 11, and 2-inch airline shall be SDR 9.

Pipe shall be extruded from a Type III, Class C, Category 5, Grade P47 compound as described in ASTM D 1248. It shall be classified as cell 445574C/E according to ASTM D 3350 and have the material designation of PE 4710. The pipe shall be manufactured to meet the requirements of ASTM F 714. Manufacturer's literature shall be adhered to when "manufacturer's recommendations" are specified. All pipe and fittings shall be provided by one manufacturer. Acceptable manufacturers include Plexco (630-350-3700), Driscopipe (800-527-0662), or approved equal.

Perforations shall be 1/2 inch in diameter at ¼ points around the perimeter of the pipe. Rows of holes shall be space approximately 6 inches along the length of the pipe. Every other row shall be offset by 3 inches.

3.0 EXECUTION

3.1 PVC PIPE HANDLING

PVC pipe and pipe fittings shall be handled carefully in loading and unloading by CONTRACTOR or SUBCONTRACTOR. Pipe and pipe fittings shall not be dropped or dumped.

3.2 PVC PIPE INSTALLATION

PVC pipe installation shall conform to these specifications, the manufacturer's recommendations, and as outlined in ASTM D 2774.

3.3 JOINING OF PVC PIPE

Joining of PVC pipe for the construction of a LFG probe shall be approved by the ENGINEER.

3.3.1 Preparation

All pipe shall be inspected for cuts, scratches, or other damage prior to installation. Pipe with imperfections shall not be used. All burrs, chips, etc. shall be removed from pipe interior and exterior. All loose dirt and moisture shall be wiped from the interior and exterior of the pipe end and the interior of the fitting. All pipe cuts shall be square, perpendicular to the center line of pipe. Pipe ends shall be beveled prior to applying primer and solvent cement so that the cement does not get wiped off during insertion into the fitting socket.

3.3.2 Solvent Welding

A coating of primer as recommended by pipe supplier shall be applied to the entire interior surface of the fitting socket and to an equivalent area on the exterior of the pipe prior to applying solvent cement. The solvent cement shall comply with the requirements of ASTM D 2564 and shall be applied in strict accordance with manufacturer's specifications. Pipe shall not be primed or solvent welded when it is raining, when atmospheric temperature is below 40°F, or above 90°F.

3.3.3 Curing

After solvent welding, the pipe shall remain undisturbed until cement has thoroughly set. As a guideline for joint setting time, use 1 hour for ambient temperatures 60-90°F, or 2 hours when ambient temperature is 40-60°F.

3.3.4 Alignment

Pipe and pipe fittings shall be selected so that there will be as small a linear deviation as possible at the joints, and so that inverts present a smooth surface. Pipe and fittings which do not fit together to form a tight fitting will be rejected.

3.4 FLEXIBLE PVC PIPE CONNECTIONS

Connections to pipe shall be made with clamps as indicated on the PLANS and in accordance with manufacturer's recommendations and step by step procedures. Connections to PVC pipe shall be solvent welded in accordance with Paragraph 3.03 above.

3.5 HDPE PIPE HANDLING

HDPE pipe shall not be bent more than the minimum radius recommended by the manufacturer for type, grade, and SDR. Care shall be taken to avoid imposing strains that will overstress or buckle the HDPE piping or impose excessive stress on the joints.

Joining HDPE Pipe:

Only two methods shall be utilized to joining HDPE pipe: heat fusion and mechanical joining.

3.5.1 Mechanical Joining

Mechanical Joining shall be accomplished with HDPE flange adapters, neoprene gaskets, and ductile iron back-up flanges, and shall be used only where shown on the Drawings. Refer also to Part 3.7.

3.5.2 Heat Fusion

Heat Fusion joints shall be made in accordance with manufacturer's step by step procedures and recommendations. Fusion equipment and a trained operator shall be provided by the Contractor. Pipe fusion equipment shall be of the size and nature to adequately weld all pipe sizes and fittings necessary to complete the project. Branch saddle fusions shall be made in accordance with manufacturer's recommendations and step by step procedures. Branch saddle fusion equipment will be of the size to facilitate saddle fusion within the pipe trench. Heat fusion shall be performed outside of the trench whenever practical. Before heat fusing pipe, each length shall be inspected for the presence of dirt, sand, mud, shavings, and other debris. Any foreign material shall be completely removed. At the end of each day, all open ends of fused pipe shall be capped or otherwise covered to prevent entry by animals or debris.

3.5.3 Shelter

As per the manufacturer’s instructions, no fusion shall be performed in precipitation unless a shelter is provided.

3.6 HDPE PIPE INSTALLATION

Pipe installation shall comply with the requirements of ASTM D 2321, PPI TR-31/9-79, and the manufacturer's recommendations. Lengths of fused pipe to be handled as one segment shall not exceed 400 feet. The Engineer shall be notified prior to any pipe being installed in the trench in order for him/her to have an opportunity to inspect the following items:

- All butt and saddle fusions.
- Pipe integrity.
- Trench excavation for rocks and foreign material.
- Proper trench slope.
- Trench contour to ensure the pipe will have uniform and continuous support.

Any irregularities found by the Engineer during this inspection must be corrected before lowering the pipe into the trench. Pipe shall be allowed sufficient time to adjust to trench temperature prior to any testing, segment tie-ins, and/or backfilling.

Tie-ins shall be made out of the trench whenever possible. When tie-ins are to be made only in the trench, a bell hole shall be excavated large enough to ensure an adequate and safe work area.

Below grade piping shall be marked with metallic locator/warning tape to be buried in the trench above the pipe as indicated on the drawings.

3.7 SEGMENT TESTING

3.7.1 Test Method

The HDPE pipeline shall be subjected to an air test per ASTM F-1417 and as described herein to detect any leaks in the piping. Testing shall be performed above grade. The CONTRACTOR shall accept the responsibility for locating, uncovering (if previously backfilled), and repairing any leaks detected during testing.

3.7.2 Test Segment

Like sizes of polyethylene piping shall be butt welded together into testing segment not to exceed 1000 feet. Segments shall be connected to a testing apparatus on one end and fitted with fusion-welded caps on all openings. The segment to be tested should be allowed time to achieve constant and/or ambient temperature before initiating the test.

3.7.3 Timing

The test should be performed during a period when the pipe segment will be out of direct sunlight when possible; i.e., early morning, late evening, or cloudy days. This will minimize the pressure changes which will occur during temperature fluctuations.

3.7.4 Pressure

The test pressure shall be 5 psig.

3.7.5 Pressure Drop

Pressure drop during the test shall not exceed one percent of the testing gauge pressure over a period of one hour. The testing gauge will have adequate sensitivity and incrementation to observe a one percent pressure drop. This pressure drop shall be corrected for temperature changes before determining pass or failure. (See Section 3.10 for test failures). The ENGINEER shall sign off on a test form to indicate test compliance.

3.7.6 Notification

The ENGINEER shall be notified prior to commencement of the testing procedure and shall be present during the test.

3.7.7 Equipment

Equipment for this testing procedure will be furnished by the CONTRACTOR. This shall consist of a polyethylene flange adaptor with a PVC blind flange. Polyethylene reducers shall be utilized to adapt test flange to size of pipe being tested. Tapped and threaded into the blind flange shall be a temperature gauge 0 to 100 degrees C, a "Schraeder tire valve" to accommodate an air compressor hose, a ball valve to release pipe pressure at completion of test, and a pressure measuring device. The pressure measuring device shall be a digital manometer capable of measuring positive pressures of air and other non-corrosive gases over a range of 0 to 199.9 in-w.c. Model No. 475-3 as manufactured by Dwyer Instruments, Inc. (770-427-9406), or approved equal.

3.8 TEST FAILURE

3.8.1 Remedial Actions

The following steps shall be performed when a pipe segment fails the one percent - 1 hour test described in this Section.

3.8.2 Inspection

The pipe and all fusions shall be inspected for cracks, pinholes, or perforations.

3.8.3 Terminations

All blocked risers and capped ends shall be inspected for leaks.

3.8.4 Location

Leaks shall be located and/or verified by applying a soapy water solution and observing soap bubble formation.

END OF SECTION 33 51 10

SECTION 33 51 20

LFG SYSTEM VALVES

1.0 GENERAL

1.1 DESCRIPTION

1.1.1 Scope of Work

The CONTRACTOR shall provide all materials, equipment, and labor needed to install and make ready all valves as specified herein and as indicated on the Drawings.

1.1.2 Related Work Described Elsewhere

Section 33 23 10:	Landfill Gas Wellheads
Section 31 51 10:	LFG Pipe and Pipe Fittings

1.2 SUBMITTALS

1.2.1 Certification

The CONTRACTOR shall prepare and submit to the ENGINEER, for review and approval, manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, inspection, maintenance, operation, and repair of each type of valve furnished. Shop drawings shall be submitted for butterfly valve assemblies requiring spacers per these SPECIFICATIONS.

2.0 PRODUCTS

2.1 GENERAL

2.1.1 Components

All valves shall be complete with all necessary operators, actuators, handwheels, chain wheels, extension stems, floor stands, worm and gear operators, operating nuts, chains, wrenches, and other accessories or appurtenances which are required for the proper completion of the work. Operators, actuators, and other accessories shall be sized and furnished by the valve supplier and factory mounted.

2.1.2 Intended Service

Valves shall be suitable for the intended service. Renewable parts including discs, packing, and seats shall be of types recommended by valve manufacturer for intended service, but not of a lower quality than specified herein.

2.1.3 Installation Conditions

Valves and operators shall be suitable for buried or exposed conditions, as applicable. Valves shall have all safety features required by OSHA.

2.1.4 Sizing

Unless otherwise shown on the Drawings, valves shall be the same size as the adjoining pipe.

2.1.5 Monitoring

Monitoring parts and hoses shall be provided at each buried isolation valve. Ports threaded into header shall be Swagelock 1/4" SS-420-1-4 x1/4" MPT, or approved equal. Monitoring hose shall be stainless steel teflon-lined hose with Swagelock tube ends, model SS-4BHT-36, or approved equal, of adequate length to extend 3-feet above the top of the final cover system. Sampling end shall have a 1/4" female connector SS-420-7-4 with a quick-connect polypropylene monitoring port by Ryan Herco, Part No. 0812-002.

2.2 BUTTERFLY VALVES

Header isolation valves shall be butterfly bubble tight, wafer design, with a PVC body, nitrile seat, and compatible with a flat face flange, as manufactured by Asahi/America or equal. Stem extensions shall be stainless steel in an epoxy coated carbon steel outer housing with a gear box assembly and visual valve position indicator mounted on top and equipped with a removable manual operating wheel. Stem extensions shall have the gear box assembly mounted a minimum 3-feet above the top of the final cover system. Monitoring ports at the butterfly valves shall be quick-connects as specified above and shown on the Drawings.

3.0 EXECUTION

3.1 INSTALLATION

3.1.1 Methods

Valves shall be installed in accordance with the manufacturer's recommendations and the following:

3.1.1.1 Butterfly Valves

Butterfly valves shall be installed between two flanges as shown on the Drawings; care shall be taken to avoid stripping bolts when tightening.

3.1.1.2 Flanges

Flanges shall be joined with hot dipped galvanized steel studs and nuts. All below grade studs and nuts shall be coated with anti-seize compound, or approved equivalent, after installation and prior to backfilling. Stud and nut diameters shall be sized as recommended by the manufacturer for each size valve. Stud lengths shall accommodate the required distance between flanges including spacers, if necessary.

3.1.2 Protection

The CONTRACTOR shall wrap and tape the valve, flanges, and bolts in 5-mil polyethylene sheeting prior to backfilling to help protect the valve assembly from corrosion.

3.1.3 Spacers and Adapters

Flanged butterfly valves may require spacers between the flange adapters and the valve body in order to allow full travel of the internal disk. If spacers are necessary for any butterfly valve, the CONTRACTOR will install valve spacers subject to the approval by the ENGINEER.

END OF SECTION 33 51 20

SECTION 35 31 20

CONCRETE BLOCK EROSION CONTROL MATS [FLEXAMAT®]

1.0 GENERAL

1.1 REQUIREMENTS INCLUDED

1.1.1

A type of Articulating Concrete Block Revetment System consisting of a matric of interconnected concrete block units used for erosion protection. Concrete units are connected by a geometric interlock of geosynthetic cables or grids and include a geotextile underlayment for retention of soil.

1.1.2

As depicted in the drawings concrete block erosion control mats serve a similar purpose as riprap for stone-lined waterways in accordance with Virginia Erosion and Sediment Control Handbook (VESCH) Section 3.17.

1.1.3

Contractor shall furnish and place tied concrete block erosion control mats (Flexamat® or approved equal) to conform to the lines, grades, design and dimensions as shown in the drawings and in accordance with this specification.

1.1.4

Contractor shall install permanent erosion control mats immediately following completion of the final channel grading and placement of permanent seeding.

1.1.5

Contractor shall follow the Erosion and Sediment requirements, guidelines, and schedule for installation of erosion control mats.

1.2 RELATED REQUIREMENTS

- Virginia Erosion and Sediment Control Handbook, latest edition. Section 3.17-Stormwater Conveyance Channel & Section 3.32 Permanent Seeding.
- Erosion and Sediment Control Regulations, 9-VAC 25-840.

2.0 PRODUCTS

2.1 GENERAL

2.1.1

Concrete block erosion mat is manufactured from individual concrete blocks tied together with high strength polypropylene bi- axial geogrid. Each block is tapered, beveled and interlocked and includes connections that prevent lateral displacement of the blocks within the mats when they are lifted for placement.

2.1.2

Concrete Block Erosion Mats for permanent stormwater conveyance channel lining shall be Flexamat® Plus, as manufactured by Motz Enterprises, Inc., or approved equal.

2.1.3

Product information per https://www.flexamat.com/

2.1.4

Concrete blocks with a minimum compressive strength of 5,000 psi at 28 days. Blocks shall have a minimum average weight of three pounds per block and tied at a maximum spacing of two inches from the adjoining blocks.

2.1.5

Concrete blocks shall be tied and cast together at the base of each block with a polypropylene Geogrid material. The Geogrid material shall meet an Ultimate Tensile strength of 2055 lb/lf.

2.1.6

Concrete block matting shall have permanent underlayment consisting of non-degradable polyester Geotextile material. Underlayment mat may consist of new or post-consumer recycled polyester. Underlayment material shall be packaged within the roll of the Flexamat Tied Concrete Blocks.

2.2 SUBMITTALS

2.2.1

Submit general product data, specifications, roll widths, and product type as required for the Flexamat product to be used for channel lining.

2.2.2

If alternate products are intended, contractor shall submit additional information. Including:

- Erosion mat dimensions. Flexamat is manufactured in standard widths of 4', 5.5', 8', 10', 12, & 16'. Lengths can be cut to order per project requirements. Stocked lengths are 30', 40', & 50', 4' x 4' mats stacked on pallets are also available. Submit the intended roll widths for each channel as determined to meet the drawings and the site conditions.
- Concrete block dimensions, weight and compressive strength
- Geogrid tie materials, specifications, and strength
- Underlayment material specifications weight, and strength

2.2.3

Additional information related to alternate products may be required by the Engineer

2.3 ALTERNATE PRODUCTS

2.3.1

The Engineer may approve alternate products for concrete block channel lining if proven to be equal to Flexamat® Plus.

2.3.2

Alternate materials or products shall meet the material and performance specifications of the Flexamat® Plus.

2.3.3

Materials or products as an alternate to Flexamat® Plus must be pre-approved in writing by the Engineer.

2.4 SAMPLES

CONTRACTOR will provide samples of product to ENGINEER for independent testing upon owns request.

3.0 EXECUTION

3.1 GENERAL

All activities shall be performed in accordance with the approved plans and details.

3.2 HANDLING AND STORAGE

3.2.1

Concrete mats should be stored in a location protected from cement, paint, excessive mud, chemicals, sparks and flames, temperatures in excess of 160 degrees F, and any other environmental condition that may degrade the physical properties. If stored outdoors, the rolls shall

be elevated from the ground surface and protected with an opaque waterproof cover. Geotextiles shall be delivered to the site in a dry and undamaged condition.

3.2.2

Geotextile rolls should be handled and unloaded by hand, with load carrying straps, or a fork lift with a stinger bar. Rolls should not be dragged, lifted by one end, lifted by cables or chains, or dropped to the ground.

3.2.3

Cover the concrete mats during long periods of storage to protect against degradation of the backing material as recommended by the manufacturer.

3.3 INSTALLATION

In general concrete block erosion mats shall be installed to the line and grade shown on the plans and per the manufacturer's guidelines. Contractor is responsible for the following activities:

- Prior to installing concrete block erosion control mats, the contractor shall prepare the channel subgrade as shown in the drawings. Subgrade surfaces shall be free of all debris, rocks, stones, sticks, roots, or any items that may penetrate the block mats.
- The contractor shall ensure the prepared subgrade provides a smooth and firm foundation for the mats. The stormwater channel subgrade shall be graded to a vee or trapezoidal shape as required.
- Contractor shall provide and install seed and fertilizer as shown in the drawings to the prepared subgrade prior to installation of the concrete mats in accordance with the specifications.
- Concrete block erosion control mats shall be installed immediately following completion of final channel grading and placement of permanent seed and mulch.
- Provide a minimum 18 in. deep concrete mat embedment toe trench at all edges exposed to concentrated flows. Recess exterior edges subject to sheet flow a minimum of 3 in.
- Provide and install soil anchoring as recommended by the manufacturer or engineer for the site conditions.
- For seams parallel to the flow line in ditch or channel applications, center a minimum 3 ft. wide strip of soil retention blanket under the seam. Fasten along the seam at 5 ft. maximum spacing. Parallel seams in the center of the ditch shall be avoided when possible.
- Shingle seams perpendicular to the flow line with the downstream mat recessed a minimum of 2 blocks under the upstream mat and fastened together along the seam at 2 ft. maximum spacing if required by manufacturer or engineer.

4.0 INSPECTION AND MAINTENANCE

4.1 GENERAL

4.1.1

Ensure that delivered products are equivalent to the approved product.

4.1.2

All mats to be inspected upon delivery. Inspect that blocks are sound and free of defects that would interfere with placement or that would limit the strength or intended life cycle of the material. Discard blocks with defects as described below.

4.1.3

Assure that all units are sound and free of defects that would interfere with the proper placing of the unit or impair the strength or permanence of the construction.

4.1.4

Chipping or missing concrete resulting in a weight loss exceeding 15% of the average weight of a concrete unit is grounds for rejection by the engineer. Replace, repair or patch the damaged areas per the manufacturer's recommendations.

4.1.5

Minor cracks, incidental to the manufacturing, or small chips that have occurred as a result of normal shipping, and placement should not be rejected.

4.1.6

Concrete mats are shipped in rolls and are packaged with handling straps. These handling straps shall only be used for lifting below 2 ft. to place heavy duty lifting straps under rolls. Upon delivery, rolls may be left exposed for up to 30 days. If exposure will exceed 30 days, cover or tarp the rolls to minimize UV exposure.

4.2 REPAIRS AND MAINTENANCE

Upon finding that any measure requires repair or maintenance, Contractor shall repair or maintain the measure at no additional cost to Owner in accordance with this specification.

END OF SECTION 35 31 20

SECTION 43 21 10
CONDENSATE SUMPS

1.0 GENERAL

1.1. DESCRIPTION

1.1.1.

Provide all materials, equipment, and labor needed to install the condensate sump and appurtenances in accordance with the Drawings.

1.1.2. Related Work Described Elsewhere

- Section 31 23 33: Trenching, Backfilling, Compacting
- Section 33 51 10: LFG Pipe and Pipe Fittings
- Section 33 51 20: Valves

0.1 SUBMITTALS

1.1.3.

The CONTRACTOR shall prepare and submit to the ENGINEER for review and approval manufacturer's literature, shop drawings, or other information pertaining to the assembly, operation, lubrication, adjustments, and other maintenance and repairs of equipment installed under this Section, together with detailed parts lists, Drawings, and/or photographs.

1.1.4.

The CONTRACTOR shall submit to the ENGINEER for review and approval the pump performance curve showing the flowrate, total dynamic head, and other performance data over the range of anticipated conditions for the project.

2. PRODUCTS

2.1. CONDENSATE SUMPS

2.1.1.

The unit shall be a standalone device with all components rated for service in harsh and explosive environments.

2.1.2.

The inline, below grade, sump shall conform to the dimensions shown on the Drawings.

2.1.3.

The sump shall be a welded, single-walled HDPE assembly. The sump shall be fabricated of PE 4710 Extra High Molecular Weight (EHMW) High Density Polyethylene (HDPE) Cell Class 445574C/E, or equal. The reservoir shall be designed to withstand:

2.1.3.1. A vacuum of 100 inches-w.c. and a pressure of 1 PSIG at 130 degrees F.

2.1.3.2. Provide resistance to a buoyancy force in a saturated soil condition.

2.1.3.3. An earthen backfill fluid pressure of 35 pcf.

2.1.4.

Each pipe penetration shall be reinforced with four gussets spaced equally around the circumference.

2.1.5.

The forces and impacts that typically occur in loading, unloading, shipping, handling at the job site, and installation.

2.1.6.

Joints shall be fused for their entire lengths. The complete sump shall be airtight, air-tested in the factory, and air-test results provided. Air testing shall be similar to the testing described in Section 33 51 10; i.e., @ 5 psig the pressure drop shall not exceed one percent over a period of one hour.

2.1.7.

The condensate sump shall have a pump access casing that allows removal of the pump and float type level controls while maintaining vacuum to the system and preventing air intrusion. The pump will discharge through a condensate forcemain.

2.1.8.

Provide 1/2-inch-diameter stainless steel tubing and fittings for the balance tube and vent. Tubing and fittings shall be as manufactured by The Swagelok Company or equivalent approved by ENGINEER.

2.1.9.

The condensate sump pump shall have a minimum design pumping capacity of 3 gpm at 80 feet of Total Dynamic Head (TDH) or approved by ENGINEER. All wetted parts of the sump pump shall be of non-corrosive materials. The pump shall be suitable for operating in the sump while under a vacuum up to 60 inches-w.c.

2.1.10.

The pneumatic pump shall be bottom-loading short pump, as manufactured by Pump One or equivalent, and equipped with a regulator and cycle counter. The pump shall be capable of submersible operation with air exhaust port equipped with a needle valve for throttling purposes and plumbed above the high liquid level in the sump. The pump air valve shall be of stainless steel construction.

2.1.11.

CONTRACTOR shall provide and install 1-inch-diameter discharge hose and pneumatically operated pump controls. CONTRACTOR shall provide and install all necessary piping, tubing, fittings, and appurtenances for the complete installation of the pump unit and controls.

2.1.12.

CONTRACTOR shall provide an Easy Level Liquid Level Indicator, as manufactured by QED Environmental Systems or equivalent, to register a high liquid level condition in the sump. Liquid level indicator shall include only the Easy Level indicator, down well liquid probe and connecting tubing (i.e., digital level meter or easy level gauge are not required).

2.1.13.

CONTRACTOR shall wrap pump discharge hose and exposed force main piping with insulation.

2.1.14.

The general piping configuration of the condensate sump shall be as shown on the Drawings.

2.2. APPURTENANCES

2.2.1. Appurtenances such as the pipe stub-outs, access port, interior piping, and handles to pick up and handle each unit shall be fabricated of like material or compatible HDPE material.

3. EXECUTION

3.1. EXCAVATION AND BACKFILL

3.1.1.

Excavation, temporary sheeting, shoring, and bracing, and backfill shall comply with Section 31 23 33.

3.1.2.

If liquids are encountered, the CONTRACTOR shall dewater the excavation during installation.

3.1.3.

Prior to setting the condensate sump, a minimum of 2-feet of VDOT #3 aggregate must be placed at the bottom of the excavation. Once the condensate sump is set in the excavation, CONTRACTOR must level and orient the sump inlet and outlet to the approval of the ENGINEER prior to backfill activities. The excavation shall be backfilled with clean, well-draining soil.

3.1.4.

CONTRACTOR shall place a minimum of 2-feet of concrete on top of sump anti-flotation base plate as ballast prior to placement of soil backfill.

3.1.5.

Backfill shall be compacted in 1-foot lifts using suitable equipment approved by the ENGINEER. If the ENGINEER suspects adequate compaction is not being achieved, the CONTRACTOR shall test the backfill material to demonstrate a density of at least 90 percent of the maximum density as determined by ASTM D698 (Standard Proctor).

3.2. INSTALLATION

3.2.1.

The CONTRACTOR shall use care in handling and installing the sump assemblies, and in backfilling so as to avoid damage. The CONTRACTOR shall be responsible for repairing any damage. Installation shall comply with the manufacturers' recommendations and the PLANS as approved by the ENGINEER.

3.3. TESTING

3.3.1.

Upon completion of the installation, tests shall be performed by the CONTRACTOR, in the presence of the ENGINEER. These tests shall demonstrate condensate sump startup, shutdown, operation, and maintenance. Equipment and other requirements necessary to perform the tests shall be furnished by the CONTRACTOR.

3.3.2.

After installation of the sump assembly, the assembly shall be air-tested in a manner similar to the testing described in Section 33 51 10: i.e., @ 5 psig the pressure drop shall not exceed one percent over a period of one hour.

3.3.3.

Test failures shall be identified, repaired, and re-tested as described in Section 33 51 10.

END OF SECTION 43 21 10

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