Invitation to Bid for
Stage II Landfill Gas Collection and Control System Expansion

Integrated Solid Waste Management Facility
2655 Valley Drive
Bristol, Virginia 24201
276-645-7380

City of Bristol, Virginia
300 Lee Street
Bristol, Virginia 24201

SCS ENGINEERS

SCS Project No. 02218208.14
February 18, 2025

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

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1 EXECUTIVE SUMMARY

ITB# SW-25-002 February 18, 2025

The City of Bristol, Virginia (the City) is seeking bids from qualified bidders for the construction of the Stage II Landfill Gas Collection and Control System (LFGCCS) Expansion at the Bristol Integrated Solid Waste Management Facility (ISWMF) 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.

SCS Engineers (SCS) has prepared this Project Manual for the City of Bristol, Virginia for the construction of the Stage II LFGCCS Expansion at the Bristol ISWMF.

SUBMITTAL REQUIREMENTS

Bids should be submitted to the City of Bristol for the Stage II Landfill Gas Collection and Control System (LFGCCS) Expansion. Three (3) complete sealed copies of bidding documents for the Stage II LFGCCS Expansion 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 the date listed on the invitation to bid. 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. The City of Bristol requires three (3) complete sealed copies of bidding documents. Those wishing to submit electronically may do so via the eVA procurement platform while also submitting the required paper copies to the City by the due date. No FAXED nor emailed bids 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-25-002 for the Stage II Landfill Gas Collection and Control System Expansion” 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: Stage II Landfill Gas Collection and Control System Expansion

Owner:

City of Bristol
2655 Valley Drive
Bristol, VA 24201

Engineer:

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

Date: February 18, 2025

Prospective Bidders

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

City of Bristol, VA
Attention: Adam Timbs, Purchasing
300 Lee Street
Bristol, VA 24201
Bid on Stage II Landfill Gas Collection and Control System Expansion
Due Date: April 17, 2025 2:00 PM
ITB# SW-25-002

Bids should be submitted to the City of Bristol for the Stage II Landfill Gas Collection and Control System (LFGCCS) Expansion. Three (3) complete sealed copies of bidding documents for the Stage II LFGCCS Expansion 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 Thursday the 17th day of April 2025. 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. The City of Bristol requires three (3) complete sealed copies of bidding documents. Those wishing to submit electronically may do so via the eVA procurement platform while also submitting the required paper copies to the City by the due date. No FAXED nor emailed bids 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-25-002 for the Stage II Landfill Gas Collection and Control System Expansion" 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.

The Owner requires the Project to be substantially completed within 330 days and will be completed and ready for final payment within 365 days.

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 $250.00 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. If a separate site visit is scheduled, questions may not be asked during the site visit and must be submitted in writing. The Pre-Bid Conference will be held at 1:00 PM on the 12th day of March 2025 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 forth in an Addendum will be binding. Questions are to be submitted by Monday, March 31th, 2025.

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 Stage II LFGCCS Expansion in accordance with Contract Documents.

1.0 DEFINED TERMS

Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

1.1 ISSUING OFFICE

The office from which the Bidding Documents are to be issued, and which registers plan holders.

1.2 BIDDING DOCUMENTS

Contract Documents supplemented with Advertisement for Bids, Invitation to Bid, Instructions to Bidders, Information Available to Bidders, Bid Form, Bid Securities, and Bidder's Qualifications, identified.

1.3 CONTRACT DOCUMENTS

The Contract Documents consist of all of the following:

- The Contract as depicted as an attachment to the terms and conditions.
- Bonds:
  - Performance bond (together with power of attorney).
  - Payment bond (together with power of attorney).
- Terms and Conditions.
- Specifications as listed in the table of contents of the project manual.
- Drawings listed in the table of contents of the project manual.
- The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
  - Notice to Proceed.
  - Work Change Directives.
  - Change Orders.
  - Field Orders.
  - Warranty Bond, if any.

The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

1.4 BID

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

1.5 BID PRICE

Monetary sum identified by the Bidder in the Bid Form.

2.0 BIDDING DOCUMENTS

2.1 COMPLETENESS

Bidder must 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 USE

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 OBTAINING

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 $250.00 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

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 Format of Electronic Documents

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.

2.4.2 Bidder's Reliance on Electronic Documents

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 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.

2.4.3 Files in native format

Upon request to Bidders during the bid process and after the Contract is awarded, the Owner will provide or direct the Engineer to provide for the use of the Contractor documents that were developed by Engineer as part of the Project design process, as Electronic Documents in native file formats.

2.4.3.1 Documents

Electronic Documents that are available in native file format include:

- Contract Drawings CAD Files

2.4.3.2 Release

Release of such documents will be solely for the convenience of the Bidder/Contractor. No such document is a Contract Document.

2.4.3.3 Availability

Unless the Contract Documents explicitly identify that such information will be available to the Successful Bidder (Contractor), nothing herein will create an obligation on the part of the Owner or Engineer to provide or create such information, and the Contractor is not entitled to rely on the availability of such information in the preparation of its Bid or pricing of the Work. In all cases, the Contractor shall take appropriate measures to verify that any electronic/digital information provided in Electronic Documents is appropriate and adequate for the Contractor's specific purposes.

2.4.3.4 Payment

In no case will the Contractor be entitled to additional compensation or time for completion due to any differences between the actual Contract Documents and any related document in native file format.

2.4.3.5 Acknowledgement

Prior to release of Electronic Documents, bidders and contractor may be required to sign a separate acknowledgement of additional terms regarding the use of electronic documents in native format.

2.4.3.6 Acceptance

Bidder's acceptance and use of the Electronic Files signifies Bidder's consent to be fully bound by the terms of this Agreement, whether or not Bidder signs the acknowledgement.

2.4.3.7 Restrictions on Use

Bidder agrees not to use the Electronic Files, in whole or in part, for any purpose other than for the Stage II Landfill Gas Collection and Control System Expansion ("Project"). Bidder agrees not to transfer the Electronic Files to others without the prior written consent of SCS.

2.4.3.8 Ownership

In accepting and using the Electronic Files provided by SCS, Bidder agrees that all Electronic Files are instruments of service of SCS, and SCS shall be deemed the author, and shall retain all common law, statutory and other rights, including copyrights, in the Electronic Files and any derivative works thereof. By this Agreement SCS grants Bidder only a non-exclusive, non-transferable, limited license to use the Electronic Files solely for purposes of the Project. Neither this Agreement nor the license hereby granted may be transferred, sold or assigned.

2.4.3.9 Title Block

If SCS's name, title block and/or logo appear in the Electronic Files, Bidder agrees to delete same prior to using the Electronic Files.

2.4.3.10 Security

SCS and the Owner make no representation or warranty as to the compatibility of the Electronic Files with Bidder's hardware or software, or that the means or media of electronic transfer of the Electronic Files is free of computer virus.

2.4.3.11 Conflicts

Bidder is aware that differences may exist between the Electronic Files delivered and the data or hard copy files from which the Electronic Files are derived. It shall be Bidder's responsibility to determine the accuracy, correctness and completeness of the information contained in the Electronic Files and whether any conflicts exist with other data or records.

2.4.3.12 Limitations

Bidder acknowledges that the Electronic Files have not been prepared for the purposes of determining exact locations of features or dimensions. SCS and the Owner make no warranties or guarantees, express or implied, as to the accuracy, correctness or completeness of the information contained in the Electronic Files, including any warranty of merchantability or warranty of fitness for a particular purpose. Bidder agrees to independently verify the accuracy, correctness and completeness of the Electronic Files for its needs. Use of the Electronic Files provided herewith is solely at the risk of the Bidder, and Bidder covenants not to sue and waives and releases SCS, its officers, directors, employees and subconsultants from and against any claims or liability resulting from such use, whether in tort, contract or otherwise.

2.4.3.13 Updates

SCS and the Owner shall have no obligation to notify Bidder of, or to provide to Bidder, any revisions or changes to the data or information contained in the Electronic Files.

3.0 BIDDER QUALIFICATIONS

To demonstrate qualification for performing the Work of this Contract, each Bidder must 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. Refer to 00 11 16 Invitation to Bid for the Pre-Bid Conference time, location, and site contact information.

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 OTHER SITE-RELATED DOCUMENTS

5.2.1 Additional Documents

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:

- N/A

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

5.2.2 Accuracy

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.

5.2.3 Relation to Contract

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

5.2.4 Review

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.

5.3 SITE VISIT AND TESTING BY BIDDERS

5.3.1 Requirements

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.

5.3.2 Post-Conference Visit

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

5.3.3 Transportation

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

5.3.4 Coordination

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 (1-276-644-3771). Bidder must conduct the required Site visit during normal working hours.

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

- 7:00 AM to 3:00 PM Monday through Friday

5.3.5 Testing

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

5.3.6 Additional Examination

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.

5.3.7 Regulatory Requirements

Bidder must comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits not obtained by the owner as outlined in the contract documents, 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.

5.3.8 Restoration

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.

5.4 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 Terms and Conditions.

5.5 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 must 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 must 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 EXAMINATION

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 AWARD

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 ISSUANCE

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

7.2 QUESTIONS

Bidders must submit all questions about the meaning or intent of the Bidding documents to the Engineer in writing via email to aworth@scsengineers.com (copy twilliams@scsengineers.com). All questions will be gathered and addressed at the pre-bid conference. Questions must be submitted according to the instructions and by the question deadline as noted in the Invitation to Bid section (00 11 16).

7.3 INTERPRETATIONS OR CLARIFICATIONS

Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions are to be submitted according to the instructions and by the question deadline noted in the Invitation to Bid (section 00 11 16).

7.4 DOCUMENTATION

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 NOTIFICATION

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

8.0 BID SECURITY

8.1 AMOUNT AND FORMAT

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 Requirements

Contractor must 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 SUCESSFUL BIDDER

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 COMPETITIVE BIDDERS

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 OTHER BIDDERS

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 EVALUATION

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 PRICES

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 DOCUMENTATION

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:

- Soils Testing Firms
- Landfill gas blower/flare station manufacturer with manufacturing lead times
- Landfill gas system installer

11.2 SUPPLEMENTAL INFORMATION

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 SUBSTITUTION

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 FORM

The Bid Form is included with the Bidding Documents.

12.1.1 Preparation

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 Alternate

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 FORMAT

If Bidder has obtained the Bidding Documents as Electronic Documents, then Bidder must 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 CORPORATE AUTHORIZATION

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 PARTNERSHIP AUTHORIZATION

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 LIMITED LIABILITY COMPANY AUTHORIZATION

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 INDIVIDUAL AUTHORIZATION

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

12.7 JOINT VENTURE AUTHORIZATION

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 PRINTED NAMES

All names must be printed in ink below the signatures.

12.9 ADDENDA

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 CONTACT INFORMATION

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

12.11 AUTHORITY

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 LICENSE

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 INSTRUCTIONS

Refer to 00 11 16 Invitation to Bid for bid submission instructions.

15.0 MODIFICATION AND WITHDRAWAL OF BID

15.1 WITHDRAWAL

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 MODIFICATION

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 POST-OPENING WITHDRAWAL

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

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 REJECTION AND ACCEPTANCE

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 RESPONSIBLE BIDDER

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

18.3 CONDITIONS AND EXCEPTIONS

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 AWARD

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 Criteria

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 Qualifications

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 Investigations

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, VA
Attention: Adam Timbs, Purchasing
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 Stage II LFGCCS Expansion. 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 Bid Lump Sum Price – Stage II LFGCCS Expansion

#	Description	Unit[1]	Lump Sum Price
1	Mobilization/Demobilization	LS	
2	Environmental, Health, and Safety Planning and Accommodations	LS	
3	Clearing, Grubbing, and Stripping	LS	
4	Erosion and Sediment Control	LS	
5	Remove and Stockpile Existing LFG Header	LS	
6	Furnish LFG Header Materials	LS	
7	Install LFG Header	LS	
8	Furnish Air and Force Main Materials	LS	
9	Install Air and Force Main	LS	
10	Furnish and Install LFG Condensate Sumps	LS	
11	Furnish and Install New Landfill Gas Blower/Flare Station	LS	
12	Furnish and Install LFG Condensate Drain Line from New Blower/Flare Station	LS	
13	Furnish and Install New LFG Wellheads for Northern Cleanout and Tie-in to New LFG Header	LS	
14	Furnish and Install New Force Main Cleanouts along Existing Lines	LS	
15	Furnish and Install Quarry Access Road	LS	
16	Furnish and Install Permanent Seeding	LS	
17	Furnish and Install Backup Generator System	LS	
18	Furnish and Install Electrical Service to Backup Generator and New Landfill Gas Blower/Flare Station	LS	

3.1.2 Total Lump Sum Bid Price

The Total Price is the summation of the bid items in section 3.1.1.

Total Price	Total Price with Bid Items	$

[1] LS indicates lump sum price

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 payment on or before the dates or within the number of calendar days indicated in the Term and Conditions.

4.2 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

In submitting this Bid, Bidder represents the following:

6.1.1 Examination of Documents

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

6.1.2 Site Examination

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.

6.1.3 Laws and Regulations

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

6.1.4 Background Documents

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 the Bid Documents, with respect to the Technical Data in such reports and drawings.

6.1.5 Hazardous Environmental Conditions

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.

6.1.6 Other Information

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.

6.1.7 No Further Examinations

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.

6.1.8 Nature of Work

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.

6.1.9 Notice

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.

6.1.10 Sufficiency of Documents

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

6.1.11 Pricing

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

The Bidder certifies the following:

6.2.1 Genuine Bid

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.

6.2.2 Solicitation

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

6.2.3 Discouragement of Bids

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

6.2.4 Corrupt, Fraudulent, Collusive, or Coercive Practices

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:

6.2.4.1.1 Corrupt

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.

6.2.4.1.2 Fraudulent

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.

6.2.4.1.3 Collusive

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.

6.2.4.1.4 Coercive

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.

7.0 VIRGINIA STATE CORPORATION COMMISSION (SCC) REGISTRATION INFORMATION

☐ is a corporation or other business entity with the following SCC identification number:

_____ -OR-

☐ is not a corporation, limited liability company, limited partnership, registered limited liability partnership, or business trust -OR-

☐ is an out-of-state business entity that does not regularly and continuously maintain as part of its ordinary and customary business any employees, agents, offices, facilities, or inventories in Virginia (not counting any employees or agents in Virginia who merely solicit orders that require acceptance outside Virginia before they become contracts, and not counting any incidental presence of the bidder in Virginia that is needed in order to assemble, maintain, and repair goods in accordance with the contracts by which such goods were sold and shipped into Virginia from bidder's out-of-state location) -OR-

☐ is an out-of-state business entity that is including with this bid an opinion of legal counsel which accurately and completely discloses the undersigned bidder's current contacts with Virginia and describes why those contacts do not constitute the transaction of business in Virginia within the meaning of § 13.1-757 or other similar provisions in Titles 13.1 or 50 of the Code of Virginia.

NOTE Check the following box if you have not completed any of the foregoing options but currently have pending before the SCC an application for authority to transact business in the Commonwealth of Virginia and wish to be considered for a waiver to allow you to submit the SCC identification number after the due date for bids (the Commonwealth reserves the right to determine in its sole discretion whether to allow such waiver): ☐

Authorized Signature

Date

Printed Name

Printed Company Name

Street Address

City, State, Zip

Telephone Number

Fax Number

Email

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

STAGE II LFGCCS EXPANSION 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	

Environmental, Health, and 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.:	02218208.14
Project:	Stage II LFGCCS Expansion		
Contract Name:	Stage II LFGCCS Expansion		
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:

Stage II LFGCCS Expansion

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

SECTION 00 55 00

NOTICE TO PROCEED[i]

Owner:	City of Bristol	Owner's Project No.:	
Engineer:	SCS Engineers	Engineer's Project No.:	02218208.14
Contractor:		Contractor's Project No.:	
Project:	Stage II LFGCCS Expansion		
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 _____; and the date to achieve readiness for final payment is _____.

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)*: **Stage II LFGCCS Expansion** **Bristol ISWMF** **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.

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:

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

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.

SECTION 00 61 13.16 - PAYMENT BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: **City of Bristol** Mailing address *(principal place of business)*: **300 Lee St** **Bristol, VA 24201**	Description *(name and location)*: **Stage II LFGCCS Expansion** **Bristol ISWMF** **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.	

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.

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;

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.

Contractor's Application for Payment

Owner:	City of Bristol	**Owner's Project No.:**	
Engineer:	SCS Engineers	**Engineer's Project No.:**	02218208.14
Contractor:		**Contractor's Project No.:**	
Project:	Stage II LFGCCS Expansion		
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.	5%	X	$ -	Work Completed	$ -
b.	5%	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:**	

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.:**	02218208.14
Contractor:		**Contractor's Project No.:**	
Project:	Stage II LFGCCS Expansion		
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	Environmental, Health, and Safety Planning and Accomodations					-		-
3	Clearing, Grubbing, and Stripping					-		-
4	Erosion and Sediment Control					-		-
5	Remove and Stockpile Existing LFG Header					-		-
6	Furnish LFG Header Materials					-		-
7	Install LFG Header					-		-
8	Furnish Air and Force Main Materials					-		-
9	Install Air and Force Main							
10	Furnish and Install LFG Condensate Sumps					-		-
11	Furnish and Install New Landfill Gas Blower/Flare Station					-		-
12	Furnish and Install LFG Condensate Drain Line from New Blower/Flare Station					-		-
13	Furnish and Install New LFG Wellheads for Northern Cleanout and Tie-in to New LFG Header					-		-
14	Furnish and Install New Force Main Cleanouts along Existing Lines					-		-
15	Furnish and Install Quarry Access Road					-		-
16	Furnish and Install Permanent Seeding							
17	Furnish and Install Backup Generator System							
18	Furnish and Install Electrical Service to Backup Generator and New Landfill Gas Blower/Flare Station							
						-		-
						-		-
						-		-
						-		-
						-		-
						-		-
	Original Contract Totals	$ -	$ -	$ -	$ -	$ -		$ -

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.:**	02218208.14
Contractor:		**Contractor's Project No.:**	
Project:	Stage II LFGCCS Expansion		
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	$ -	$ -	$ -	$ -	$ -		$ -

Progress Estimate - Unit Price Work **Contractor's Application for Payment**

Owner:	City of Bristol	**Owner's Project No.:**	
Engineer:	SCS Engineers	**Engineer's Project No.:**	02218208.14
Contractor:		**Contractor's Project No.:**	
Project:	Stage II LFGCCS Expansion		
Contract:			

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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					-		-		-		-
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					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
				Original Contract Totals	$ -		$ -	$ -	$ -		$ -

Progress Estimate - Unit Price Work **Contractor's Application for Payment**

Owner:	City of Bristol	**Owner's Project No.:**	
Engineer:	SCS Engineers	**Engineer's Project No.:**	02218208.14
Contractor:		**Contractor's Project No.:**	
Project:	Stage II LFGCCS Expansion		
Contract:			

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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					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
				Change Order Totals	$ -		$ -	$ -	$ -		$ -
					Original Contract and Change Orders						
				Project Totals	$ -		$ -	$ -	$ -		$ -

EJCDC C-620 Contractor's Application for Payment

Stored Materials Summary

Contractor's Application for Payment

Owner:	City of Bristol	**Owner's Project No.:**	
Engineer:	SCS Engineers	**Engineer's Project No.:**	02218208.14
Contractor:		**Contractor's Project No.:**	
Project:	Stage II LFGCCS Expansion		
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	$ -	$ -	$ -	$ -	$ -	$ -	$ -

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.:	02218208.14
Contractor:		Contractor's Project No.:	
Project:	Stage II LFGCCS Expansion		
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.:	02218208.14
Contractor:		Contractor's Project No.:	
Project:	Stage II LFGCCS Expansion		
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.:	02218208.14
Contractor:		Contractor's Project No.:	
Project:	Stage II LFGCCS Expansion		
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.:	02218208.14
Contractor:		Contractor's Project No.:	
Project:	Stage II LFGCCS Expansion		
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, environmental compliance, 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 City must be listed as a Certificate Holder when contracted work might result in injury or property damage. By signing and submitting a bid under this solicitation, the bidder certifies that if awarded the contract, it will have the following insurance coverage at the time the contract is awarded and certifies it will immediately add the City as a Certificate Holder as listed. For construction contracts, if any subcontractors are involved, the subcontractor will have workers' compensation insurance in accordance with §§ 2.2-4332 and 65.2-800 et seq. of the Code of Virginia. The bidder further certifies that the contractor and any subcontractors will maintain these insurance coverages during the entire term of the contract and that all insurance coverage will be provided by insurance companies authorized to sell insurance in Virginia by the Virginia State Corporation Commission.

3. 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.

4. 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. The City shall be added as an additional insured to the policy by an endorsement. The contractor shall be totally responsible for damages to the premises including crane and truck operations on sidewalks, pavement and or grass.

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

    (Required only if a motor vehicle not owned by the City is to be used in the contract. Contractor must assure that the required coverage is maintained by the Contractor (or third party owner of such motor vehicle.)

    e. Professional Liability:

Profession/Service	Limits
Accounting	$1,000,000 per occurrence, $3,000,000 aggregate
Architecture	$2,000,000 per occurrence, $6,000,000 aggregate
Asbestos Design, Inspection or Abatement Contractors	$1,000,000 per occurrence, $3,000,000 aggregate

Profession/Service	Limits
Health Care Practitioner (to include Dentists, Licensed Dental Hygienists, Optometrists, Registered or Licensed Practical Nurses, Pharmacists, Physicians, Podiatrists, Chiropractors, Physical Therapists, Physical Therapist Assistants, Clinical Psychologists, Clinical Social Workers, Professional Counselors, Hospitals, or Health Maintenance organizations.)	$2,150,000 per occurrence, $4,250,000 aggregate (Limits increase each July 1 through fiscal year 2031per Code of Virginia § 8.01-581.15.)
Insurance/Risk Management	$1,000,000 per occurrence, $3,000,000 aggregate
Landscape/Architecture	$1,000,000 per occurrence, $1,000,000 aggregate
Legal	$1,000,000 per occurrence, $5,000,000 aggregate
Professional Engineer	$2,000,000 per occurrence, $6,000,000 aggregate
Surveying	$1,000,000 per occurrence, $1,000,000 aggregate

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

5. 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.

6. 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.

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

8. 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.

9. 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.

10. 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. Environmental Compliance

All Offerors and sub-offerors performing services for the City are required and must comply with all City, state and federal environmental regulations and permits as applicable. Also, all Offerors and sub-offerors must be held responsible for the environmental compliance of their employees and any non-compliant acts or conditions that may cause harm to human health and the environment within and around the work site area under this Contract.

I. 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.

J. 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.

By submitting their bids, bidders certify that their bids are made without collusion or fraud and that they have not offered or received any kickbacks or inducements from any other bidder, supplier, manufacturer or subcontractor in connection with their bid, and that they have not conferred on any public employee having official responsibility for this procurement transaction any payment, loan, subscription, advance, deposit of money, services or anything of more than nominal value, present or promised, unless consideration of substantially equal or greater value was exchanged.

K. Drug-free Workplace

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.

L. 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.

M. 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.

N. Payment

1. Payments to Prime Contractor

a. Invoices for items ordered, delivered and accepted shall be submitted by the contractor directly to the payment address shown on the purchase order/contract. All invoices shall show the state contract number and/or purchase order number; social security number (for individual contractors) or the federal employer identification number (for proprietorships, partnerships, and corporations).

b. Any payment terms requiring payment in less than 45 days will be regarded as requiring payment 45 days after invoice or delivery, whichever occurs last. This shall not affect offers of discounts for payment in less than 45 days, however.

c. All goods or services provided under this contract or purchase order, that are to be paid for with public funds, shall be billed by the contractor at the contract price.

d. The following shall be deemed to be the date of payment: the date of postmark in all cases where payment is made by mail, or when offset proceedings have been instituted as authorized under the Virginia Debt Collection Act.

e. **Unreasonable Charges**. Under certain emergency procurements and for most time and material purchases, final job costs cannot be accurately determined at the time orders are placed. In such cases, contractors should be put on notice that final payment in full is contingent on a determination of reasonableness with respect to all invoiced charges. Charges which appear to be unreasonable will be resolved in accordance with Code of Virginia, § 2.2-4363 and -4364. Upon determining that invoiced charges are not reasonable, the City shall notify the contractor of defects or improprieties in invoices within fifteen (15) days as required in Code of Virginia, § 2.2-4351. The provisions of this section do not relieve the City of its prompt payment obligations with respect to those charges which are not in dispute (Code of Virginia, § 2.24363)

2. Payments to Subcontractors

   a. 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(s) for the proportionate share of the total payment received from the City attributable to the work performed by the subcontractor(s) under this Contract; or

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

   b. The contractor is obligated to pay the subcontractor(s) interest at the rate of one percent per month (unless otherwise provided under the terms of the contract) on all amounts owed by the contractor that remain unpaid seven (7) days following receipt of payment from the City, except for amounts withheld as stated in (2) above. The date of mailing of any payment by U. S. Mail is deemed to be payment to the addressee. These provisions apply to each sub-tier contractor performing under the primary contract. A contractor's obligation to pay an interest charge to a subcontractor may not be construed to be an obligation of the City.

3. Each prime contractor who wins an award in which provision of a SWaM procurement plan is a condition to the award, shall deliver to the City, on or before request for final payment, evidence and certification of compliance (subject only to insubstantial shortfalls and to shortfalls arising from subcontractor default) with the SWaM procurement plan. Final payment under the contract in question may be withheld until such certification is delivered and, if necessary, confirmed by the City, or other appropriate penalties may be assessed in lieu of withholding such payment.

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 City. 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 cancel the contract without penalty when it is determined to be in the best interest of the City (termination for the convenience of the City). Any contract cancellation notice shall not relieve the contractor of the obligation to deliver and/or perform on all outstanding orders issued prior to the effective date of cancellation.

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 Attention: Adam Timbs, Purchasing 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.

Notices and communications requiring email may be sent to adam.timbs@bristolva.org.

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 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 within 330 days after the date when the Contract Times commence to run, and completed and ready for final payment in accordance within 365 days after the date when the Contract Times commence to run.

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

LL. 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.

MM. 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.

NN. 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).

OO. Weather-Related Delays in Contractor's Progress

Notwithstanding anything in the Contract Documents to the contrary, Contract Times extensions because of weather delays shall be based only on the following criteria and will be determined only as set forth below:

1. Even though a cause of delay meets any or all of the conditions stated herein, it shall in all cases be presumed that no extension, or further extension, of time is due unless Contractor shall demonstrate that the delay is justified and had an impact on the updated schedule's critical path for the delay period. To this end, Contractor shall maintain adequate records supporting any claim for an extension of time and shall submit such records, including a revised schedule showing the impact of the delay, with the claim. Claims due to weather shall be submitted on a monthly basis and within five days after the end of the month in which the delay is claimed to have occurred.

2. If abnormal weather conditions are the basis for a request for an equitable adjustment in the Contract Times, such request must be documented by data substantiating each of the following: 1) that weather conditions were abnormal for the period of time in which the delay occurred, 2) that such weather conditions could not have been reasonably anticipated, and 3) that such weather conditions had an adverse effect on the Work as scheduled.

3. The existence of abnormal weather conditions will be determined on a month-by-month basis in accordance with the following:

a) Every workday on which one or more of the following conditions exist will be considered a "bad weather day":

   i) Total precipitation (as rain equivalent) occurring between 7:00 p.m. on the preceding day (regardless of whether such preceding day is a workday) through 7:00 p.m. on the workday in question equals or exceeds **1.0 inch** of precipitation as rain equivalent. Two inches of sleet shall equal one inch of rain. See 3.e) in this subsection for snow.

   ii) For earthwork operations, a daily high temperature of twenty degrees Fahrenheit (**20°F**) or less; or, at 3:00 p.m. the ambient outdoor temperature is equal to or greater than the one hundred degrees Fahrenheit (**100°F**).

   iii) Regarding placement of the geosynthetic materials, the following conditions are considered justification for a "bad weather day": (1) a daily high temperature of thirty-three degrees Fahrenheit (33°F) or less, (2) a geosynthetic materials temperature less than forty degrees Fahrenheit (40°F), or (3) wind speeds greater than 15 mph.

b) Determination of actual bad weather days during performance of the Work will be based on the weather records measured and recorded by the City of Bristol weather monitoring station located at the facility, near the scalehouse building.

c) Contractor shall anticipate the number of foreseeable bad weather days per month indicated in the following table:

Month	Number of Foreseeable Bad Weather Days in Month Based on Precipitation as Rain Equivalent (inches) (1)
January	8
February	8
March	8
April	6
May	7
June	6
July	7
August	7
September	5
October	5
November	5
December	6

d) In each month, every bad weather day exceeding the number of foreseeable bad weather days established in the preceding table will be considered as "abnormal weather conditions." The existence of abnormal weather conditions will not relieve Contractor of the obligation to demonstrate and document that delays caused by abnormal weather are specific to the planned work activities or that such activities thus delayed were on Contractor's then-current Progress Schedule's critical path for the Project.

e) Three inches (3") or more of snow cover is considered to be justification for a one-day time extension for each day of 3" or more of snow coverage. However, only one application of this rule, mud or snow, per day is allowed.

PP. Retainage

1. *Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract*

   a) 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

2. *Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 100 percent of the Work completed, less such amounts set off by Owner and less 200 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.*

QQ. Vendors Manual

This solicitation is subject to the provisions of the Commonwealth of Virginia Vendors Manual and any changes or revisions thereto, which are hereby incorporated into this contract in their entirety. The procedure for filing contractual claims is in section 7.19 of the Vendors Manual. A copy of the manual is normally available for review at the purchasing office and is accessible on the Internet at www.eva.virginia.gov under "I Sell To Virginia".

RR. Applicable Laws and Courts

This solicitation and any resulting contract shall be governed in all respects by the laws of the Commonwealth of Virginia, without regard to its choice of law provisions, and any litigation with respect thereto shall be brought in the circuit courts of the Commonwealth. The City and the contractor are encouraged to resolve any issues in controversy arising from the award of the contract or any contractual dispute using Alternative Dispute Resolution (ADR) procedures (Code of Virginia, § 2.2-4366). ADR procedures are described in Chapter 9 of the Vendors Manual. The contractor shall comply with all applicable federal, state and local laws, rules and regulations.

SS. Clarification of Terms

If any prospective bidder has questions about the specifications or other solicitation documents, the prospective bidder should contact the buyer whose contact information appears in the solicitation no later than ten working days before the due date. Any revisions to the solicitation will be made only by addendum issued by the buyer.

TT. Precedence of Terms

The following General Terms and Conditions VENDORS MANUAL, APPLICABLE LAWS AND COURTS, ANTI-DISCRIMINATION, ETHICS IN PUBLIC CONTRACTING, IMMIGRATION REFORM AND CONTROL ACT OF 1986, DEBARMENT STATUS, ANTITRUST, MANDATORY USE OF STATE FORM AND TERMS AND CONDITIONS, CLARIFICATION OF TERMS, PAYMENT shall apply in all instances. In the event there is a conflict between any of the other General Terms and

Conditions and any Special Terms and Conditions in this solicitation, the Special Terms and Conditions shall apply.

UU. Qualifications of Bidders

The City may make such reasonable investigations as deemed proper and necessary to determine the ability of the bidder to perform the services/furnish the goods and the bidder shall furnish to the City all such information and data for this purpose as may be requested. The City reserves the right to inspect bidder's physical facilities prior to award to satisfy questions regarding the bidder's capabilities. The City further reserves the right to reject any bid if the evidence submitted by, or investigations of, such bidder fails to satisfy the City that such bidder is properly qualified to carry out the obligations of the contract and to provide the services and/or furnish the goods contemplated therein.

VV. Testing and Inspection

The City reserves the right to conduct any test/inspection it may deem advisable to assure goods and services conform to the specifications.

WW. Changes to the Contract

Changes can be made to the contract in any of the following ways:

1. The parties may agree in writing to modify the terms, conditions, or scope of the contract. Any additional goods or services to be provided shall be of a sort that is ancillary to the contract goods or services, or within the same broad product or service categories as were included in the contract award. Any increase or decrease in the price of the contract resulting from such modification shall be agreed to by the parties as a part of their written agreement to modify the scope of the contract.

2. The City may order changes within the general scope of the contract at any time by written notice to the contractor. Changes within the scope of the contract include, but are not limited to, things such as services to be performed, the method of packing or shipment, and the place of delivery or installation. The contractor shall comply with the notice upon receipt, unless the contractor intends to claim an adjustment to compensation, schedule, or other contractual impact that would be caused by complying with such notice, in which case the contractor shall, in writing, promptly notify the City of the adjustment to be sought, and before proceeding to comply with the notice, shall await the City's written decision affirming, modifying, or revoking the prior written notice. If the City decides to issue a notice that requires an adjustment to compensation, the contractor shall be compensated for any additional costs incurred as the result of such order and shall give the City a credit for any savings. Said compensation shall be determined by one of the following methods:

    a. By mutual agreement between the parties in writing; or

    b. By agreeing upon a unit price or using a unit price set forth in the contract, if the work to be done can be expressed in units, and the contractor accounts for the number of units of work performed, subject to the City's right to audit the contractor's records and/or to determine the correct number of units independently; or

    c. By ordering the contractor to proceed with the work and keep a record of all costs incurred and savings realized. A markup for overhead and profit may be allowed if

provided by the contract. The same markup shall be used for determining a decrease in price as the result of savings realized. The contractor shall present the City with all vouchers and records of expenses incurred and savings realized. The City shall have the right to audit the records of the contractor as it deems necessary to determine costs or savings. Any claim for an adjustment in price under this provision must be asserted by written notice to the City within thirty (30) days from the date of receipt of the written order from the City. If the parties fail to agree on an amount of adjustment, the question of an increase or decrease in the contract price or time for performance shall be resolved in accordance with the procedures for resolving disputes provided by the Disputes Clause of this contract or, if there is none, in accordance with the disputes provisions of the Commonwealth of Virginia Vendors Manual. Neither the existence of a claim nor a dispute resolution process, litigation or any other provision of this contract shall excuse the contractor from promptly complying with the changes ordered by the City or with the performance of the contract generally.

XX. Default

In case of failure to deliver goods or services in accordance with the contract terms and conditions, the City, after due oral or written notice, may procure them from other sources and hold the contractor responsible for any resulting additional purchase and administrative costs. This remedy shall be in addition to any other remedies which the City may have.

YY. Warranty

The bidder agrees that the goods or services furnished under any award resulting from this solicitation shall be covered by the most favorable commercial warranties the bidder gives any customer for such goods or services and that the rights and remedies provided therein are in addition to and do not limit those available to the City by any other clause of the solicitation. A copy of this warranty should be furnished with the bid. The bidder shall provide with each piece of equipment an operations and maintenance manual with wiring diagrams, parts list and a copy of all warranties.

ZZ. Announcement of Award

Upon the award or the announcement of the decision to award a contract as a result of this solicitation, the City will publicly post such notice for a minimum of 10 days.

AAA. Non-Discrimination of Contractors

A bidder or contractor shall not be discriminated against in the solicitation or award of this contract because of race, religion, color, sex, national origin, age, disability, faith-based organizational status, any other basis prohibited by state law relating to discrimination in employment or because the bidder employs ex-offenders unless the City has made a written determination that employing ex-offenders on the specific contract is not in its best interest. If the award of this contract is made to a faith-based organization and an individual, who applies for or receives goods, services, or disbursements provided pursuant to this contract objects to the religious character of the faith-based organization from which the individual receives or would receive the goods, services, or disbursements, the City shall offer the individual, within a reasonable period of time after the date of this objection, access to equivalent goods, services, or disbursements from an alternative provider.

BBB. Bid Price Currency

Unless stated otherwise in the solicitation, bidders shall state bid prices in US dollars.

CCC. State Corporation Commission Identification Number

Pursuant to Code of Virginia, §2.2-4311.2 subsection B, an offeror organized or authorized to transact business in the Commonwealth pursuant to Title 13.1 or Title 50 is required to include in its bid or proposal the identification number issued to it by the State Corporation Commission (SCC). Any offeror that is not required to be authorized to transact business in the Commonwealth as a foreign business entity under Title 13.1 or Title 50 or as otherwise required by law is required to include in its bid or proposal a statement describing why the offeror is not required to be so authorized. Indicate the above information on the SCC Form provided. Contractor agrees that the process by which compliance with Titles 13.1 and 50 is checked during the solicitation stage (including without limitation the SCC Form provided) is streamlined and not definitive, and the Commonwealth's use and acceptance of such form, or its acceptance of Contractor's statement describing why the offeror was not legally required to be authorized to transact business in the Commonwealth, shall not be conclusive of the issue and shall not be relied upon by the Contractor as demonstrating compliance.

DDD. Award

An award will be made to the lowest responsive and responsible bidder. Evaluation will be based on net prices. Unit prices, extensions and grand total must be shown. In case of arithmetic errors, the unit price will govern. If cash discount for prompt payment is offered, it must be clearly shown in the space provided. Discounts for prompt payment will not be considered in making awards. The City reserves the right to reject any and all bids in whole or in part, to waive any informality, and to delete items prior to making an award.

EEE. Bid Acceptance Period

Any bid in response to this solicitation shall be valid for ninety (90) days. At the end of the days the bid may be withdrawn at the written request of the bidder. If the bid is not withdrawn at that time it remains in effect until an award is made or the solicitation is canceled.

FFF. Mandatory Use of Forms

Failure to submit a bid on the form provided for that purpose shall be a cause for rejection of the bid. Modification of or additions to any portion of the Invitation for Bids may be cause for rejection of the bid; however, the City reserves the right to decide, on a case by case basis, in its sole discretion, whether to reject such a bid as nonresponsive. As a precondition to its acceptance, the City may, in its sole discretion, request that the bidder withdraw or modify nonresponsive portions of a bid which do not affect quality, quantity, price, or delivery. No modification of or addition to the provisions of the contract shall be effective unless reduced to writing and signed by the parties.

GGG. Defective Work

1. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective and in compliance with all applicable permits, rules, and regulations.
2. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

3. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
4. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective or non-compliant Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
5. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
6. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective or non-compliant Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work or non-compliant activity, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article N.

ATTACHMENT A

Sample Contract

CONTRACT FOR

Contract Number:

This contract entered into this_____day of_____2025, 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 as needed.
- Environmental, 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, rocks, boulders, 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 site area as shown in plans and specifications, which will include excavation and removal of rock per Design Drawing details and specifications.
- Maintenance and restoration of stockpiles and borrow areas associated with the work including appropriate erosion and sediment controls.
- Installation of the new quarry landfill access road within the Solid Waste Permit (SWP) No. 588 landfill, including the following:
    - Installation and compaction of soil fill
    - Construction of road surface
- Installation of landfill gas system piping, portions of which are within the SWP. No. 588 landfill, including the following:
    - Trenching, placement, testing, and backfilling for new landfill gas header and removal and stockpiling of existing LFG header

  - Installation of new landfill gas header down the quarry sidewall per Design Drawing details.
  - Trenching, placement, testing, and backfilling for new air and force main lines
  - Construct tie-ins and all necessary connections for new landfill gas features' connections to existing system components
  - Installing new landfill gas isolation valves and other valves
  - Connecting new landfill gas header to new leachate cleanout wellheads
- Installation of the new landfill gas force main cleanouts along the existing lines within and outside of the SWP No. 588 landfill, including:
  - Excavate and expose existing force main lines
  - Furnish and install new force main cleanouts by splicing into existing lines
  - Backfilling and compaction
- Installation of two new landfill gas condensate sumps, one of which will be within the SWP No. 588 landfill, and the other located near the northwest corner of the closed SWP No. 498 landfill outside of the landfill limits, including:
  - Construction of condensate sump structures
  - Excavation, placement, testing, backfilling, and compaction for sump installation
  - Installation of all fittings, valves, pumps, ports, level sensor, tubing, base plate, and all other necessary components
- Installation of the backup generator system, including:
  - Clearing area, grading, and pouring concrete pads for installation of equipment
  - Installation and connection of various electrical equipment, including diesel backup generator, automatic transfer switch, panels, fixtures, cable runs, etc.
- Installation of electrical service to backup generator and landfill gas blower/flare station, including:
  - Connect backup generator system to new overhead electrical service provided by utility company
  - Install electrical cable run between backup generator system and new landfill gas blower/flare station
  - Connection to new landfill gas blower/flare station control system
- Installation of the new landfill gas flare station, including:
  - Installation of concrete pad foundations
  - Installation of skid-mounted equipment atop concrete pads
  - Installation of blowers and flare stack
  - Testing and demonstration of flare operation
  - Preparation and submittal of associated documentation
- Repair/replacement of existing features impacted during construction
- Temporary and permanent seeding and establishment of grass on all disturbed vegetated 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 Schedule

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 Areas

Construction operations limited to areas noted on Drawings.

1.4.3 Cooperation

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

1.4.4

Contractor must 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 must be at Contractor's expense.

1.5 OWNER OCCUPANCY

1.5.1 Term

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

1.5.2 Conflict

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

1.5.3 Schedule

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 must 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 must be included in the Contract Lump Sum Price. Mobilization must be compensated as indicated on the bid form. Mobilization must 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 must 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 must 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 must 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 Environmental, Health, and Safety Planning and Accommodations

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

Payment for Health and Safety Planning and Accommodations must be made at the Lump Sum Price, which price and payment must 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, including work procedures in the vicinity of overhead power lines; personal protective equipment; laboratory testing; field testing equipment; safety meetings; safety training; environmental compliance; environmental best practices; and environmental planning. 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 must be included in the contract Lump Sum Price.

Payment for site clearing and grubbing must be made at the Lump Sum Price, which price and payment must be full compensation for all labor, equipment, materials, and incidentals required for removal, including off-site disposal as needed, of surface debris, rocks, boulders, trees, shrubs, existing pavement, existing stockpiles, 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 must be included in the contract Lump Sum Price.

Payment for Erosion and Sediment Control must be made at the Lump Sum Price, which price and payment must be full compensation for all labor, equipment, and incidentals required to provide erosion and sediment control including temporary seeding, 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 Remove and Stockpile Existing LFG Header

Measurement for Remove and Stockpile Existing LFG Header must not be made for payment and all items must be included in the contract Lump Sum Price.

Payment for Remove and Stockpile Existing LFG Header must be made at the Lump Sum Price, which price and payment must be full compensation for all labor, materials, equipment, testing, and incidentals required to remove and stockpile the existing LFG header as described in the Contract Drawings, including, excavating, disconnecting, cutting, hauling, restoring, and stockpiling, and all other items complete and in-place in accordance with the plans and specifications.

3.1.6 Furnish LFG Header Materials

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

Payment for Furnishing Landfill Gas Header Materials must be made at the Lump Sum Price, which price and payment must 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.

3.1.7 Install LFG Header

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

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

3.1.8 Furnish Air and Force Main Materials

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

Payment for Furnishing Airline and Force Main Materials must be made at the Lump Sum Price, which price and payment must 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.

3.1.9 Install Air and Force Main Lines

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

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

3.1.10 Furnish and Install LFG Condensate Sumps

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

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

3.1.11 Furnish and Install New Landfill Gas Blower/Flare Station

Measurement for the various items required to construct the New Landfill Gas Blower/Flare Station will not be made for payment and all items must be included in the contract Lump Sum Price.

Payment for the construction of the Landfill Gas Blower/Flare Station must be made at the Lump Sum Price, which price and payment must be full compensation for all labor, materials, equipment,

grading, testing, and incidentals required for construction of the blowers, blower skid, flare, concrete pads, fencing, controls, lighting, encasements, air conditioner; and all other construction items complete and in-place in accordance with the plans and specifications.

3.1.12 Furnish and Install LFG Condensate Drain Line from the New Blower/Flare Station

Measurement for the various items required to construct the LFG Condensate Drain Line from the New Blower/Flare Station will not be made for payment and all items must be included in the contract Lump Sum Price.

Payment for the construction of the LFG Condensate Drain Line from the New Blower/Flare Station must be made at the Lump Sum Price, which price and payment must be full compensation for all labor, materials, equipment, testing, and incidentals required for construction including excavation, placement, backfill, compaction, 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 New LFG Wellheads for Northern Cleanout and Tie-in to New LFG Header

Measurement for Furnish and Install New LFG Wellheads for Northern Cleanout and Tie-in to New LFG Header must not be made for payment and all items must be included in the contract Lump Sum Price

Payment for the construction of Furnish and Install New LFG Wellheads for Northern Cleanout and Tie-in to New LFG Header must be made at the Lump Sum Price, which price and payment must 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.

3.1.14 Furnish and Install New Force Main Cleanouts along Existing Lines

Measurement for the various items required to construct the New Force Main Cleanouts along Existing Lines will not be made for payment and all items must be included in the contract Lump Sum Price.

Payment for the construction of the New Force Main Cleanouts along Existing Lines must be made at the Lump Sum Price, which price and payment must be full compensation for all labor, materials, equipment, excavation, testing, backfilling, 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.

3.1.15 Furnish and Install Quarry Access Road

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

Payment for the construction of the Quarry Access Road must be made at the Lump Sum Price, which price and payment must 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.

3.1.16 Furnish and Install Permanent Seeding

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

Payment for permanent seeding of all areas must be made at the Lump Sum Price, which price and payment must 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.

3.1.17 Furnish and Install Backup Generator System

Measurement for the various items required to construct the Backup Generator will not be made for payment and all items must be included in the contract Lump Sum Price.

Payment for the construction of the Backup Generator System must be made at the Lump Sum Price, which price and payment must be full compensation for all labor, materials, equipment, grading, testing, and incidentals required for construction of the backup generator, automatic transfer switch, electrical panels, concrete pads, fencing, controls, lighting, encasements; and all other construction items complete and in-place in accordance with the plans and specifications.

3.1.18 Furnish and Install Electrical Service to Backup Generator and New Landfill Gas Blower/Flare Station

Measurement for the various items required to construct the Electrical Service to Backup Generator and New Landfill Gas Blower/Flare Station will not be made for payment and all items must be included in the contract Lump Sum Price.

Payment for the construction of the Electrical Service to Backup Generator and New Landfill Gas Blower/Flare Station must be made at the Lump Sum Price, which price and payment must be full compensation for all labor, materials, equipment, excavation, testing, and incidentals required for construction of the new above ground and underground cable runs, connections to existing utility company lines, connections to new equipment; and all other construction items complete and in-place in accordance with the plans and specifications.

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

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 Blower-Flare Installation.

1.4.4 Minutes

Engineer will record minutes and distribute copies within 5 business 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 5 business 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, and 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.
- Safety and environmental review
- 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 5 business 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 blower-flare 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 5 business 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 Form

Transmit each submittal with a Submittal Form.

1.2.2 Numbering

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

1.2.3 Details

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

1.2.4 Certification

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

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

1.2.6 Review

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

1.2.7 Variations

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

1.2.8 Space

Allow space on submittals for Contractor and Engineer review stamps.

1.2.9 Revisions

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

1.2.10 Copies

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

1.2.11 Excess

Submittals not requested will not be recognized or processed.

1.2.12 Submission

All submittals must be submitted electronically.

1.3 CONSTRUCTION PROGRESS SCHEDULES

1.3.1 Submittal

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 Revisions

Submit revised Progress Schedules with each Application for Payment.

1.3.3 Copies

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

1.3.4 Concerns

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

1.3.5 Format

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 Sequence

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 Progress

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

1.3.8 Additional Schedules

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 Delivery Dates

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

1.3.10 Revisions To Schedules

1.3.10.1 Progress

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

1.3.10.2 Modifications

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

1.3.10.3 Narrative

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 List Submission

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 Referenced Products

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

1.4.3 Safety Data Sheets

All Safety Data Sheets for materials/products must be submitted to the City for review and retention for compliance.

1.5 PRODUCT DATA

1.5.1 Submission

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 Method

Submit product data electronically.

1.5.3 Data

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 Characteristics

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 Submission

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 Identification

Include identification on each sample, with full Project information.

1.7.3 Number

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

1.7.4 References

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 Manufacturer

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 Data

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

1.10.3 Relevance

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 Submittal

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 Special Methods

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

1.12 INSTALLATION DRAWINGS

1.12.1 Submittal

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

1.12.2 Data

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 must 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 Stop Work

Actions that potentially endanger workers must 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 must 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 must include as a minimum, the following:

1.2.1.1 Organizational Structure

Organizational Structure to include general supervision, Health, Safety, and Environmental officer, lines of authority, and responsibility and communication. The Health, Safety, and Environmental Officer must 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, safety, and environmental, machine operations license, etc.). This must also include a section on safety procedures to be followed for excavation and well drilling (if applicable) 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 (including communication tree), 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 must be recorded with the date and time of sample, and the sampler's name. Sampling must be done by a CONTRACTOR's worker trained in the use of the gas sampling equipment. These trained workers must 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 (if applicable).

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 must 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 must 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 if applicable.

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 35 43

ENVIRONMENTAL PROCEDURES

1.0 GENERAL

1.1 DESCRIPTION

1.1.1 Scope

1.1.1.1 Contractor's Responsibility

The Contractor shall be responsible for furnishing all necessary items for fulfilling the work described herein for Environmental Protection including prevention and control of erosion and sedimentation that results directly or indirectly from the project.as set forth in Section 31 25 00 of these Specifications.

1.1.2 General

The General Assembly of the Commonwealth of Virginia has determined that the lands and waters comprising the watersheds of the State are great natural assets and resources; that as a result of erosion and sediment deposition on lands and in waters within the watersheds of the State, the waters are being polluted and despoiled to such a degree that fish, marine life, and recreational use of the waters are being adversely affected.

1.1.3 Related Work Specified Elsewhere

- Section 31 00 00 Earthwork
- Section 31 05 16 Aggregates
- Section 31 23 33 Trenching, Backfilling, and Compacting
- Section 31 25 00 Erosion and Sediment Control

1.2 DEFINITIONS

1.2.1 Environmental Protection and Restoration

1.2.1.1 Description

This Work shall consist of the protection of the environment and natural resources. It includes cleanup and restoration of the construction site to prevent accidents involving any person, to protect all work in place, to restore all disturbed areas, removal of all evidence of construction activities, and to effect completion of the contract in an orderly manner.

1.2.2 Preservation of Natural Resources

Land Disturbance is defined as any earth movement and land changes including but not limited to tilling, clearing, grading, excavating, stripping, filling and related activities. All land disturbance resulting from construction operations, contract work, clean-up and the condition of the adjacent terrain upon completion of the Work shall fully comply with all applicable regulations and laws concerning the preservation of natural resources.

1.3 PROVISIONS

1.3.1 Private Agreements

CONTRACTOR shall make no agreements with property owners adjacent to the project site. Any arrangements involving private agreements between the CONTRACTOR and property owners beyond those set forth in the Contract Documents shall not involve the CITY and shall be at the CONTRACTOR'S expense.

1.3.2 Method of Measurement

Measurement for the work addressed under this section will be in accordance with the appropriate sections of these specifications as referenced in the Contract Documents. Where no such reference is made, no measurement will be made for this Work.

1.3.3 Basis of Payment

1.3.3.1 Referenced

Work performed under the requirements of this section will be paid for as measured above in accordance with the appropriate sections of these specifications or as otherwise set for in the Contract Documents.

1.3.3.2 Unreferenced

Where no such measurement is provided for and where no bid item is set forth in the contract, the Work shall be considered incidental to the several bid items required to construct the project.

1.4 ENVIRONMENTAL PROTECTION PLAN

Prior to beginning work the contractor must prepare and submit an Environmental Protection Plan which will include but not be limited to the following sections:

- Spill Prevention
  - Oil
  - Chemical
- Waste Handling and Disposal
  - Brush
  - Chemicals
  - Oils
  - Municipal Solid Waste

    - Construction Debris
- Fueling Procedures
- Fugitive Emissions
- Stormwater Control
- Concrete
    - Wastewater
    - Other Concrete Waste

2.0 PRODUCTS

Not used.

3.0 EXECUTION

3.1 PREVENTION OF WATER POLLUTION

3.1.1 Precautions

The Contractor shall take all such precautions in the conduct of his operations as may be necessary to avoid contaminating the water in adjacent watercourses or water storage areas including wells whether natural or man-made.

3.1.2 Earthwork

All earthwork, moving of equipment, water control of excavations, and other operations likely to create silting, shall be conducted so as to prevent pollution of watercourses or water storage areas.

3.1.3 Water

Water used during the Contract work which has become contaminated with landfill leachate, oil, bitumens, harmful or objectionable chemicals, sewage or other pollutants shall be disposed of so as to avoid affecting all nearby waters and lands. Under no circumstances shall the Contractor discharge pollutants into a watercourse or water storage area. Water used in aggregate processing, concrete curing, foundation and concrete lift cleanup or any other waste shall not be permitted to enter a stream. When water from adjacent sources is used in the contract Work, intake methods shall be such as to avoid contaminating the source of supply or becoming a source of erosion.

3.2 DUST CONTROL

Throughout the entire construction period, maintain dust control by use of water truck, water sprinklers or chemical dust control binder as may be approved by the ENGINEER.

3.3 RESTORATION

3.3.1 Cleanup

Construction cleanup must proceed as construction progresses and must consist of the removal of all mud, oil, soil, gravel, trash, debris and any other materials that are unsightly.

3.3.2 Disturbed Areas

All areas disturbed by the Contractor's operations, including staging and stockpiling areas, construction strips, access roads, and areas within the acquired right-of-way must be restored and restabilized as specified in these Specifications.

3.3.3 Restabilization

Unless otherwise indicated, provide seeding on all disturbed areas which supported a previously established stand of turf. Seed slopes of 3:1 and as otherwise directed by the ENGINEER. Provide seeding on all other disturbed and filled areas. Restabilization shall be done in accordance with Virginia Stormwater Management Handbook Specifications Section C-SSM-09 and C-SSM-10.

3.3.4 Signs, Markers, Etc.

Preserve public and private signs, markers, guardrails and fences and maintain in their original condition unless written permission is obtained for their removal and replacement. Remove and properly store such items when in conflict with grading operations. Store in a manner to keep them clean and dry and re-erect at such new locations to prevent damage to underground or overhead public utility structures. Such items lost or damaged as a result of the Contractor's failure to properly protect or store them will result in replacement by the City with cost deducted from the Contractor's retainage.

3.3.5 Gravel Surface and Shoulders

Gravel surface and shoulders shall be restored equal to or better than their original condition. Do not reuse shoulder material if contaminated by foreign material. In such case, replace with new material of equal quality and gradation. Material and methods of construction shall be in accordance with these Specifications and applicable permits secured for this Contract.

3.3.6 Final Restoration

Final restoration and restabilization including seeding, sodding and paving when season permits, must proceed immediately after construction activity is completed in a given area. The Contractor must tear down and remove all temporary construction facilities constructed by him and leave the site in an orderly condition.

3.3.7 Disposal of Waste Materials

Construction waste materials shall be disposed of in an authorized disposal area. Waste material disposed of in an unauthorized area shall be removed by the Contractor and the area shall be restored to its original condition, at no cost to the City.

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.

1.2 QUALITY CONTROL REQUIREMENTS

1.2.1 Construction Quality Control

The CONTRACTOR is responsible for construction quality control (CQC or QC) and must establish and maintain an effective quality control system in compliance with the Contract Documents. The construction quality control system must consist of plans, procedures, tests and observation, and organization necessary to produce an end product which complies with the contract requirements. The system must cover all construction and manufacturing operations, both on-site and off-site, and must 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 or QA), which will provide independent monitoring and verification of compliance with all construction and CQC requirements. The CQA Representative (also referred to as the Quality Assurance Officer or QAO) is the on-site project representative for CQA. The CQA Engineer (also referred to as the Quality Assurance Engineer) is in direct supervision of the CQA Representative (QAO).

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

1.2.2.1 Materials Testing

Owner may provide limited testing as outlined in the project specifications.

All tests which fail to comply with the minimum requirements must 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.

1.2.2.4 Results

Results of all analyses must 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 must 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. Submittal of results will be required for payment of applicable pay items.

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 must be included within the applicable work item on the bid form. Payment of bid items may be withheld until documentation of quality control has been submitted.

1.4 QUALITY CONTROL AND CONTROL OF INSTALLATION

1.4.1 Sub-Contractors

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

1.4.2 Manufacturer's Instructions

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

1.4.3 Conflicts

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

1.4.4 Standards

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 Qualifications

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

1.4.6 Measurements

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

1.4.7 Anchorage

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 Observations

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

1.5.2 Manufacturer's Tolerances

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

1.5.3 Adjustment

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

1.6 REFERENCES

1.6.1 Standards

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 Version

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 Copies

Obtain copies of standards where required by product specification sections.

1.6.4 Conflicts

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

1.6.5 Contract

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

1.7 TESTING AND INSPECTION SERVICES

1.7.1 Outside Services

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

1.7.2 Laboratory

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 Tests

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

1.7.4 Location

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

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 Cooperation

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

1.7.6.1 Notification

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

1.7.6.2 Additional Tests

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 must 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 must implement the three phase control system for all aspects of the work specified. The staff must include a CQC System Manager who must report to the Site Superintendent or someone higher in the CONTRACTOR's organization. Site Superintendent in this context must 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 must implement the three phase control system for all aspects of the work specified. The staff must include a CQC System Manager who must report to the Site Superintendent or someone higher in the CONTRACTOR's organization. Site Superintendent in this context must 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 must 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 must 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 must identify an individual within his organization at the site of the work who must be responsible for overall management of CQC and have the authority to act in all CQC matters for the CONTRACTOR. This CQC System Manager must 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 must provide a CQC staff which must 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 must be subject to acceptance by the OWNER.

3.1.3.1 CQC System Manager:

The CQC System Manager must demonstrate that they have a minimum of 2 years landfill gas construction experience on construction similar to this contract. The CQC System Manager must 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 must 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 must obtain OWNER acceptance before replacing any member of the CQC staff. Requests must 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 must 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 must be conducted by the CQC System Manager for all definable features of work, as follows:

3.3.1.1 Specifications

A review of each paragraph of applicable specifications.

3.3.1.2 Plans

A review of the contract plans.

3.3.1.3 Materials

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

3.3.1.4 Inspection

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

3.3.1.5 Examination

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 Confirmation

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 Hazards

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

3.3.1.8 Procedures

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

3.3.1.9 Acceptance

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 Preliminary Work

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 Contract Compliance

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

3.3.1.12 Workmanship

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

3.3.1.13 Conflicts

Resolve all differences between parties.

3.3.1.14 Safety

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 Coordination

The ENGINEER must be notified at least 48 hours in advance of beginning any actions. A meeting must 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 must be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The CONTRACTOR must instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.3.2 Follow-up

Daily checks must be performed to assure continuing compliance with contract requirements, including control testing, until completion of the particular feature of work. The checks must be made a matter of record in the CQC documentation. Final follow-up checks must 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 must 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 must 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 must 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 must be by the furnished by the CONTRACTOR as a part of the CQC plan. The list must 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 must perform the following activities and record and provide the following data:

3.4.1.1 Contract

Verify that testing procedures comply with contract requirements.

3.4.1.2 Equipment

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

3.4.1.3 Calibration

Check test instrument calibration data against certified standards.

3.4.1.4 Records

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

Results of all tests performed, both passing and failing tests, will be recorded on the Quality Control report for the date performed. Tests must 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 must 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 must be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and must include the estimated date by which the deficiencies will be corrected. The CQC system manager or staff must 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 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 E329 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 must 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 must 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 must direct attention of Engineer to such failure.

1.3.3 Written Reports

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

- Independent Soils QC 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 must provide qualified personnel, materials, equipment, and transportation as required to perform the services identified herein, within the agreed to timeframe. The work to be performed must be as identified herein and must include but not be limited to the following:

3.1.1.1 Observations

Observe fill and subgrades 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 Fill

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 Technician

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 Term and Conditions, Contractor must:

1.1.1 Access

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

1.1.2 Benchmarks

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

1.1.3 Structures

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 Movement

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 Existing Conditions

Notify ENGINEER of differing subsurface or physical conditions.

1.1.6 Environmental Devices

Verify required environmental protection devices, best management practices (BMPs), and procedures are in place, properly maintained, and operational.

1.1.7 Coordination

Coordinate the Work with OWNER.

1.2 COORDINATION

1.2.1 Site Access

Arrangements for access to the Site, workmen's parking locations, sites for storing material, sanitary facilities, utilities during construction, etc., must 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

Contact OWNER to coordinate Site access.

1.3 COMMUNICATION

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

1.4 FIELD OFFICE

Contractor must provide and maintain a suitable temporary field office as necessary at the Site for its own use. Contractor must be responsible for necessary permits to install the temporary office and utilities. The location of the field office must 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 must 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 must 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 Safety

It must 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 Interference

This site includes landfills with ongoing maintenance activities. At no time will Contractor impede any operations at any time without appropriate notification to and approval of the OWNER.

1.6.3 Traffic Control

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

1.6.4 Operation

Contractor must operate vehicles and equipment in a safe manner.

1.6.5 Waste

The Contractor must promptly remove excavated material or other debris that may be spilled or tracked onto the traveled pavement during the conduct of the Work. Waste and debris must be disposed of in accordance with Section 01 35 43 of the Project Specifications, Environmental Procedures.

1.6.6 Flagging

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 must 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 Service

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

1.7.2 Supplemental Power

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 Protection

CONTRACTOR must 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 Claims

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

1.9.3 Minimums

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

1.10 ACCESS ROADS

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

1.11 PARKING

CONTRACTOR must 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 must keep all natural drainage and water courses unobstructed or provide equal courses effectively placed, and prevent accumulations of surface water.

1.13 DUST CONTROL

Fugitive dust is not allowed on site. 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 Schedule

Remove temporary utilities, equipment, facilities, and materials prior to Final Application for Payment inspection.

1.15.2 Repair

Clean and repair damage caused by installation or use of temporary work.

1.15.3 Restoration

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. Debris and dirt should be disposed of as outlined in Section 01 35 43 of the Project Specifications.

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 Drawings

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 Subcontractor List

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

Affidavit of Payment of Debts and Claims.

1.1.3.4

Affidavit of Release of Liens.

1.1.4 Cleaning Requirements

1.1.4.1 Maintenance

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 Final Cleaning

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, safe, and environmentally compliant condition. Sweep paved areas.

1.1.4.3 Restoration

Restore areas damaged from construction activities to their original condition.

1.1.4.4 Facilities and Equipment

Remove construction facilities and equipment from the project site and restore area used by facilities and equipment to their original condition.

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 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 must:

- Locate existing features,
- Generate cut sheets,
- Provide construction stake out and field surveying
- Survey installed landfill gas header to verify position, elevation, and slope requirements and share data with OWNER/ENGINEER
- Survey positions and elevations of installed landfill gas features, including the condensate sump, valves, leachate cleanout wellheads, tie-ins, and blower-flare equipment; and share data with OWNER/ENGINEER
- Verify final locations and elevations on all Work,
- Create final Record Drawings (as required by OWNER),
- Provide survey base maps for record Drawings.

The OWNER's surveyor will perform the following:

- 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:

- Access Roads
- Extensive buried piping, including landfill gas piping
- Grass lined, rip rap lined, and gabion lined channels
- Groundwater Monitoring wells, Gas Monitoring Probes, and LFG collection wells
- Landfill gas system valves
- Leachate Systems
- Manholes and Sumps
- Settlement Plates

- Stormwater Systems (Drop inlets, slope drains, Culverts, ditches, etc.)
- Stormwater Basins
- Temperature Probes

1.3.2 Independent Surveyor:

Employed by an organization which is independent from the CONTRACTOR.

1.4 SUBMITTALS

1.4.1 Qualifications of Surveyor

Within 14 days before commencing work, submit the following items to the ENGINEER for review: surveyor's name, Virginia license number, and qualifications.

1.4.2 Project Record Documents

Upon Substantial Completion of the Work, deliver record documents to the ENGINEER. Final payment will not be made until satisfactory record documents are received by ENGINEER. Accompany record documents with transmittal letter containing:

- Date.
- Project title and number.
- CONTRACTOR'S name and address.
- Title and number of each record document.
- Certification that each document as submitted is complete and accurate.
- Signature of CONTRACTOR, or his authorized representative.

1.5 MONTHLY INSPECTIONS

To verify the CONTRACTOR's monthly progress payment requests, the following items must 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 surface elevations from historical survey data. Filling activities, maintenance activities, regrading, and routine settlement may have occurred since the original survey. Rapid settlement is ongoing within the quarry landfill.

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 must base all measurements, both horizontal and vertical, from established benchmarks. The CONTRACTOR must 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 must notify the ENGINEER in writing and request clarification and instructions on how to proceed. The CONTRACTOR must not proceed with his work until he has received the same from the ENGINEER. CONTRACTOR must be aware of and anticipate ongoing settlement within the quarry landfill.

1.6.6 No Additional Payment

No claims must 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 must be constructed as indicated.

3.2.1 Liner

3.2.1.1 Earthwork

Outside of the SWP No. 588 quarry landfill, earthwork must be graded to ±0.2-feet of required grade provided required slopes and material thicknesses are maintained.

Within the SWP No. 588 quarry landfill, CONTRACTOR must closely coordinate with ENGINEER to adjust design grade to conform to the current landfill topography. Required minimum (5%) and maximum (3H:1V or 33%) slopes will be maintained along with required minimum material thicknesses. CONTRACTOR must establish and maintain a minimum of 12.0-inches of intermediate soil cover over the top of waste.

3.2.1.2 Piping

Piping must be graded to ±0.1 feet provided required slopes are maintained.

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 must 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

CONTRACTOR must 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 LFG Record Drawing:

The OWNER's surveyor or ENGINEER will prepare an LFG record drawing using data provided by the CONTRACTOR. The following information is recommended:

1. 2-foot contours
2. Pipe sizing and inverts at 50-foot intervals
3. Locations and inverts of fittings, vaults, control valves, wells, condensate knockout locations and condensate transmission lines.

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 COUNTY'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, if required, must be performed by the CONTRACTOR'S surveyor and verified by the ENGINEER. Drawings and calculations must be checked and sealed by the SURVEYOR. 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 03 10 00

CONCRETE FORMS AND ACCESSORIES

1.0 GENERAL

1.1 SUMMARY

1.1.1 Section Includes

- Formwork for cast-in place concrete
- Shoring, bracing, and anchorage
- Form accessories
- Form stripping

1.2 REFERENCES

1.2.1 American Concrete Institute

- ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials
- ACI 301 Specifications for Structural Concrete
- ACI 318 Building Code Requirements for Structural Concrete
- ACI 318M Metric Building Code Requirements for Structural Concrete
- ACI 347 Guide to Formwork for Concrete

1.2.2 American Forest and Paper Association

AF&PA National Design Specifications for Wood Construction

1.2.3 The Engineered Wood Association

APA/EWA PS 1 Voluntary Product Standard for Construction and Industrial Plywood

1.2.4 American Society for Testing and Materials:

ASTM D1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

1.2.5 West Coast Lumber Inspection Bureau

WCLIB Standard Grading Rules for West Coast Lumber

1.3 RELATED SECTIONS

- Section 01 45 29 – Quality Control Testing Laboratories
- Section 03 20 00 – Concrete Reinforcement
- Section 03 30 00 – Cast in Place Concrete

1.4 DESIGN REQUIREMENTS

Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements to achieve concrete shape, line and dimension as indicated on DRAWINGS.

1.5 QUALITY ASSURANCE

Within 14 days before commencing work, submit the following items to the ENGINEER for review: surveyor's name, Virginia license number, and qualifications.

1.5.1 Standards

Perform work in accordance with ACI 347.

1.5.2 Specifications

For wood products furnished for work of this Section, comply with AF&PA.

1.6 QUALIFICATIONS

Design formwork and shoring under direct supervision of Professional Engineer experienced in design of this work and licensed in the State of Virginia.

1.7 COORDINATION

Coordinate with excavation and backfilling activities.

2.0 PRODUCTS

2.1 WOOD FORM MATERIALS

2.1.1 Plywood

Douglas Fir species; solid one side select sheathing, tight face grade; sound undamaged sheets with clean, true edges.

2.1.2 Lumber Forms:

2.1.2.1 Application

Use for edge forms and unexposed finish concrete.

2.1.2.2 Boards

6 inches or 8 inches in width, shiplapped or tongue and groove, "Standard" Grade Douglas Fir, conforming to WCLIB Standard Grading Rules for West Coast Lumber. Surface boards on four sides.

2.1.3 Plywood Forms:

2.1.3.1 Application

Use for exposed finish concrete.

2.1.3.2 Forms

Conform to PS 1; full size 4 x 8 feet panels; each panel labeled with grade trademark of APA/EWA.

2.1.3.3 Plywood for Surfaces to Receive Membrane Waterproofing

Minimum of 5/8 inch thick; APA/EWA "B-B Plyform Structural I Exterior" grade.

Plywood where "Smooth Finish" is required, as indicated on DRAWINGS: APA/EWA "HD Overlay Plyform Structural I Exterior" grade, minimum of 3/4 inch thick.

2.2 PREFABRICATED FORMS

2.2.1 Preformed Steel Forms

Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

2.2.2 Pan Type

Steel of size and profile required.

2.2.3 Steel Forms

Sheet steel, suitably reinforced, and designed for particular use indicated on DRAWINGS.

2.2.4 Form Liners

Smooth, durable, grainless and non-staining hardboard, unless otherwise indicated on DRAWINGS.

2.2.5 Framing, Studding and Bracing

Stud or No. 3 structural light framing grade.

2.3 FORMWORK ACCESSORIES

2.3.1 Form Ties

Snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, free of defects capable of leaving holes larger than 1 inch in concrete surface.

2.3.2 Spreaders

Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. Wire ties, wood spreaders or through bolts are not permitted.

2.3.3 Form Anchors and Hangers

Do not use anchors and hangers for exposed concrete leaving exposed metal at concrete surface.

2.3.4 Form Release Agent

Colorless mineral oil that will not stain concrete, or absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete.

2.3.5 Corners

Chamfer type 3/4 x 3/4 inch size, unless otherwise noted on DRAWINGS; maximum possible lengths.

2.3.6 Bituminous Joint Filler

ASTM D1751.

2.3.7 Nails, Spikes, Lag Bolts, Through Bolts, Anchorages

Size, strength and character to maintain formwork in place while placing concrete.

3.0 EXECUTION

3.1 EXAMINATION

Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with DRAWINGS.

When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from the RPR.

3.2 INSTALATION

3.2.1 Earth Forms

- Trench earth forms neatly, accurately, and at least **2 inches** wider than footing widths indicated on DRAWINGS.
- Trim sides and bottom of earth forms.
- Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing.
- Form sides of footings where earth sloughs.
- Tamp earth forms firm and clean forms of debris and loose material before depositing concrete.

3.2.2 Formwork General

- Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
- Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
- Camber forms where necessary to produce level finished soffits unless otherwise shown on DRAWINGS.
- Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
- Complete wedging and bracing before placing concrete.

3.2.3 Forms for Smooth Finish Concrete

- Use steel, plywood or lined board forms.
- Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
- Install form lining with close-fitting square joints between separate sheets without springing into place.
- Use full size sheets of form lines and plywood wherever possible.
- Tape joints to prevent protrusions in concrete.
- Use care in forming and stripping wood forms to protect corners and edges.
- Level and continue horizontal joints.
- Keep wood forms wet until stripped.

3.2.4 Framing, Studding and Bracing

- Space studs at **16 inches** on center maximum for boards and **12 inches** on center maximum for plywood
- Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations
- Construct beam soffits of material minimum of **2 inches** thick
- Distribute bracing loads over base area on which bracing is erected

- When placed on ground, protect against undermining, settlement or accidental impact

3.2.5 Installation

Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.

3.2.6 Assembly

Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

3.2.7 Corners

Install fillet and chamfer strips on external corners.

3.2.8 Void Forms

Install void forms in accordance with manufacturer's recommendations.

3.2.9 Reuse

Do not reuse wood formwork more than 3 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.3 APPLICATION FORM RELEASE AGENT

Apply form release agent on formwork in accordance with manufacturer's recommendations.

Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.3.1 Reuse and Coating of Forms

Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer’s specifications. Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

- Install formed openings for items to be embedded in or passing through concrete work.
- Locate and set in place items required to be cast directly into concrete.
- Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

- Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- Install water stops continuous without displacing reinforcement.
- Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Flushing water must be contained and captured. Collected water must be allowed to harden and then properly disposed. The containment, capture, and disposal of flushing water is the responsibility of the contractor.
- Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.4.1 Form Ties

- Use sufficient strength and sufficient quantity to prevent spreading of forms
- Place ties at least 1 inch away from finished surface of concrete
- Leave inner rods in concrete when forms are stripped
- Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on DRAWINGS

3.4.2 Arrangement

Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

3.4.3 Construction Joints

- Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
- Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
- Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
- Arrange joints in continuous line straight, true and sharp.

3.4.4 Embedded Items

- Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
- Do not embed wood or uncoated aluminum in concrete.
- Obtain installation and setting information for embedded items furnished under other Specification sections.
- Securely anchor embedded items in correct location and alignment prior to placing concrete.
- Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 (ACI 318M), Section 6.3.

3.4.5 Openings for Items Passing Through Concrete

- Frame openings in concrete where indicated on DRAWINGS. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
- Coordinate work to avoid cutting and patching of concrete after placement.
- Perform cutting and repairing of concrete required as result of failure to provide required openings.

3.4.6 Screeds

- Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
- Slope slabs to drain where required or as shown on DRAWINGS.
- Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water. Water must be contained and captured. Collected water must be allowed to harden and then properly disposed. The containment, capture, and disposal of flushing water is the responsibility of the contractor.

3.4.7 Screed Supports

- For concrete over waterproof membranes and vapor barrier membranes, use cradle, pad or base type screed supports which will not puncture membrane.
- Staking through membrane is not permitted.

3.4.8 Cleanouts and Access Panels

- Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
- Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

- Clean forms as erection proceeds, to remove foreign matter within forms.
- Clean formed cavities of debris prior to placing concrete.
- Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports. If water is used, it must be contained and captured. Collected water must be allowed to harden and then properly disposed. The containment, capture, and disposal of flushing water is the responsibility of the contractor.
- During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL

- Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by the QA CONSULTANT.
- Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view
- Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.
- Leave forms in place for minimum number of days as specified in ACI 347.

3.7 ERECTION TOLERANCES

3.7.1 Standards

Construct formwork to maintain tolerances required by ACI 301.

3.7.2 Tolerances

Construct formwork to produce completed concrete surfaces within construction tolerances specified in ACI 117.

3.7.3 Slabs and Beams

Camber slabs and beams in accordance with ACI 301, unless otherwise noted on DRAWINGS.

3.8 FIELD QUALITY CONTROL

- Section 01411 – Quality Control Testing Laboratories.
- Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure
- Notify the QA CONSULTANT after placement of reinforcing steel in forms, but prior to placing concrete.
- Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION 03 10 00

SECTION 03 20 00

CONCRETE REINFORCEMENT

1.0 GENERAL

1.1 SUMMARY

1.1.1 Section Includes:

- Reinforcing bars.
- Reinforcement accessories.

1.2 REFERENCES

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 American Concrete Institute:

- ACI 301 - Specifications for Structural Concrete.
- ACI 318 - Building Code Requirements for Structural Concrete.
- ACI SP-66 - ACI Detailing Manual.

1.2.2 ASTM International:

- ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- ASTM A704 - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.

1.2.3 American Welding Society:

- AWS D1.4 - Structural Welding Code - Reinforcing Steel.

1.2.4 Concrete Reinforcing Steel Institute:

- CRSI - Manual of Standard Practice.
- CRSI - Placing Reinforcing Bars.

1.3 RELATED SECTIONS

- SECTION 01 45 29 – Quality Control Testing Laboratories
- SECTION 03 10 00 – Concrete Forms and Accessories.
- SECTION 03 30 00 – Cast in Place Concrete

1.4 SUBMITTALS

1.4.1 Shop Drawings

Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

1.4.2 Certificates

Submit AWS qualification certificate for welders employed on the Work.

1.4.3 Manufacturer's Certificate

Certify Products meet or exceed specified requirements.

1.4.4 Reports

Submit certified copies of mill test report of reinforcement materials analysis.

1.4.5 Product Information

1.4.6 Product information and sample of synthetic fiber reinforcement.

1.5 QUALITY ASSURANCE

Perform Work in accordance with ACI 301, ACI SP-66, ACI 318/318M.

1.6 QUALIFICATIONS

1.6.1 Welders

AWS qualified within previous 12 months.

1.7 COORDINATION

Coordinate with placement of formwork, formed openings and other Work.

2.0 PRODUCTS

2.1 REINFORCEMENT

2.1.1 Reinforcing Steel

ASTM A615, 60 ksi (420 MPa) yield grade; deformed billet steel bars, unfinished.

2.1.2 Reinforcing Steel Plain Bar and Rod Mats

ASTM A704/A704M, ASTM A615, Grade 40; steel bars or rods, unfinished.

2.2 ACCESSORY MATERIALS

2.2.1 Tie Wire

Minimum 16 gage annealed type.

2.2.2 Chairs, Bolsters, Bar Supports, Spacers

Sized and shaped for strength and support of reinforcement during concrete placement conditions.

2.2.3 Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces

Plastic tipped steel type; size and shape to meet Project conditions.

2.3 FABRICATION

- Fabricate concrete reinforcement in accordance with ACI SP-66, ACI 318/318M.
- Weld reinforcement in accordance with AWS D1.4.
- Locate reinforcement splices not indicated on DRAWINGS, at point of minimum stress. Review location of splices with RPR.

3.0 EXECUTION

3.1 BAR PLACEMENT

- Place, support and secure reinforcement against displacement. Do not deviate from required position.
- Accommodate placement of formed openings.
- Conform to ACI code for concrete cover over reinforcement.
- Splice reinforcing where indicated on DRAWINGS in accordance with splicing device manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

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 constructing the aggregate layer, the underlying course must be cleaned of all foreign substances. At the time of construction of the course, the underlying course must contain no frozen material. The underlying course must conform to Section 31 00 00 - EARTHWORK.

3.4 GRADE CONTROL

During construction, the lines and grades must be maintained by the CONTRACTOR.

3.5 PLACING

3.5.1 Coarse Aggregate

Coarse aggregate bedding and backfill material must be placed in accordance with VDOT RBS Section 303 earthwork.

3.6 QUALITY CONTROL

Section 01 45 29 - Quality Control Testing Laboratories

END OF SECTION 03 20 00

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

1.0 GENERAL

1.1 SUMMARY

1.1.1 Section includes all labor, materials, equipment and incidentals required to place all concrete, reinforcing steel, forms and miscellaneous related items for concrete items noted on DRAWINGS prepared by SCS Engineers.

1.2 REFERENCES

1.2.1 American Concrete Institute:

- ACI 301 – Specifications for Structural Concrete
- ACI 305 – Hot Weather Concreting
- ACI 306.1 – Standard Specification for Cold Weather Concreting
- ACI 318/318M – Building Code Requirements for Structural Concrete.

1.2.2 ASTM International

- ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field
- ASTM C33 – Standard Specification for Concrete Aggregates
- ASTM C94 – Standard Specification for Ready-Mixed Concrete
- ASTM C150 – Standard Specification for Portland Cement
- ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
- ASTM C494 – Standard Specification for Chemical Admixtures for Concrete
- ASTM C618 – Standard Specification for Coal Fly Ash and Raw of Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
- ASTM C881 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
- ASTM C1017 – Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

- ASTM C1107 – Standard Specification for Packaged Day, Hydraulic-Cement Grout (Nonshrink).
- ASTM C116 – Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
- ASTM D1190 – Standard Specification for Concrete Joint Sealer,Hot-Applied Elastic Type
- ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types.)
- ASTM E1643 – Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
- ASTM E1745 – Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.Additional Excavation

1.3 RELATED WORK SPECIFIED ELSEWHERE

- Section 03 10 00 – Concrete Forms and Accessories
- Section 03 20 00 – Concrete Reinforcement

1.4 SUBMITTALS

1.4.1 Product Data

Submit data on joint devices, attachment accessories and admixtures.

1.4.2 Design Data

1.4.2.1 Mix Designs

Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:

- Hot and cold weather concrete work.
- Air entrained concrete work.

1.4.2.2 Ingredients

Identify mix ingredients and proportions, including admixtures

1.4.3 Manufacturer's Installation Instructions

Submit installation procedures and interact required with adjacent Work.

1.4.4 Shop Drawings

Provide shop drawings for all slip-form, cast-in-place and precast reinforced concrete structures, slabs, and equipment pads. Shop drawings must show location, dimensions, and arrangement, and indicate locations of expansion, contraction and control joints for concrete sections, for the following:

- Concrete Placement
- Formwork
- Reinforcement
- Accessories
- Equipment Anchor Bolt Template

1.5 CLOSEOUT SUBMITTALS

1.5.1 Project Record Documents

Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

1.6 QUALITY ASSURANCE

- Perform Work in accordance with applicable ACI codes.
- The actual acceptance of aggregates and development of mix proportions to produce concrete conforming to the specific requirements must be determined prior to the placement of concrete by means of laboratory tests.
- The CONTRACTOR must demonstrate documented, substantial experience with reinforced concrete construction to illustrate to the RPR that CONTRACTOR has the experience to perform the work in an acceptable manner and complete the work as required by the DRAWINGS and these Specifications.
- Maintain one copy of each document on site.
- Acquire cement and aggregate from one source for Work.
- Conform to ACI 305 when concreting during hot weather.
- Conform to ACI 306 when concreting during cold weather.

1.7 COORDINATION

Coordinate placement of joint devices with erection of concrete framework and placement of form accessories.

2.0 PRODUCTS

2.1 CONCRETE MATERIALS

2.1.1 Cement

ASTM C150, Type I - Normal, Type IA – Air Entraining, Type II – Moderate, Type IIA – Air Entraining Portland type, or as shown in Drawings

2.1.2 Fine and Coarse Aggregates

ASTM C33.

2.1.3 Water

Clean and not detrimental to concrete.

2.2 ADMIXTURES

- Furnish material in accordance with VDOT Specifications.
- Air Entrainment: ASTM C260.
- Chemical: ASTM C494 Type E – Water Reducing and Accelerating and/or other admixtures may be permitted subject to written approval by the ENGINEER.
- Calcium Chloride Based Admixtures will not be permitted.
- Fly Ash: ASTM C618 Class F.
- Plasticizing: ASTM C1017

2.3 ACCESSORIES

2.3.1 Bonding Agent

Two component modified epoxy resin conforming to ASTM C881, Type I, II, IV and V, Class B & C.

- Manufacturers: Prime Resins, Inc. Model 3900 High Mod. LPL or approved equal.

2.3.2 Epoxy Anchoring Adhesive

Epoxy anchoring adhesive must be HILTI HIT HY-150 Adhesive Anchor Systems as manufactured by HILTI, INC., 5400 South 122 East Avenue, Tulsa, OK 74166 or approved equal.

2.4 JOINT DEVICES AND FILLER MATERIALS

2.4.1 Joint Filler

ASTM D1751; Asphalt impregnated fiberboard or felt, thickness as shown on the DRAWINGS; tongue and groove profile.

2.4.2 Construction Joint Devices

Integral galvanized steel, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge

2.4.3 Sealant

ASTM D1190; Hot applied polymer based asphalt compound, unless otherwise noted.

2.5 CONCRETE MIX

- Mix concrete in accordance with ACI 301. Deliver concrete in accordance with ASTM C94.
- Select proportions for normal weight concrete in accordance with ACI 301 trial mixtures.
- Provide concrete to the following criteria, unless otherwise specified for VDOT standard drainage structures or on the DRAWINGS:

Unit	Measurement
Compressive Strength (7 day)	3000 psi (21 MPa)
Compressive Strength (28 day)	4000 psi (28 MPa)
Water/ Cement Ratio (Maximum)	0.45 by weight (mass)
Aggregate Size (Maximum)	1.5 inch
Air Entrained	4.5 percent
Admixture	As approved by the ENGINEER
Fly Ash Content	Maximum 25 percent content
Slump	3 inches plus or minus 1 inch

2.5.1 Admixtures:

Include admixtures types and quantities indicated in concrete mix designs approved through submittal process.

- Use accelerating admixtures in cold weather. Use of admixtures will not relax cold weather placement requirements.
- Do not use calcium chloride
- Use set retarding admixtures during hot weather.
- Add air entraining agent to normal weight concrete mix.

2.6 GROUT

2.6.1 Non-Shrink Grout

ASTM C1107, Grade A: premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi (17 MPa) in 48 hours and 7,000 psi (48 MPa) in 28 days.

3.0 EXECUTION

3.1 EXAMINATION

Verify requirements for concrete cover over reinforcement.

Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

Prepare previously placed concrete by cleaning with steel brush and applying bonding agent

In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout unless otherwise shown or noted on the DRAWINGS.

3.3 PLACING CONCRETE

- Place concrete in accordance with ACI 301 or ACI 318/318M.
- Notify the QA CONSULTANT minimum 24 hours prior to commencement of operations.
- Concrete must be consolidated by means of internal vibrators operated by competent workmen. Topping and/or overlay concrete may be consolidated by means of vibrating screeds.
- Vibrators must have a minimum head diameter of at least 2 inches, a minimum centrifugal force of 700 pounds and a minimum frequency of 8,000 vibrations per second.
- For confined areas, the specified vibrators must be supplemented by others having a minimum head diameter of 1 ½ inches, a minimum centrifugal force of 300 pounds and a minimum frequency of 9,000 vibrations per second.
- One spare vibrator for each three in use must be kept on the site during all concrete placing operations.
- Vibrators must be inserted and withdrawn at points approximately 18 inches apart. The duration of each insertion must be from 5 to 15 seconds. Concrete must not be transported in the forms by means of vibrators.

- Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, and other embeds are not distributed concrete placement.
- Separate slabs on grade from vertical surfaces with joint filler.
- Set top of joint filler to required elevations. Secure to resist movement by wet concrete.
- Extend joint filler bottom of slab to within ½ inch of finished slab surface.
- Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- Install joint device anchors where required. Maintain correct position to allow joint cover to be flush with floor and wall finish.
- Install joint covers where shown in one piece of longest practical length, when adjacent construction activity is complete.
- Apply sealants to joint devices per sealant manufacturer's instructions.
- Maintain records of concrete placement. Record data, location quantity, air temperature, and test samples taken.
- Place concrete continuously between predetermined expansion, control, and/or construction joints.
- Do not interrupt successive placement; do not permit cold joints occur.
- Saw cut joints where required within 12 hours after placing.
- Screed floors and slabs on grade level, unless otherwise indicated on the DRAWINGS, maintaining surface flatness of F_F of 30.

3.4 EPOXY ANCHORING

Threaded steel rods, deformed reinforcing bars, smooth dowels, etc. must be anchored in drilled holes where indicated on the DRAWINGS.

3.5 CONCRETE FINISHING

- Provide formed concrete surfaces to be left exposed, smooth rubbed finish.
- Finish concrete floor surfaces in accordance with ACI 301.
- Steel trowel surfaces which are indicated to be exposed.

3.6 CURING AND PROTECTION

- Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical inquiry.
- Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.7 FIELD QUALITY CONTROL

- Field inspection and testing will be performed in accordance with ACI 301.
- Submit proposed mix design of each class of concrete to RPR and testing firm for review at least 2 weeks prior to commencement of Work.
- Tests of cement and aggregates may be performed to ensure conformance with specified requirements.
- Four concrete test cylinders **must** be taken for every 100 or less cu. yds of each class of concrete placed. One **must** be tested at 7 days, two at 28 days and one held for future testing. No less than one set of cylinders **must** be taken per day per mix. All specimens **must** be taken in conformance with ASTM C31.
- One additional test cylinder will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.
- One slump test will be taken on each set of test cylinders taken.
- One air content test will be made for each set of test cylinders taken.
- Maintain records of concrete placement. Record data, location, quantity, air temperature and test samples taken.

3.8 PATCHING

- Allow QA CONSULTANT to inspect concrete surfaces immediately upon removal of forms.
- Excessive honeycomb or embedded debris in concrete not acceptable. Notify QA CONSULTANT upon discovery.
- Patch imperfections as directed by QA CONSULTANT in accordance with ACI 301.

3.9 DEFECTIVE CONCRETE

- Concrete not conforming to required lines, details, dimension, tolerances or specified requirements.
- Repair or replacement of defective concrete will be determined by the QA CONSULTANT.
- Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of QA CONSULTANT for each individual area.

3.10 WATER

Water generated during the process constructing cast-in-place concrete must be contained and captured. Collected water must be allowed to harden and then properly disposed. The containment, capture, and disposal of flushing water is the responsibility of the contractor.

END OF SECTION 03 30 00

SECTION 31 00 00

EARTHWORK

1.0 GENERAL

1.1 DESCRIPTION

1.1.1 Scope

The work in this section includes all labor, materials, equipment, construction quality control (CQC) testing, and incidentals required to perform earthwork for the installation of the landfill gas flare station and other landfill gas features as shown on the Plans and as specified herein and in General Conditions.

1.1.1.1 Activities

Earthwork includes, but is not limited to excavation, filling, backfilling and compacting earthen materials to achieve final grades for the installation of the landfill gas system features and access road. This includes backfilling of trenches; sheeting and shoring; dewatering; general backfilling and compacting, constructing diversions, 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 Cost

The cost of all excavation must 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 Responsibility

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 16 Aggregates
- 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 must be backfilled and compacted as specified for authorized excavations at no additional cost to the OWNER.

1.2.3 Maximum Dry Density

Maximum dry weight in pounds per cubic foot (pcf) of a specific soil material as determined by ASTM D698.

1.2.4 Optimum Moisture Content

The moisture content at which the maximum dry density of a soil material is determined by ASTM D698.

1.2.5 Filled Areas

Filled areas are areas which have received trench backfill, structural fill or embankment materials, placed and compacted as specified herein.

1.2.6 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 (Mustow 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 Procedures

Refer to SECTION 01 33 00 – SUBMITTAL PROCEDURES for submittal requirements.

1.3.2 Shoring

Sheeting, shoring and bracing must be designed and signed by a registered professional ENGINEER and submitted for approval.

1.4 SAFETY

All excavation guidelines must 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 must 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 must explore ahead of the required earthwork to determine the exact location of all structures. They must be supported and protected from injury by the CONTRACTOR. If they are broken or injured, they must be restored immediately by the CONTRACTOR at his expense.

1.5.3 Protection of Persons and Property

1.5.3.1 Secure

Barricade open excavations or trenches occurring as part of this work and post warning signs or lights, as appropriate.

1.5.3.2 Existing Features

CONTRACTOR must plan and conduct operations to prevent damage or disturbance to existing structures and utilities, buried utilities, existing monitoring wells, roads, signs, trees, bench marks, and other existing site features.

1.5.3.3 Existing Grades

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 Responsibility

Failure of ENGINEER to order the use of bracing or sheeting or shoring must 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 Limits

Work is restricted to the area provided for CONTRACTOR'S use.

1.5.3.6 Slopes

Side slopes must be maintained in stable condition under all normal anticipated weather conditions for the duration of earthwork activities. The CONTRACTOR must regrade side slopes to be a more stable configuration if so directed by ENGINEER.

1.5.4 Dust Control

The CONTRACTOR must 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. Failure to do so will place the OWNER out of compliance with the Facility's Title V air permit which is unacceptable.

1.5.5 Traffic

Traffic inside and outside the site is anticipated. The CONTRACTOR must coordinate with the OWNER regarding traffic control during construction.

1.6 QUALITY CONTROL

1.6.1 Regulations

All materials and labor furnished under this section must comply with OSHA, ASTM, ANSI and other applicable Federal (including the United States Environmental Protection Agency), State (including the Virginia Department of Environmental Quality) 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

General Fill may be available from an on-site area. The CONTRACTOR must stabilize and seed the borrow area in compliance with the Virginia Stormwater Management Handbook following completion of earthwork activities. Seeded areas will be checked for adequate coverage regularly and fertilized and re-seeded if deemed necessary by the Engineer. Re-seeding will be performed at no additional cost to the Owner

2.1.1.2 Quality

General Fill must 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 must be capable of maintaining its stability on all slopes. Excess or unsuitable material must 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 must identify the source a minimum of 3 weeks in advance of intent to import. The Owner's Quality Assurance personnel must 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 must 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.

2.1.1.5 Stability

The satisfactory excavated soil materials must be capable of maintaining its stability on all slopes. Excess or unsatisfactory material must be removed and disposed as directed by the ENGINEER to the designated areas on-site designated by the OWNER.

2.1.2 Aggregates

Refer to SECTION 31 05 16 - AGGREGATES.

2.1.3 Trench Backfill

Refer to SECTION 31 23 33 – TRENCHING, BACKFILLING, AND COMPACTING for additional requirements

2.1.4 Embankments

Fill material for structural fill and embankments higher than four feet must be compacted to a minimum 95% of theoretical maximum density as determined by ASTM D698, and must contain no more than 25 percent rocks, none being larger than four inches in the greatest dimension. Liquid limit must not exceed 25 and plasticity must not exceed 6.

2.1.5 Bedding for Pipe and Pipe Structures

Bedding for Pipe and Pipe Structures must 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.

2.1.6 Sheeting and Shoring

Sheeting, shoring and bracing materials must be timber or steel, designed to retain the earth around structures to prevent cave-in and settlements, and to fulfill all safety requirements.

2.1.7 Other Materials

All other materials, not specifically described, but required for proper completion of the work must be selected by the CONTRACTOR and approved by the ENGINEER.

3.0 EXECUTION

3.1 PREPARATION

3.1.1 Dewatering

3.1.1.1 Equipment

The CONTRACTOR must at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and must 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 Accumulation

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 must be removed and replaced by crushed stone as required by the ENGINEER at the CONTRACTOR's expense. The bottom of excavations must 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 Drainage

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 environmental compliance issues or inconvenience to the OWNER, the ENGINEER, or others involved in work about the site. Trench excavations must not be used as temporary drainage ditches. If dewatering is needed, prior to discharge the contractor have a plan for discharge approved in writing by the owner to verify environmental requirements are met.

3.1.1.5 Construction Quality Assurance (By Others)

3.1.1.5.1

The CONTRACTOR must 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 must 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 must 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 is subject to the relevant tests in Table 31 00 00 - 1.

Table 31 00 00 - 1 Soils and Aggregates Test Frequency

Test	ASTM Designation or Other Test Method	CQC Frequency
Pre-Construction/Stockpile Testing		
Classification	D2487	1 per 2,500 cy and changes in material
Atterberg Limits	D4318	1 per 2,500 cy and changes in material
Grain Size Analysis	D6913 and D1140	1 per 10,000 cy
Natural Moisture Content	D2216	1 per 2,500 cy
Moisture-Density Relationship (Standard Proctor)	D698	1 per 2,500 cy and changes in material
Shear Strength	D2850 or D1557	1 per 10,000 cy
During Construction Testing		
Compacted Density	D2922, D1556, or D2937	5 tests/acre/lift or 1 per 500 linear feet of trench
Compacted Moisture Content	D3017 or D2216	5 tests/acre/lift or 1 per 500 linear feet of trench

Test	ASTM Designation or Other Test Method	CQC Frequency
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
Backfill Placement Depths and Extents	Observation, Field Measurement	Survey Verification

Notes:

- Every fifth sample tested with ASTM D6938 must be verified by ASTM D1556, Sand Cone or ASTM D2937, Drive Cylinder unless Engineer specifies otherwise.
- Every fifth sample tested with ASTM D6938 must be verified with ASTM D2216, Laboratory Determination of Water Content of Soil, Rock, and Soil-Aggregate Mixtures unless Engineer specifies otherwise.
- Test locations must 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 must be reworked and retested at the Contractor's expense Corrective measures must be documented in the Quality Control and Quality Assurance reports.

3.2 GENERAL

3.2.1 Excavation

The CONTRACTOR must perform excavations described in whatever substance encountered to dimensions and elevations shown on the Contract Drawings. Excavation must be unclassified. The CONTRACTOR must be responsible for verifying the grades and dimensions as shown.

3.2.2 Existing Facilities

Existing utilities, structures, and fencing must be protected during the construction period, and if damaged or removed by the CONTRACTOR in his operations, must be repaired or replaced by the CONTRACTOR at no additional cost to the Owner.

3.3 EXCAVATION

3.3.1 General

3.3.1.1 Obstructions

Excavation equipment operators and other concerned parties must be familiar with subsurface obstructions as shown on the PLANS.

3.3.1.2 Safety

Excavation work must 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 must provide adequate working space and clearances for the work to be performed therein. If walls of the excavation cannot be kept stable, the excavation must be properly shored and braced.

3.3.1.3 Elevations

Excavation must be unclassified and includes excavation to 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 Subgrade Condition

If subgrade "pumping" is encountered during excavation, perform the following:

3.3.1.4.1 Removal

Excavate and remove the underlying unsuitable material for a minimum depth of 12 inches.

3.3.1.4.2 Compaction

Proof-roll and compact by appropriate heavy equipment for at least 6 passes and approve by the ENGINEER.

3.3.1.4.3 Backfill

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 Limits

Excavation must conform to the limits indicated on the PLANS and as specified herein. This work must 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

Unsatisfactory materials must be removed to the required depth and replaced to the satisfaction of the ENGINEER with General Fill or Subbase material. Unsatisfactory materials must 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 must be stockpiled in such a manner as to prevent stormwater pollution and nuisance conditions, including but not limited to endangering work areas or obstructing driveways and natural water courses. Valve pit covers, valve boxes, or other utility controls must be left unobstructed and accessible at all times. The CONTRACTOR must limit operations to the project

areas shown on the drawings unless otherwise approved by the ENGINEER. Surface drainage must 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 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 must 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 must 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 must be placed in layers that when compacted must not exceed six (6) inches. Each layer must be spread evenly and must be thoroughly bladed and mixed during the spreading to obtain uniformity of material in each layer.

3.8.4 Backfilling of LFG Trenches

LFG trenches must be backfilled and compacted by CONTRACTOR, as approved by CQA engineer and quality assurance officer. Backfill material must consist of clean structural fill. Trench backfill material must be placed in 8 inch thick loose lifts and compacted by a method and equipment type approved by CQA Consultant. Material must be compacted to a minimum of 90 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 must be approved by the QAO prior to material placement.

3.9.1.2 Moisture Content

General fill and backfill soil must 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 must 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 must be wetted by the use

of water trucks or sprinklers. Dried or wetted fill or backfill soil must 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 must 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.

3.9.1.3 Nonconforming Material

Re-compact areas or lifts if soil density and moisture tests indicate inadequate compaction and/or moisture. No additional compensation must be given to the CONTRACTOR due to re-working of failed areas. The extent of area for repair must be determined by the ENGINEER.

3.9.1.4 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.

3.9.1.5 Landfill Gas Pipe Aggregates

Aggregates surrounding perforated landfill gas collection pipe must not be compacted, but must 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 must be continuous over its entire area and the compaction equipment must make sufficient trips to verify that the required density has been obtained. After each layer has been placed, mixed and spread evenly, it must be thoroughly compacted in six (6) inch maximum compacted thickness lifts. The minimum dry density of the soil must 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 must 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 must submit to the ENGINEER, for approval, a list of compaction equipment to be used. The ENGINEER must have 7 days to approve or disapprove the list. The list must 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 must be compacted. Compacting operations must 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 must maintain and prevent erosion of at all times during construction. Repair of damages to the soil surfaces due to inadequate maintenance, and erosion must 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 must be kept free of standing water with positive drainage maintained. Sloping of the fill surface and drainage ditches must be provided to carry off water as it collects. Pumping must be required to remove water from areas that cannot drain naturally. Pumping activities will be coordinated with the Owner prior to discharge to prevent non-compliance with environmental permits and regulations.

3.13 SEASONAL LIMITS

No fill material must 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 must 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 must be scarified to a depth of 6 inches, compacted and tested prior to placing addition fill lifts.

3.14 INTEGRITY OF THE WORK

It must be the CONTRACTOR's responsibility to maintain the integrity of the work. Work that is damaged by weather or construction activities must 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 General Fill

After the General Fill has been installed, the CONTRACTOR must 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 must 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 must be within 0.2 feet of those shown on the PLANS.

3.15.4 Finish Grading

After berms, ditches, swales, shoulders, and embankments are completed, the disturbed areas must be finish graded. Any lumber, undesirable materials, and rocks larger than the 3 inches in size must be removed from the surface immediately and the surface must be prepared for final landscaping.

3.16 DISPOSAL OF EXCESS AND WASTE MATERIALS

Limited waste excavation is anticipated within the SWP#588 landfill for the Stage II LFGCCS Expansion construction. 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 within the SWP#588 waste limits may be relocated and covered within the SWP#588 landfill using a minimum of 12" intermediate soil cover.

Any waste encountered during excavation outside of the SWP#588 landfill limits must be hauled off-site to an active waste disposal facility.

For waste excavation within the SWP#588 landfill, the CONTRACTOR will 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 must minimize the open area of disturbed waste at any given time.

Within the SWP#588 landfill limits, the CONTRACTOR must 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 must haul the excavated waste materials to a designated area for waste relocation at the site, as directed by the OWNER. The CONTRACTOR must 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 will not require the CONTRACTOR to pay tipping fee for disposal of excavated waste materials encountered during work activities within the SWP#588 landfill. If odors or emissions from the excavated waste become a nuisance as determined by the OWNER, CONTRACTOR must increase the frequency of excavated waste removal or cover soil placement as directed by the ENGINEER.

END OF SECTION 31 00 00

SECTION 31 05 16

AGGREGATES

1.0 GENERAL

1.1 SUMMARY

The requirements for riprap, pipe bedding aggregates, road base course, 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 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), Latest Edition
- Virginia Stormwater Management Handbook, 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 (Mustow Depth)
- ASTM D 4373 Calcium Carbonate Content of Soils
- ASTM D 5856 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 E 329 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 must be selected not less than thirty (30) working days prior to the time the material will be required in the work. Any changes in the source of materials must be reported to the ENGINEER immediately. The new source must be approved by the ENGINEER. Allow a minimum of 10 working days for review and approval. The CONTRACTOR must be fully responsible for any delays in construction due to changes in material sources.

1.3.3 Certificate of Compliance

The CONTRACTOR must submit to the ENGINEER for approval at least 15 working 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 must consist of clean, sound, durable particles of crushed stone, or gravel, and screenings. Slag must not be used.

2.1.1.1 Grade and Smoothness

CONTRACTOR must 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 Objectionable Materials

Aggregates must be free of silt and clay (as defined by ASTM D2487), vegetable matter, and other objectionable materials or coatings.

2.1.1.3 Noncalcareous

Aggregate surrounding perforated landfill gas collection pipe must contain less than 15% by weight of calcium carbonate as measured by ASTM D4373. Test results must be submitted to the ENGINEER demonstrating compliance with this requirement.

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 must be as specified on the PLANS.

2.1.3 Coarse Aggregate

2.1.3.1 Standards

Coarse aggregate refers to the portion retained on the No. 4 sieve, and must 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 Soundness

The coarse aggregate must have a loss of density not greater than 10 percent of the weighted average at five cycles when tested for soundness. The coarse aggregate must 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

Material designations for the various coarse aggregates used for the project must be as specified on the PLANS.

2.1.3.4 Flat and Elongated

The percentage of flat and/or elongated particles must 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 must meet the requirements set forth herein.

3.0 EXECUTION

3.1 EQUIPMENT

3.1.1 Weather Limitation

Aggregates must be placed in accordance with VDOTRBS Section 309. Areas of completed work that are damaged by freezing, rainfall, or other weather conditions must be corrected to meet specified requirements.

3.2 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites must be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, must be stockpiled in a manner and at locations approved by the ENGINEER. Aggregates must be stockpiled on the cleared and leveled areas designated by the OWNER so as to prevent segregation. Materials obtained from different sources must be stockpiled separately. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.2.1 Stockpile Erosion and Sediment Control

Stockpiles must have appropriate Erosion and Sediment Controls managed in accordance with applicable regulations and Section 31 25 00 of the Project Specifications, Erosion and Sediment Control.

3.2.2 Stockpile Cleanup

Remove stockpile and temporary erosion and sediment controls, leave area in clean and neat condition. Grade site surface to prevent free standing surface water. Seed and stabilize stockpile areas following clean-up.

3.3 PREPARATION OF UNDERLYING COURSE

Prior to placing aggregate, the underlying course must be cleaned of all foreign substances. At the time of construction of the course, the underlying course must contain no frozen material. The underlying course must conform to Section 31 00 00 - EARTHWORK.

3.4 GRADE CONTROL

During construction, the lines and grades must be maintained by the CONTRACTOR.

3.5 PLACING

3.5.1 Roadway

Roadway crushed stone base material must be placed in accordance with VDOTRBS Section 308 subbase course.

3.5.2 Coarse Aggregate

Coarse aggregate bedding and backfill material must be placed in accordance with VDOTRBS Section 303 Earthwork.

END OF SECTION 31 05 16

SECTION 31 05 19.13

GEOTEXTILE FABRICS FOR ACCESS ROAD

1.0 GENERAL

1.1 SUMMARY

1.1.1 Scope

This section covers the material, installation, and testing of the nonwoven geotextile for the road underlayment. The nonwoven geotextile fabric must be furnished by the CONTRACTOR unless otherwise specified. The nonwoven geotextile must be prepared and installed per these specifications, referenced specifications and as detailed on drawings. CONTRACTOR must provide all labor, materials, equipment, and services necessary for the placement of the nonwoven geotextile.

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 14 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.

1.3.1.2 Production Dates:

Submit statement of production dates for the geotextile.

1.3.2 Acknowledgement

CONTRACTOR must 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.

1.4 DELIVERY, STROAGE, AND HANDLING

1.4.1 General

Manufacturer and CONTRACTOR must follow the guidelines stated in ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples unless otherwise approved by ENGINEER.

1.4.2 Protection

Geotextile must 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 prior to installation. Nonwoven geotextile rolls must be shipped and stored in relatively opaque and watertight wrappings.

1.4.3 Delivery Inspection

CONTRACTOR must 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 must 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 must 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 must 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}

2.1.2 Packaging

The geotextile must be uniformly rolled onto a core, and must be wrapped in plastic to protect the material from moisture and damage during shipment. Protective wrapping must be left on the geotextile until installation. Rolls must be externally tagged for easy field identification. External tagging must include the following:

- Name of Manufacturer
- Product Type
- Product Grade
- Lot Number
- Physical Dimensions (length, width & weight)

2.1.3 Storage

The geotextile must not be exposed to precipitation prior to being installed. The geotextile must 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 NONWOVEN GEOTEXTILE PLACEMENT

3.1.1 Installation-General

CONTRACTOR must meet all manufacturer's Specifications and comply with the following unless approved in writing by CQA Consultant, ENGINEER, and manufacturer.

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.

3.1.1.1 Placement

Geotextile must be placed smoothly and in direct contact with the underlying medium. Excessive wrinkles will not be acceptable. Equipment must never be run directly on the geotextile.

3.1.1.2 Ballasting

All nonwoven geotextile must be weighted with sandbags or the equivalent when required. Such sandbags must be installed during placement and must remain until removed and replaced with cover material or adjoining nonwoven geotextile. Removed bags should be disposed of as outlined in Section 01 35 43 of the Project Specifications.

3.1.1.3 Projections/Debris

Prior to placing the nonwoven geotextile, care must 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.

3.1.1.4 Protection

Nonwoven geotextile must not be exposed to precipitation prior to being installed, and must not be exposed to direct sunlight for more than 90 days.

3.1.2 Protection from Damage

Geotextiles should be secured from the wind. Geotextiles must 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 must replace geotextile that is left exposed for more than 90 days.

3.1.3 Geotextile Repair

CONTRACTOR must repair any damage, as follows:

3.1.3.1 Holes/Tears

Any holes or tears in the fabric must be repaired as follows:

a. On slopes: A fabric patch must 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 must be removed from the slope and replaced.

b. Non-slopes: A fabric patch must be spot-seamed in place with a minimum of 24 inches of overlap in all directions.

3.1.3.2 Penetrations

Care must be taken to remove any soil, granular material, or material which may have penetrated through the torn nonwoven geotextile.

3.1.3.3 Daily Placement

The amount of nonwoven geotextile unrolled and laid daily must 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.

3.2 INSPECTION

3.2.1 Initial Inspection

The nonwoven geotextile material must be placed after the receiving surface has been property prepared and inspected and approved by the CQA Consultant or otherwise approved by the ENGINEER. No nonwoven geotextile material must be placed in the absence of the CQA Consultant unless otherwise approved by the ENGINEER.

3.2.2 Inspection

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 must perform whatever work is required to provide an acceptable nonwoven geotextile layer at no additional cost to O'WNER. This WORK must 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 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 rocks and boulders.
- 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

1.2 DEFINITIONS

1.2.1 Clearing

Clearing shall consist of removing vegetation, including trees and brush, rocks and boulders, 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 Reference Standards

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 VDOT Specifications

Perform Work in accordance with Virginia Department of Transportation Road and Bridge Specifications (2020) where applicable.

1.3.3 Environmental Regulations

Conform to applicable Virginia code for environmental requirements and disposal of debris. Debris should be disposed of as outlined in Section 01 35 43 of the Project Specifications.

1.3.4 Utility Coordination

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 Existing Vegetation

Verify existing plant life designated to remain is tagged or identified.

3.1.2 Waste Area

Identify waste area for placing removed materials. The waste/salvage area must be approved by the ENGINEER or OWNER prior to placement of materials. The waste/salvage area must have appropriate erosion and sediment control in accordance with state regulations and Section 31 25 00

of the Project Specifications, Erosion and Sediment Control. Upon removal of the debris the Contractor is responsible for removing the erosion and sediment controls and seed as appropriate.

3.2 PROTECTION

3.2.1 Utilities

Locate, identify, and protect utilities indicated to remain, from damage.

3.2.2 Benchmarks

Protect benchmarks, survey control points, wells, probes, and existing structures from damage or displacement.

3.3 REMOVAL

3.3.1 Limits

Clearing and grubbing of vegetative cover shall be performed in the required areas only. Required areas include the earthwork areas, trench footprints, stockpiles, and other areas as noted on the Contract Drawings. Vegetation in other areas shall be undisturbed.

3.3.2 Stockpile

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 Grubbing

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 Backfill

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 must be responsible for controlling fugitive and objectionable dust by his operation of vehicles and equipment during all land disturbing activities. The CONTRACTOR must use methods, subject to the ENGINEER'S approval, that keep dust in the air to a minimum, and to prevent non-compliance with the Facility's Title V air permit, 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 materials required for the purpose of erosion control, site grading, and 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
- Section 31 10 00 Clearing Grubbing Stripping

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 (Mustow 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 must 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 must 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 must be responsible for and must satisfactorily correct all damage resulting from use of explosives. The use of explosives will require an approved blasting plan and will be subject to additional requirements.

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 must 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 Experience

Products used in the work of this section must 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 Personnel

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 must 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 must be approved by the ENGINEER prior to commencing compaction operations. The approval of the ENGINEER must be construed merely to mean that at the time the ENGINEER knows of no good reason for objecting thereto; and no such approval must 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 must explore ahead of the work to determine the exact location of all structures. They must be supported and protected from injury by the CONTRACTOR. If they are broken or injured, they must be restored immediately by the CONTRACTOR at his expense.

1.8.2 Dust Control

The CONTRACTOR must 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 to prevent non-compliance with stormwater and air permit requirements.

1.8.3 Traffic

Traffic inside the site is anticipated. The CONTRACTOR must coordinate with the OWNER regarding traffic control during construction. CONTRACTOR must 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 must 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 must 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 must 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 must 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 must 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 must 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 must be performed at no additional cost to the OWNER.

3.7 TRENCH EXCAVATION

3.7.1 Dimensions and Limits

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 must more than 200 feet of trench be opened at one time. Trenches must be backfilled at the end of each working day except where otherwise permitted.

3.7.2 Width

Unless otherwise depicted on the plans, the width of the trench at and below the top of the pipe must not exceed the outside diameter of the pipe plus 18 inches except that for pipe 12 inches or less in diameter, the trench width must not exceed 33 inches. Where this width is exceeded, CONTRACTOR must 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 Safety

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 must be performed in accordance with OSHA requirements.

3.7.4 Elevations

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 Bedding – Gravity Lines

The bottom of the trench for gravity lines must be as specified herein under "Pipe Bedding."

3.7.6 Bedding – Pressure Lines

The bottom of the trench for pressure lines must 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 Dewatering

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 must be subject to the approval of the OWNER and ENGINEER.

3.7.8 Unsuitable Soil

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 must be construed as unsuitable material for backfill.

3.7.9 Groundwater

Where underground streams or springs are found, provide temporary drainage and notify ENGINEER.

3.7.10 Waste

Continuously remove from the project site and dispose of material unsatisfactory for backfill and all excess material with the progress of the Work. Solid Waste encountered during excavation should be disposed of as outlined in Section 01 35 43 of the Project Specifications.

3.7.11 Shoring Removal

Remove shoring and all form materials unless ordered to remain.

3.7.12 Rock

Where rock is encountered so that a manhole, vault, or other structure will bear on rock, it must 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 must be provided below bottom of footings.

3.7.13 Blasting

Blasting for the excavation of trenches must require prior written approval by the ENGINEER. The use of explosives will require an approved blasting plan and will be subject to additional requirements.

3.7.14 Rock Separation

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 Width

Trench width must be minimized to greatest extent practical but must 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 Depth

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 Excavation - Small Pipes

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 Excavation – Large Pipes

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 Open Excavation

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 Stability

All trenches must be constructed in a uniform grade, and free of standing water. The CONTRACTOR must 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 must be removed and replaced by VDOT Size No. 3 stone or approved equal at the CONTRACTOR'S expense.

3.8.5 Appurtenance Excavation

Excavation for appurtenances must maintain a minimum clearance of 12 inches between their outer surfaces and the face of the excavation, or sheeting, if used.

3.8.6 Records

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 Safety

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 Regulations

Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

3.9.3 Cost

All costs of providing sheeting and shoring must be borne by the CONTRACTOR.

3.9.4 Maintenance

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 Depth

Sheeting, shoring and bracing left in-place must be cut off to a depth of not less than 18 -inches below grade.

3.10 PIPE BEDDING

3.10.1 Dimensions

Bed all pipe in accordance with bedding details as shown on the Drawings.

3.10.2 Gravity Lines – Rigid Pipe

Except where otherwise shown on the Contract Drawings, all gravity lines using rigid pipe such as concrete, etc. must be Class C bedding as a minimum.

3.10.3 Gravity Lines – Flexible Pipe

Except where otherwise shown on the Contract Drawings, all gravity lines using flexible pipe such as HDPE, etc. must be Class B-1 bedding as a minimum.

3.10.4 Compaction

Compact pipe bedding by tamping or rodding to prevent settlement. Pipe bedding must be an approved granular material compacted to a minimum 95% of theoretical maximum density as determined by ASTM D698. The bedding must have a minimum thickness of six inches under the barrel and must extend to four inches over the crown of the pipe.

3.10.5 Fine Aggregate

Fine aggregate bedding must meet requirements for fine aggregates, VDOT Road and Bridge Specifications, latest edition.

3.10.6 Coarse Aggregate

Coarse aggregate bedding must meet requirements for coarse aggregates, VDOT Road and Bridge Specifications, latest edition.

3.11 TRENCHING BACKFILL

3.11.1 Methods

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 must 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 Materials

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 must not exceed 12 inches in compacted thickness, except that under road shoulders and under existing or future paved areas, layers must not exceed 6 inches in compacted thickness. Backfill must be compacted to the density specified for the areas in which it is located except that minimum compaction in any area must be to the density of the adjacent soil.

3.11.3 Depressions

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 Structures

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 Compaction

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 Aggregate

Compact aggregate fill placed around manholes or other structures to required density.

3.11.7 Buried Pipe Warning Tape

Trenches for pressure lines must include inert polyethylene locating tape having a metallic foil core. Tape must be placed above the centerline of pipes at a depth not exceeding two feet below ground surface. Tape must be labeled appropriately as to the contents inside.

3.11.8 Inspections Prior to Backfilling

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 must 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 must be partially backfilled at any time

3.11.9 Open Areas

Fill material for trenches in open areas must be compacted to a minimum 90% of theoretical maximum density as determined by ASTM D698. The top 12 inches of backfill material must contain no rocks larger than one inch in the greatest dimension. Material from two feet above pipes to 12 inches below surface must contain no more than 25 percent rocks, none being larger than four inches in the greatest dimension. Liquid limit must not exceed 40 and plasticity index must 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.
    - 90% in all other unpaved areas unless otherwise indicated on the Contract Drawings.

3.13 GRADING

3.13.1 Elevations

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 Undesirable Materials

Finish all surfaces free from irregular changes. Lumber, earth clods, or rocks larger than four inches and other undesirable materials must be removed from the site at the completion of construction.

3.13.3 Tolerances

Finish subgrade areas to receive topsoil to within 0.20 foot of required subgrade elevations.

3.13.4 Utilities

All utility lines not in streets, must be mulched with hay or straw and seeded within 15 days after backfill.

3.13.5 Temporary Seeding

Any disturbed area not paved, sodded or built upon between within 14 days must receive temporary seeding.

3.13.6 Protection

Protect graded areas from the action of the elements. Settlement or other damage that occurs prior to acceptance of the work must be repaired and grades satisfactorily reestablished.

3.13.7 Repair

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 Restoration

The CONTRACTOR must return all gates, fences, culverts, lawn areas, paved areas, channels, etc. to the same condition existing prior to construction. Any culverts damaged during construction must 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 must 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 must 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 must 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 must 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 Provisions

Contractor must provide personnel, equipment, materials, and supplies to reduce erosion and control sediment during the Project.

1.2.2 Regulations

Contractor must 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 Additional Controls

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 must implement any additional measures that it deems necessary or as required by the City of Bristol Erosion Control inspection personnel.

1.2.4 Cost

Additional compensation will not be paid for measures installed in conjunction with the development and operations of borrow areas. This includes supplemental controls that may be required outside of what is specified in the drawings. Costs for these efforts are already included in the Contract Price.

1.2.5 Responsible Land Disturber

Contractor is the Responsible Land Disturber for the project and may be required to obtain the City of Bristol Land Disturbance Permit.

1.2.6 Clean-Out

Contractor must 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 final stabilization is achieved.

1.3 RELATED REQUIREMENTS

- Virginia Stormwater Management Handbook, latest edition.
- Erosion and Stormwater Management Regulations, 9-VAC 25-875.

1.4 PERMITS

1.4.1 Land Disturbance Permit

If required, the Contractor must be responsible for obtaining a Land Disturbance Permit from the City of Bristol and payment of the associated erosion and sediment control bond. Copies of all permits or approvals must be provided to the ENGINEER prior to starting any work covered by the permits or approvals.

1.4.2 Off-Site Work

The Contractor must be responsible for obtaining all necessary permits and approvals from the appropriate governmental agencies, including those located outside of the City of Bristol, for any off-site work as applicable for waste or spoil areas and borrow pits. Copies of all permits or approvals must 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 will apply.

1.4.4 Inspection of Off-Site Area

The ENGINEER must have the right to inspect erosion control measures in off-site borrow pits and waste areas and to report violations of permit requirements to the City 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 must 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 must 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 LAND DISTURBANCE 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 must 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 Stormwater Management Handbook unless otherwise listed herein.

3.0 EXECUTION

3.1 GENERAL

3.1.1 Plan

All activities must be performed in accordance with the approved erosion control plan and stormwater pollution prevention plan.

3.1.2 Perimeter Controls

Prior to significant disturbance of the Site, perimeter erosion control must be established in order to reduce uncontrolled drainage from leaving the limits of construction or from reaching State waters. Sediment barriers must be constructed as soon as possible.

3.2 INSTALLATION

Contractor must be responsible for the following activities:

- All measures necessary to provide a continuous siltation barrier must be down slope from construction activities as indicated on the Drawings or as necessary to reduce sediment runoff. Barriers must 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 must be installed as per the manufacturer's directions and the Virginia Stormwater Management 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 must be taken immediately. All construction must 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 INSPECTION

4.1.1 General

Erosion and sediment control measures must be inspected by the Contractor at least weekly and after each significant rainfall, and maintained in accordance with the approved erosion control plan. The following will be checked in particular:

- Silt fences for signs of clogging
- Check dams for signs of clogging

- Inlet and outlet protection for clogging
- Perimeter surface berms for signs of erosion damage and adequacy

4.1.2 Coordination

The Contractor must notify the owner prior to beginning the inspection and accommodate attendance by the owner's representative during the inspection.

4.1.3 Records

Contractor must submit inspection reports to the owner weekly. No payment will be made for erosion and sediment control if inspection records have not been submitted.

4.2 REPAIRS AND MAINTENANCE

Upon finding that any measure requires repair or maintenance, Contractor must 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 must be fully repaired by the end of the day on which they are disturbed. All erosion and sediment control devices must be maintained when the project is closed down.

4.3 DUST CONTROL

It must be the sole responsibility of Contractor to adequately control dust that is created as a result of construction on the project. At a minimum, the contractor should anticipate operating a water truck during the duration of the project. Dust suppression will also be required at stockpiles and material handling operations.

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 for Access Road

2.0 PRODUCTS

The wearing course must consist of durable gravel, crushed gravel, crushed stone, or crushed slag, meeting Virginia Department of Transportation Standard Specifications, latest revision. The aggregate must be VDOT No. 21A or approved alternative for the aggregate wearing course.

A geotextile must 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 must 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 must be placed, shaped, and compacted. The grade and alignment must be controlled during placement. Necessary shaping must be performed prior to final compaction to ensure a rut- and bump-free surface and adequate drainage slopes. Depths of the aggregate must be as shown on the Drawings.

For roads on the landfill, the soil must consist of erosion control/protective cover material compacted to the requirements for that layer. For other roads, the soil must 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 must be corrected. If consistent deficiencies occur, regardless of thickness, the entire deficient section of roadway will be corrected.

Aggregate must be rolled with one pass immediately with a self-propelled steel wheel roller. The roller weight must 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 33 23 10

LANDFILL GAS WELLHEADS

1.0 GENERAL

1.1 DESCRIPTION

1.1.1 Scope of Work:

The CONTRACTOR must provide all equipment and labor needed to connect landfill gas wellheads to the existing leachate cleanouts as specified herein and as indicated on the Drawings.

1.1.2 Qualification

All work must be performed by qualified workers in accordance with the best standards and practices available.

1.1.3 Leachate

The CONTRACTOR must make provisions for the containment of discharged leachate if emitting from leachate cleanouts. Provisions must be in alignment with maintaining compliance with all federal, state and local environmental requirements.

1.1.4 Related Work Described Elsewhere

Section 33 51 10 LFG Pipe and Pipe Fittings

1.2 SUBMITTALS

1.2.1 Materials

The CONTRACTOR must 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 Shop Drawings

The CONTRACTOR must 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 must 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, pitot tube housing for flow measurements, adapter bushing or Fernco reducer fitting, stabilizing well cap with support ring, temperature port, multiple barbed hose monitoring ports, and dust caps. Wellheads must be QED Accuflo Model AF020-P or equivalent, which can be installed in vertical or horizontal orientation on the cleanout. Wellhead assembly is mounted to the leachate cleanouts using reducers and donuts, then connected to lateral piping 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.

2.2 SPARE PARTS

No spare parts are included in this work.

3.0 EXECUTION

3.1 WELLHEAD INSTALLATION

3.1.1 Wellhead Assembly

Wellhead assembly must be installed in accordance with the manufacturer's recommendations. Care must be taken not to damage or impact the orifice plate during installation. If an orifice plate is damaged during installation, CONTRACTOR must replace it at no cost to the OWNER.

3.1.2 Wellhead Connection

The leachate cleanout wellheads must be connected to the vacuum riser using Kanaflex flexible tubing or equivalent, as shown on the Drawings. Install so that no sags are formed.

END OF SECTION 33 23 10

SECTION 33 51 10

LANDFILL GAS PIPE AND PIPE FITTINGS

1.0 GENERAL

1.1 DESCRIPTION

The CONTRACTOR must 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 flare station.

Related Work Described Elsewhere:

Section 31 23 33 Trenching, Backfilling, and Compacting

1.2 SUBMITTALS

1.2.1 Certification

The CONTRACTOR must 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 must prepare and submit Shop Drawings to the ENGINEER for review and approval. The Shop Drawings must show all dimensions, slopes, and invert elevations at connections. All tie-ins to the existing system must be field-verified and shown on the Shop Drawings. The CONTRACTOR must 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
- ASTM F 714 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
- ASTM F 1417 Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air

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) must be Schedule 80 PVC conforming to ASTM D 1784, ASTM D 1785 (for pipe), and ASTM D 2467 (for fittings). Perforated pipe must 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 40 PVC (SCH 40) must be Schedule 40 PVC conforming to ASTM D 1784, ASTM D 1785, and ASTM D 2467.

PVC pipe joints must be solvent welded.

2.1.1 PVC Fittings

Fittings must be of the same material and manufacturer as the pipe they are to be attached to. PVC fittings must conform to ASTM D 2466 or ASTM D 2467.

2.1.1.1 Gaskets

Flange gaskets must 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 must be Solarguard Flex Hose as manufactured by QED Environmental Systems.

2.1.2.2 Fasteners

Fasteners for flexible PVC pipe must 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 must 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 must be SDR 11, and 2-inch airline must be SDR 9.

Pipe must be extruded from a Type III, Class C, Category 5, Grade P47 compound as described in ASTM D 1248. It must be classified as cell 445574C/E according to ASTM D 3350 and have the material designation of PE 4710. The pipe must be manufactured to meet the requirements of ASTM F 714. Manufacturer's literature must be adhered to when "manufacturer's recommendations" are specified. All pipe and fittings must be provided by one manufacturer. Acceptable manufacturers include Core and Main (800-353-3747), Driscopipe (800-527-0662), or approved equal.

Perforations must be 1/2 inch in diameter at ¼ points around the perimeter of the pipe. Rows of holes must be space approximately 6 inches along the length of the pipe. Every other row must be offset by 3 inches.

3.0 EXECUTION

3.1 PVC PIPE HANDLING

PVC pipe and pipe fittings must be handled carefully in loading and unloading by CONTRACTOR or SUBCONTRACTOR. Pipe and pipe fittings must not be dropped or dumped.

3.2 PVC PIPE INSTALLATION

PVC pipe installation must 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 an LFG probe must be approved by the ENGINEER.

3.3.1 Preparation

All pipe must be inspected for cuts, scratches, or other damage prior to installation. Pipe with imperfections must not be used. All burrs, chips, etc. must be removed from pipe interior and exterior. All loose dirt and moisture must be wiped from the interior and exterior of the pipe end and the interior of the fitting. All pipe cuts must be square, perpendicular to the center line of pipe. Pipe ends must 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 must 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 must comply with the requirements of ASTM D 2564 and must be applied in strict accordance with manufacturer's specifications. Pipe must 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 must 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 must 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 must 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 must be solvent welded in accordance with Paragraph 3.3.2 above.

3.5 HDPE PIPE HANDLING

HDPE pipe must not be bent more than the minimum radius recommended by the manufacturer for type, grade, and SDR. Care must be taken to avoid imposing strains that will overstress or buckle the HDPE piping or impose excessive stress on the joints.

3.6 JOINING HDPE PIPE:

Only two methods must be utilized to joining HDPE pipe: heat fusion and mechanical joining.

3.6.1 Mechanical Joining

Mechanical Joining must be accomplished with HDPE flange adapters, neoprene gaskets, and ductile iron back-up flanges, and must be used only where shown on the Drawings. Refer also to Part 3.7.

3.6.2 Heat Fusion

Heat Fusion joints must be made in accordance with manufacturer's step by step procedures and recommendations. Fusion equipment and a trained operator must be provided by the Contractor. Pipe fusion equipment must be of the size and nature to adequately weld all pipe sizes and fittings necessary to complete the project. Branch saddle fusions must 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 must be performed outside of the trench whenever practical. Before heat fusing pipe, each length must be inspected for the presence of dirt, sand, mud, shavings, and other debris. Foreign material must be completely removed. At the end of each day, all open ends of fused pipe must be capped or otherwise covered to prevent entry by animals or debris.

3.6.3 Shelter

As per the manufacturer’s instructions, no fusion will be performed in precipitation unless a shelter is provided.

3.7 HDPE PIPE INSTALLATION

Pipe installation must 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 must not exceed 400 feet. The Engineer must 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 (or approved representative) during this inspection must be corrected before lowering the pipe into the trench. Pipe must be allowed sufficient time to adjust to trench temperature prior to any testing, segment tie-ins, and/or backfilling.

Tie-ins must be made outside of the trench whenever possible. When tie-ins are to be made only in the trench, a bell hole must be excavated large enough to ensure an adequate and safe work area.

Below grade piping must be marked with metallic locator/warning tape to be buried in the trench above the pipe as indicated on the drawings.

3.8 SEGMENT TESTING

3.8.1 Test Method

The HDPE pipeline must be subjected to an air test per ASTM F-1417 and as described herein to detect any leaks in the piping. Testing must be performed above grade. The CONTRACTOR must accept the responsibility for locating, uncovering (if previously backfilled), and repairing any leaks detected during testing.

3.8.2 Test Segment

Like sizes of polyethylene piping must be butt welded together into testing segment not to exceed 1000 feet. Segments must 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.

3.8.3 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.

3.8.4 Pressure

The test pressure must be 5 psig.

3.8.5 Pressure Drop

Pressure drop during the test must 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 must be corrected for temperature changes before determining pass or failure. (See Section 3.10 for test failures). The ENGINEER (or approved representative) must sign off on a test form to indicate test compliance.

3.8.6 Notification

The ENGINEER must be notified prior to commencement of the testing procedure and must be present during the test.

3.8.7 Equipment

Equipment for this testing procedure will be furnished by the CONTRACTOR. This must consist of a polyethylene flange adaptor with a PVC blind flange. Polyethylene reducers must be utilized to adapt test flange to size of pipe being tested. Tapped and threaded into the blind flange must 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 must 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.

3.9 TEST FAILURE

3.9.1 Remedial Actions

The following steps must be performed when a pipe segment fails the one percent - 1 hour test described in this Section.

3.9.2 Inspection

The pipe and all fusions must be inspected for cracks, pinholes, or perforations.

3.9.3 Terminations

All blocked risers and capped ends must be inspected for leaks.

3.9.4 Location

Leaks must 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 approved 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 grade. 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 43 21 10
CONDENSATE SUMPS

1.0 GENERAL

1.1 DESCRIPTION

1.1.1 Scope

Provide all materials, equipment, and labor needed to install condensate sumps 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: LFG System Valves

1.2 SUBMITTALS

1.2.1 Product Information

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.

1.2.2 Performance Data

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.

2.0 PRODUCTS

2.1 CONDENSATE SUMPS

2.1.1 Construction

The unit shall be a standalone device with all components rated for service in harsh and explosive environments.

2.1.2 Design

The inline, below grade, sump shall conform to the dimensions shown on the Drawings.

2.1.3 Materials

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 by the MANUFACTURER. Sump shall be fabricated by LEE SUPPLY, ISCO-PIPE, CORE & MAIN, or approved equal. The reservoir shall be designed to withstand:

2.1.3.1 Pressure

A vacuum of 100 inches-w.c. and a pressure of 1 PSIG at 130 degrees F.

2.1.3.2 Buoyancy Force

Provide resistance to a buoyancy force in a saturated soil condition.

2.1.3.3 Structure

An earthen backfill fluid pressure of 35 pcf.

2.1.4 Pipe Penetration Support

Each pipe penetration shall be reinforced with four gussets spaced equally around the circumference. Pipe penetrations will be formed using stacked tee fittings.

2.1.5 Installation Conditions

The forces and impacts that typically occur in loading, unloading, shipping, handling at the job site, and installation.

2.1.6 Joints

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 Pump Access

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 Tubing

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 Minimum Capacity

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 Pump

The pneumatic pump shall be bottom-loading short pump, as manufactured by Pump One, QED Environmental Systems, 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 Discharge Hose

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 Liquid Level Indicator

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 Insulation

CONTRACTOR shall wrap pump discharge hose and exposed force main piping with insulation.

2.1.14 Configuration

The general piping configuration of the condensate sump shall be as shown on the Drawings.

2.2 APPURTENANCES

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.

3.0 EXECUTION

3.1 EXCAVATION AND BACKFILL

3.1.1 Excavation

Excavation, temporary sheeting, shoring, and bracing, and backfill shall comply with Section 31 23 33.

3.1.2 Dewatering

If liquids are encountered, the CONTRACTOR shall dewater the excavation during installation. Dewatering must be in compliance with applicable regulations and project specifications.

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 Concrete

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

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

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 Operation

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 Air

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 Failures

Test failures shall be identified, repaired, and re-tested as described in Section 33 51 10.

END OF SECTION 43 21 10

SECTION 44 11 20

SKID-MOUNTED LANDFILL GAS BLOWER/FLARE SYSTEM

1.0 GENERAL

1.1 DESCRIPTION

1.1.1 Scope of Work

1.1.1.1 Description

The work described in this section consists of furnishing all labor, materials, equipment, and incidentals necessary to furnish, install, and field test a SKID-MOUNTED LANDFILL GAS BLOWER/FLARE SYSTEM, also referred to as the landfill gas blower/flare station, as shown on the PLANS and as specified herein, including all appurtenances to provide a complete system ready for operation.

1.1.1.2 Sub-systems

The Skid-Mounted Landfill Gas Blower/Flare System shall include the following four sub-systems:

- Gas Handling System.
- Interconnecting Piping System.
- Candlestick Flare System.
- Control System.

1.1.1.3 Electrical

The CONTRACTOR shall be responsible for all electrical wiring connections for operation and control of all equipment related to the Skid-Mounted Landfill Gas Blower/Flare System.

1.1.1.4 Related Work

- Section 31 20 00: Earthwork
- Section 03 30 00: Concrete
- Section 33 51 10: LFG Pipe and Pipe Fittings

1.2 SUBMITTALS

1.2.1 Shop Drawings

All equipment and accessories shall have manufacturer's Shop Drawings approved by the ENGINEER prior to shipment and shall be tested for conformance with these Specifications prior to acceptance

and final payment by the OWNER. The following materials and shop drawing information shall be submitted:

- Certified Shop Drawings showing all important details of construction and dimensions.
- Descriptive literature, bulletins, and/or catalogs of the equipment.
- A complete bill of materials for all equipment.
- The total weight of the equipment, including the weight of the single largest item.
- Complete performance data that will indicate full compliance with the Specifications; performance curves for flow and pressure/vacuum capacity; calculations showing the equipment gas flow and motor corrections required for operation at the elevation of the job site.
- Complete control panel diagrams and elevations showing all components, wires, connections, and numbered terminals.
- Complete electrical interconnect diagram showing all wires and terminals between the control panel and external devices.
- Exceptions to the applicable requirements, PLANS, Specifications, and applicable codes and standards.
- Certification that the equipment furnished for this project does not exceed the sound pressure specified herein.

1.2.2 Operation and Maintenance Manual

An operation and maintenance manual shall be furnished. The manual shall be prepared specifically for this installation and shall include all required catalog cuts, drawings, equipment list, descriptions, definitions, procedures, and information necessary to instruct operating and maintenance personnel unfamiliar with such equipment. The manual shall include a list of suppliers, with phone numbers and contact information, for equipment parts that may need servicing or replacement.

1.2.3 Test Procedures

Detailed outline of functional test procedures shall include a step-by-step description of the proposed tests, a list of all test equipment including calibration dates, and signoff sheets.

1.2.4 Spare Parts

Detailed outline of functional test procedures shall include a step-by-step description of the proposed tests, a list of all test equipment including calibration dates, and signoff sheets.

1.3 QUALIFICATION

1.3.1 Experience

The Skid Mounted Landfill Gas Blower/Flare System, including all ancillary equipment, shall be furnished by a manufacturer who is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed and fabricated in accordance with

the best practices and methods. The manufacturer shall have experience in supplying equipment for landfill gas handling systems.

1.3.2 Manufacturer

The Skid Mounted Landfill Gas Blower/Flare System shall be manufactured by Callidus Technologies Inc., John Zink Company, LFG Specialties, Inc., Parnel Biogas Inc., or Perennial Energy, Inc.

1.4 DESIGN CRITERIA

1.4.1 Landfill Gas Blowers

1.4.1.1 Gas Classification

Equipment specified herein is intended to be standard equipment for use in a landfill gas handling system.

1.4.1.2 Operating Standards

The blowers shall be designed for continuous operation in an outdoor environment and shall conform to the values in Table 44 11 20 - 1, measured at standard 14.7 psia and 68 degrees F condition:

Table 44 11 20 - 1 – Blower Operating Standards

Standard	Value
Number required	2
Rated capacity, scfm (per blower)	2,500
Minimum capacity, scfm	500
Site elevation, ft AMSL	1900
Gas composition	
Methane, %	18 - 55
Carbon Dioxide, %	25 - 50
Oxygen, %	0 – 5
Nitrogen, %	0 – 20
Traces gases (e.g., VOCs, H2S), %	0 – 1
Blower inlet vacuum, inches of water	20 - 60
Blower outlet pressure, inches of water	15
Landfill gas inlet temperature	
Maximum, degrees F	140
Minimum, degrees F	60
Motor	
Totally enclosed, fan cooled	
Minimum motor horsepower	50
Noise limit, dbA at 3 ft	85
LFG moisture content, % saturated	100
Shaft Type	Gas with mechanical seal

1.4.1.3 Surging

When rated volumetric capacity is reduced to 20 percent of design, blowers under the specified inlet conditions shall not surge or overload the motor.

1.4.1.4 Rating

Each blower equipment rating shall be based upon data previously established by tests in accordance with the ASME Power Test Code for Centrifugal Blowers.

1.4.2 Candlestick Flare System

1.4.2.1 Operating Standards

The landfill gas flare system shall be designed to operate continuously at the service conditions listed in Table 44 11 20 – 2.

Table 44 11 20 - 2 – Candlestick Flare Operating Standards

Standard	Value
Landfill gas flow rate, scfm	250 to 2500
Btu loading, MM Btu/hour	3.0 to 66
Inlet temperature, degrees F	80 to 140
LFG moisture content, % saturated	100
Landfill gas composition range:	
Methane, %	18 - 55
Carbon Dioxide, %	25 - 50
Oxygen, %	0 – 5
Nitrogen, %	0 – 20
Traces gases (e.g., VOCs, H2S), %	0 – 1
Site elevation, ft AMSL	1900

1.4.2.2 Controls

Controls and accessories to include the following:

- Propane supply with a spark plug igniter for flame ignition
- Thermocouple for flame temperature confirmation
- Ultraviolet flame scanner or thermocouple for flame confirmation
- Flare control panel
- Auto re-start
- Automatic notification system
- Pneumatically-operated emergency shut-off valve
- Totalizing Flow meter
- Digital Data Recorder
- Flame arrester
- Flare stack liquids drain
- Continuous landfill gas methane analyzer

1.4.3 Pressure

At maximum landfill gas flow rate of 2,500 scfm, the flare system shall require a maximum landfill gas pressure of 10 inches water column.

1.4.4 Destruction Efficiency

The landfill gas flare shall be capable of achieving a minimum weighted average destruction efficiency of greater than 98 percent of total non methane organic compounds and meet the requirements of 40 CFR 60.18.

1.4.5 Thermal Radiation

The thermal radiation at 6 feet above ground level shall be less than 500 BTU/h ft2 when the flare is operating at its maximum design flow rate and methane composition.

1.5 APPLICABLE CODES AND STANDARDS

All equipment shall be manufactured in accordance with codes and guidelines as specifically detailed herein and in accordance with applicable portions of the following (latest edition):

- Local laws and ordinances
- State and Federal laws
- National Electrical Code
- National Electrical Manufacturers Association (NEMA)
- Underwriters Laboratories (UL)
- Uniform Building Code (UBC)
- American National Standards Institute (ANSI)
- American Society of Mechanical Engineers (ASME)
- American Gas Association (AGA)
- American Petroleum Institute (API)
- Institute of Electrical and Electronic Engineers (IEEE)
- Instrument Society of America (ISA)
- Industrial Risk Insurance (IRI)
- Factory Mutual (FM)
- National Fire Protection Agency (NFPA)
- Environmental Protection Agency (EPA)

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

1.6.1 Protection

All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

1.6.2 Delivery

The equipment shall be delivered on site as fully assembled as transportation will allow. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the ENGINEER.

1.6.3 Exposed Surfaces

Finished surfaces of all exposed openings shall be protected by wooden blanks, strongly built, and securely bolted thereto.

1.6.4 Labeling

Each box or package shall be properly marked to show its net weight in addition to its contents.

1.7 WARRANTY AND GUARANTEES

The CONTRACTOR shall warrant the units being supplied to the OWNER against defects in workmanship and material for a period of one (1) year from the date of equipment acceptance by the OWNER. In the event that the equipment fails to perform as specified, the equipment manufacturer shall promptly repair or replace the defective equipment without any cost to the OWNER (including handling and shipment costs).

2.0 PRODUCTS

2.1 GENERAL

2.1.1 New Equipment

Equipment shall not have been in service, except for shop tests, at any time prior to delivery. The equipment shall be furnished factory assembled to the extent possible and ready for installation. If equipment is damaged or found to be defective it must be replaced. Re-built equipment will not be accepted.

2.1.2 Equipment Standards

Equipment must be designed and proportioned to have liberal strength, stability, and stiffness and shall be especially adapted for the intended service. Ample room and facilities must be provided for inspection, repairs, and adjustments.

2.1.3 Parts Standards

Parts of equipment must be amply proportioned for all stresses which may occur during operation and for any additional stresses which may occur during fabrication, transportation, handling, and erection.

2.1.4 Additional Considerations

These Specifications are intended to give a general description of what is required, but do not cover all requirements of the equipment as offered. They are, however, intended to cover the furnishing,

delivery, and field testing of all materials, equipment, and apparatus as required. Auxiliary equipment necessary for proper operation of the proposed Skid Mounted Landfill Gas Blower/Flare System not mentioned in these Specifications or shown on the PLANS shall be furnished and installed.

2.1.5 Pressure

At all levels of performance of each gas system, the sound pressure shall not exceed 85 dbA over a frequency range of 37.8 to 9,600 cycles per second. Measurement shall be made a distance of 3 feet from the outer face of the equipment. The manufacturer shall certify that the equipment furnished for this project does not exceed the specified sound pressure. This written certification shall be submitted with the Shop Drawings.

2.1.6 Nameplate

A brass or stainless steel nameplate shall be attached to each piece of equipment in a conspicuous place. The following information shall be plainly marked on the nameplate: name and address of the manufacturer, serial number, model number, and any other information necessary for complete identification.

2.1.7 Modifications

If necessary, modifications shall be made in the manufacturer's standard product to make it conform to the specific requirements of the Specifications and to requirements contained in regulations issued by public agencies. Such modifications shall be noted in Shop Drawing submittals.

2.2 GAS HANDLING SYSTEM

2.2.1 Blower and Motor

2.2.1.1 Blower

The blower unit shall be a gas inlet driven, direct drive, multistage centrifugal type. The blowers shall be designed for and include variable frequency drive (VFD) control. Impellers shall be mounted on one shaft supported on each end by bearings mounted in the outboard bearing housings. The blower shall be built from parts cast in patterns from which previous units have been built and tested. Blower shall comply with the Design Criteria of Section 1.4 above.

2.2.1.2 Blower Housings

The housings shall consist of cast iron sections held securely between cast iron inlet and outlet heads with steel tie rods.

2.2.1.2.1 Shaft Contact

No contact shall be made between the shaft rotor and the housing, other than through the bearings. Stuffing boxes shall be used as seals to insure no leakage of gas to the atmosphere or air into the landfill gas.

2.2.1.2.2 Connections

The inlet and outlet connections shall be drilled and tapped flange pattern per ANSI 1316.1, 125 pound, and shall be an integral part of the heads.

2.2.1.3 Impellers

2.2.1.3.1 Manufacture

Impellers shall be one piece cast aluminum alloy, keyed to the shaft and held by a locknut. Hubs of the impellers shall butt against each other directly or through one piece metal spacers. There shall be ample clearance and tip speed shall not exceed 375 feet per second.

2.2.1.3.2 Balance

Impellers shall be precisely machine balanced. Vibration shall not exceed 2 mils in the vertical plane measured at the blower bearing housings.

2.2.1.4 Diffusers

Diffuser sections which receive the gas from the impeller and guide the gas to the next impeller shall be provided. The diffusing vanes shall be an integral part of the sections.

2.2.1.5 Shaft

Each shaft shall be made of high grade carbon steel of sufficient diameter to operate below first critical speed.

2.2.1.6 Bearing Housings

Each blower shall be provided with two antifriction bearings. It shall be possible to replace bearings without disconnecting piping or disassembling the compressor casing. Both inlet and outlet bearings shall be designed for a minimum expected life of 10 years of continuous operation.

2.2.1.7 Casing Drains

Each blower stage shall be provided with 3/8-inch diameter casing drains manifolded to a single manual shut-off valve.

2.2.1.8 Internal Lining

The blower internals shall be furnished with a factory applied Bisonite, Kynar, phenolic coating or approved equal, minimum 10 mils thick to provide resistance to corrosion by landfill gas. The coating shall be applied to all parts of the blower (excluding aluminum impellers) which come in contact with the landfill gas stream.

2.2.1.9 Motor

Each blower shall be direct-coupled to a horizontal 480V, 3-phase, 60-hertz motor. The blower manufacturer shall be responsible for selecting the proper motor size to suit this equipment, the

performance requirements noted herein, and the site conditions. The motor shall be totally enclosed fan-cooled (TEFC) suitable for Class 1, Division 2, Group D, classified location, and UL-approved.

Motor shall be rated at 104 degrees F ambient with not more than 131 degrees F rise. Bearings shall be of the antifriction type with an AFBMA L-10 life rating of not less than 25,000 hours.

2.2.1.10 Flexible Couplings and Drives

The blowers shall be connected to the drivers with a suitable flexible coupling. The CONTRACTOR shall check and adjust the alignment of the couplings and drives in accordance with the instructions of the blowers' manufacturer to a tolerance of plus or minus 2 mils. Couplings shall be covered with base-mounted aluminum or non-sparking metallic guard.

2.2.1.11 Bases

Hot dip galvanized or epoxy-coated steel bedplates of suitable size for mounting blowers and drivers shall be furnished by the blower manufacturer. The blower and motor shall be carefully aligned and then bolted in place. Suitable vibration isolation pads shall be provided under the steel bedplates of the units.

2.2.1.12 Blower Motor Assemblies

The blower motor assemblies shall be located, installed, and plumbed on a skid, and delivered to the site as a complete unit.

2.2.1.13 Auxiliary Equipment

The following auxiliary items shall be provided by the blower manufacturer:

- The manufacturer of the blowers shall provide flanged expansion joints and concentric tapered reducers; e.g. Lamson BA-1024 series.

2.2.1.14 Blower Controls

Blower-motor starters and controls are specified in Part 2.5. Starters and controls shall be commonly available parts. The manufacturer shall provide the OWNER with a list of known suppliers for parts not commonly available that are expected to need servicing or replacement.

2.2.1.15 Variable Frequency Drive

CONTRACTOR shall supply a VFD for control of each blower/motor assembly. The VFD shall be capable of controlling the blower motor by either a manually selected speed control or a 4-20 mADC signal provided by the flow rate or vacuum monitoring system. The operator shall be able to select a desired flow rate or vacuum at the operator interface console, and the VFD shall automatically control the blower speed to maintain the selected flow rate and/or vacuum.

2.2.1.16 Experience

2.2.1.16.1 Manufacturer Experience

Blowers shall be manufactured in the United States. Blower manufacturers shall have a minimum of 5 years experience in the design and manufacture of this type of equipment and have a minimum of 25 operating installations on landfills in the U.S.

2.2.1.16.2 Acceptable Manufacturers

- Hoffman Air & Filtration Systems
  - Syracuse, New York 13057
  - (315) 423-8617
- Gardner Denver, Inc (Lamson Corporation)
  - Peachtree City, Georgia
  - (800) 982-3009
- Other manufacturers as approved by the Engineer

2.2.2 Moisture Separator Assembly (knock-out pot):

2.2.2.1 Materials

The moisture separator shall be completely fabricated from epoxy coated steel or 6061 T6, 6063 T6 and/or 3003 alloy aluminum. It shall be of a vertical, cylindrical design with element removal from the top. An 8 inch flanged, covered, inspection port shall be provided in the side near the bottom for manual clean out of accumulated debris. Nozzle flanges shall meet ANSI 125 pound specifications. HDPE fabrication may be acceptable if approved by the ENGINEER.

2.2.3 Demister

The demister shall be made from non-corrosive mesh and shall be supported on and held down by high open area, stainless steel grid, or equivalent. The moisture separator shall be able to remove 100 percent of droplets greater than 6 micron and shall also remove particulates having a density equal to or greater than water which are greater than 6 micron in size.

2.2.4 Capacity

The moisture separator shall have a flow capacity of at least 2,500 scfm. At the design flow rates, temperatures and pressures, the moisture separator shall not have a pressure drop greater than 3 inches water column and shall be capable of withstanding no less than 3.0 pounds per square inch gauge vacuum.

2.2.5 Condensate Removal

There shall be a 4-inch IPS pipe coupling in the bottom of the assembly for condensate removal.

2.2.6 Pressure Drop Monitoring

There shall be two 1/2-inch pipe couplings in the side of the unit, one upstream and one downstream of the demister element material, for the purpose of connecting differential pressure monitoring device(s).

2.2.7 Manufacturer Experience

The moisture separator assembly shall be manufactured in the United States. Manufacturers shall have a minimum of 5 years experience in the design and manufacture of this type of equipment, and have a minimum of 10 units operating successfully on similar landfill gas installations in the U.S.

2.2.8 Location

The moisture separator assembly shall be located, installed, and pre-plumbed on the gas handling system skid.

2.3 INTERCONNECTING PIPING SYSTEM

2.3.1 Valves

2.3.1.1 Butterfly Valves

2.3.1.1.1 Shafts

All valve shafts shall be connected to operators by use of keys and keyways. The use of compression or friction connection will not be accepted.

2.3.1.1.2 Materials

The butterfly valves, for low-pressure/vacuum landfill gas services, shall have cast-iron wafer-style valve body with contoured 316 stainless steel disc, Type 316 stainless steel stem, Acetal stem bushing, and viton (teflon is insufficient) replaceable resilient seat. Valves shall be bubble-tight at 150 pounds per square inch differential pressure and shall be suitable for installation between ANSI 125-pound flanges.

2.3.1.1.3 Operation

All butterfly valves shall open left or counterclockwise when viewed from the stem. Manual valve operators shall be either worm gear or lever type. Valves installed greater than 6 feet in height from the ground or skid platform shall be provided with chain wheel operators. All operators shall have adjustable mechanical stop limiting devices to prevent overtravel of disc. Should an adjustment of the disc be required to maintain a bubble-tight seal, this adjustment shall be made externally without removing the operator housing cover. The operator shall be designed such that adjustments can be made under pressure and without the possibility of dirt getting into the operator lubricant. Adjustments through the lower shaft will not be acceptable. Operator components shall, at the extreme operator positions, withstand without damage a pull of 200 lb for handwheel or a torque of 300 ft-lb for operating nuts.

2.3.1.1.4 Interior

Interior of valve body and valve disc except for valve seat and stainless steel valve seat ring shall be coated with a fusion bonded, thermosetting epoxy coating in accordance with AWWA C550, latest revision. Coating shall be holiday free with a minimum thickness of 12 mils. Surfaces shall be clean, dry, and free from rust and grease before coating.

2.3.1.1.5 Manufacturer

All butterfly valves shall be manufactured by American-Darling Valves, Clow Valve Company, DeZurik, Kennedy Valve Manufacturing Company, or approved equal. Replacement parts and valves shall be commonly available.

2.3.1.1.6 Exterior

All exterior surfaces of butterfly valves shall be clean, dry and free from rust and grease before coating. The exterior ferrous parts of all valves shall be shop primed at the factory with one coat, minimum dry film thickness 1.5 mils, of a primer with rust inhibitive pigments and synthetic resins. Following installation, aboveground valves shall be finish painted. The color of the paint shall be selected by the OWNER.

2.3.1.2 PVC Cock Valves

PVC Cock Valves. Gas and pressure sampling valves shall be quick connects or 1/4-inch PVC cock valves. Valve seats and seals shall be EPDM. Valves shall have a 1/4-inch MPT on one end and hose connection on the other and. Valves shall be as manufactured by Asahi/America, Chemtrol, or equal. Replacement parts and valves shall be commonly available.

2.3.2 Piping

2.3.2.1 Material

Piping on the gas handling system skid shall be Schedule 80 PVC, or approved equal. The same specification applies to tees, elbows, wyes, flanges, and other pipe fittings. Flanges shall conform to ANSI 125-pound specifications.

2.3.2.2 Gaskets

The gaskets shall be full-face rubber, 1/16 inch to 1/8 inch in thickness, and shall meet the requirements of ANSI Specification A21.11.

2.3.2.3 Drainage

Where shown on the PLANS or as required, pipes and fittings shall be drilled and tapped to receive drainage or other piping or plugs. All holes shall be drilled at right angles to the axis of pipes and fittings.

2.3.2.4 Supports

Piping and fittings shall be supported so as to prevent any strain being transmitted between sections and connected equipment and appurtenances. Release of any joint shall result in no transverse piping movement and shall allow easy removal and replacement of any piping component. Supports in addition to those shown on the PLANS may be required.

2.3.2.5 Heat Tracing

Where shown on the PLANS or as required, piping and fittings shall be heat traced between sections and connected equipment and appurtenances. Heat tracing may be done by the MANUFACTURER or the CONTRACTOR. Heat tracing in addition to that shown on the PLANS may be required.

2.4 CANDLESTICK FLARE SYSTEM

2.4.1 Manufacture

The landfill gas flare system shall be a unitized, modular system including all components for a complete and operational system. The flare shall comply with the Design Criteria of Part 1.4 above.

2.4.2 Piping and Wiring

The landfill gas flare system shall be pre-piped and pre-wired to the extent possible, requiring minimal field assembly.

2.4.3 Components

The landfill gas flare system shall include, but not be limited to, the following components:

2.4.3.1 Automatic Shut-Off Valve

The valve shall open when prompted by the flare. The landfill gas flare system shall include, but not be limited to, the following components: control panel and closed by loss of electrical power, flame failure, or blower failure. It shall be a pneumatically operated butterfly valve, bubble-tight, wafer-style, equipped with a stainless-steel disk and Viton seat. The operator shall have a manual override and be equipped as a spring fail close device. It shall close when directed by the logic in less than 5 seconds. The compressed gas necessary to operate the valve shall be supplied by a nitrogen bottle.

2.4.3.2 Flame Arrester

2.4.3.2.1 Connections

Flame arrester shall have 125 pound ANSI flanged connections.

2.4.3.2.2 Materials

The housing construction shall be aluminum. The bank assembly shall be all aluminum and shall be arranged for easy removal from the housing to facilitate inspection and cleaning. The net free area through the bank assembly shall not be less than four times that of the corresponding size pipe.

2.4.3.2.3 Capacity

Maximum head loss through the flame arrester shall not exceed 3 inches of water column at 1,000 scfm. All grids of the bank shall be arranged for individual removal. The flame arrester shall be UL approved and manufactured by Whessoe Varec, Model 5010E or approved equal.

2.4.3.3 Flare Stack

The flare stack shall be constructed from ASTM A53 steel, and it shall be of sufficient length to provide an overall flare system height of more than 20 feet. Flare construction shall consist of welds conforming to AWS D1.1 standards. The top 5 feet of the stack/burner tip shall be constructed of 304 stainless steel.

2.4.3.4 Burner

The burner unit shall be constructed of 304 stainless steel. It shall consist of the burner nozzle, vanes, and impingement assembly. It shall be designed such that the full range of flow rates, as specified herein, shall combust without causing either flame yellowing, flame lift off, or flashback, and shall perform according to the destruction and reduction efficiency requirements listed earlier in this specification.

2.4.3.5 Windshield

The flare windshield shall be constructed of 310 stainless steel. The windshield shall extend at least 2 feet above landfill gas exit.

2.4.3.6 Propane Pilot System

Removable pilot assembly shall include pressure regulator, pressure indicator, solenoid valve, manual shutoff valve and pilot gas pressure manometer port. CONTRACTOR shall provide two (2) 100 pound L.P. bottles equipped with fuel gauges and regulators arranged such that one bottle can be removed from the system for re-filling without affecting system operation.

2.4.3.7 Electronic Spark Ignition

5,000 V electronic igniter assembly removable from outside the flare without disconnecting conduit or wiring. Igniter assembly shall be commonly available parts. The manufacturer shall provide a list of parts not commonly available and known suppliers.

2.4.3.8 Flare Mounting System

This system shall be manufactured of ASTM A36 carbon steel members, which shall be welded to the structure using AWS D1.1 methods. Sufficient steel gusset material shall be incorporated in the structure to prevent erratic vertical alignment of the flare pipe. Flare mounting shall provide anchorage to the foundation to prevent overturning and provide resistance against seismic or wind forces. Structural design shall comply with UBC 100 MPH criteria.

2.4.3.9 Finish

Carbon steel base of the flare stack shall be sand-blast prepared and primed. Sand blasting shall be to SP-6 guidelines. An inorganic zinc primer, solvent or water based, with a minimum of 14 lbs

metallic zinc content per gallon shall be applied. Minimum application will involve 1 coat, 4 MDFT cover. Acceptable coating suppliers include Ameron Protective Coatings (Brea, CA), DuPont Chemical Company (Wilmington, DE), Glidden Company (Cleveland, OH), and Koppers Company (Pittsburgh, PA). Finishing must be completed prior to shipment to site.

2.4.3.10 Control Louvers

Flare stack will include control louvers (dampers) to adjust flow.

2.5 CONTROL SYSTEM

2.5.1 Control Panel

The control panel for the Skid Mounted Landfill Gas Blower/Flare System shall be NEMA 4-rated. The main control panel shall be sized to accommodate the required controls, and shall be provided with a swing out panel, and with a window in the door through which status annunciators, recorder, controller, etc. may be viewed. The control panel shall be mounted, installed and prewired by the manufacturer. The panel shall include, but not be limited to, the following components:

2.5.1.1 Load Center

A load center for the motors, outlets, fixtures, controls, devices, lights, etc.

2.5.1.2 Control Center

A control center to receive all the signals from the various safeties, controls and monitoring equipment, and to automatically control all the components of the system.

2.5.1.3 Operator Control Panel

The control panel for the landfill gas blower/flare system shall be NEMA 4-rated. The main control panel shall be sized to accommodate the required controls and shall be provided with a swing out panel, and with a window in the door through which status annunciators, recorder, controller, etc. may be viewed. The panel shall include, but not be limited to, the following components:

2.5.1.3.1 Flare Controls

Flare controls shall include trouble light contacts, automatic start/stop for pilot ignition, controllers, spark plugs, ultraviolet (UV) scanner, flame safeguard controller, thermocouples, timers, and other components necessary for a complete, operational automatic system. Automatic operation shall be achieved through adjustable timers, relays, and switches activated by the thermocouples and UV scanners.

2.5.1.3.2 Blower Controls

Blower controls shall include ITE Type ETI, or equal motor circuit protectors, variable frequency drives, voltage monitors, dual set point ammeter switch gauges (undercurrent and over-current points shall be clearly indicated on the ammeters), running time meters, hand-off-automatic switches, and green push-to-test run lights. A time delay will prevent blower restart until sufficient time has elapsed for the shaft to stop spinning minimum 5 minutes)

2.5.1.3.3 Blower Operations

The blower controls shall provide for 1 or 2 blower operation through a selector switch (Blower 1, Blower 2, or Blower 1 and 2). During automatic startup of Blower 1 and 2, a time delay will prevent both blowers from starting simultaneously.

2.5.1.3.4 Computer Interface

The control panel shall be sized to accommodate a laptop personal computer.

2.5.1.3.5 Climate Control

The control panel shall be air conditioned to maintain the internal panel temperature between 55°F and 85°F.

2.5.1.3.6 Touchscreen

Local touch screen, no less than 7-inches in size. Must be Ethernet and USB ready. Program it to record flare compliance data on a minute-by-minute basis on to an external storage medium (e.g., CF card, SD card, USB storage, etc.):

- Flare controlling temperature (F)
- Flare status (on/off)
- All LFG flow rates (SCFM)
- All LFG totalized flows (SCF, MMSCF, etc.)

Approved HMI manufacturers are:

- Allen Bradley – Panelview Plus 7
- Automation Direct – C-more HMI EA9
- Maple Systems - Advanced HMI

2.5.1.3.7 Programmable Logic Controller

Control of the flare shall be achieved using a Programmable Logic Controller (PLC).

- Approved PLC manufacturers are:
  - Allen-Bradley - CompactLogix PLC or MicroLogix PLC
  - Automation Direct – DirectLogic 205 or Productivity 1000, 2000, or 3000 series
  - ENGINEER approved equal
- PLC HARDWARE
  - All control circuits will use 24VDC unless otherwise specified.
  - Ethernet communications are required.
- Minimum 8 channel analog input and output cards are required. Mixed input/output cards will be accepted, but the combined inputs and outputs must be equal to or greater than 10 points.
- All analog channels are required to be wired through analog isolators.

- Minimum 16 point input and output cards are required.
- All IO will be terminated to terminal blocks.
    - Minimum of 20% spare slot space will be required.
    - Ethernet card will be installed in the last slot of the CPU rack.
    - CPU rack will contain at least 2 empty slots.
    - Filler cards will be used to fill spare slots.

Contractor shall furnish a copy of the complete source code to the OWNER.

2.5.1.4 Communication Protocol

The PLCs will communicate via the Ethernet card using Modbus TCP/IP or EtherNet/IP. Vendor shall furnish a full tag list of every PLC tag with its corresponding Modbus TCP/IP or EtherNet/IP tag. All Ethernet equipment shall be IPd by the vendor.

Furnish an Ethernet switch with a minimum of 8 ports.

2.5.1.5 Power

All control power shall be 24 VDC. Where applicable, a 24 VDC relay shall be used to interface with other control voltages.

Provide a battery backup system (UPS) to power the PLC, HMI, data recorder, Ethernet switches, future cellular modem, and future SCADA Edge PC. The UPS shall provide a minimum of 3 minutes of backup power and shall provide pure-sinewave power.

Approved manufacturers are:

- APC – E.g., SMC1500C
- CyberPower – CP1500PFCLCD
- Tripplite

2.5.1.6 Control Mode

The operator control panel to allow either manual or automatic selection for the control of the operating components of the system.

2.5.1.6.1 Flare Controls

Flare controls shall include trouble light contacts, automatic start/stop for pilot ignition, controllers, spark plugs, ultraviolet (UV) scanner, flame safeguard controller, thermocouples, timers, and other components necessary for a complete, operational automatic system. Automatic operation shall be achieved through adjustable timers, relays, and switches activated by the thermocouples and UV scanners.

2.5.1.6.2 Blower Controls

Blower controls for two (2) blowers. Blower controls shall include ITE Type ETI, or as approved by the ENGINEER as equal motor circuit protectors, variable frequency drives, voltage monitors, dual set point ammeter switch gauges with flow indication (obtained from blower manufacturer), running time meters, hand-off-automatic switches, and green push-to-test run

lights housed in a NEMA 4 enclosure. A time delay will prevent blower restart until sufficient time has elapsed for the shaft to stop spinning.

The blower controls shall provide for one or both blowers operation through a selector switch (Blower 1, Blower 2). During automatic startup of more than one blower, a time delay will prevent multiple blowers from starting simultaneously.

2.5.1.7 Weather Shield

A weather/heat shield shall be provided to protect the control panel against radiated heat (solar and/or flare) and rain. The control system shall be designed and manufactured as an outdoor system.

2.5.1.8 Safeties

The system shall be equipped with the following safeties as a minimum:

- Blower motor overcurrent shall cause system shutdown.
- Blower motor undercurrent (surge) shall cause system shutdown.
- Flame failure shall cause system shutdown.
- High temperature shutdown.
- Low temperature shutdown.
- High temperature flashback shutdown.
- High blower bearing temperature shutdown.
- High liquid level in knock-out pot shutdown.
- Inlet valve failure.
- Low methane content shutdown.

2.5.1.9 Control Panel Face-Mounted Devices

The system shall be equipped with the following control panel face-mounted devices as a minimum:

- Alarm and shutdown indicating lights.
- Blower motor current meter.
- LFG and supplemental fuel flowmeters.
- Hand/off/auto switches for the blowers.
- Hand/off/auto switches for the flare.
- Run indicators for the blower.
- Total elapsed run time for each blower.
- Flame failure indicator for the flare.
- Automatic shut-off valve failure indication.
- Inlet Valve Failure Indication.
- Safety Shutoff Switch.
- Blower Bearing Temperature Gauges.
- Supplemental Gas Flow Indication.
- Digital data recorder.

2.5.2 Auxiliary Equipment

2.5.2.1 Local Alarm Light.

Local alarm light shall be provided.

2.5.2.2 Auxiliary Lighting

Auxiliary lighting shall be provided via photocell-activated light mounted to the flare/blower control panel rack and a second light in the vicinity of the blowers.

2.5.2.3 Receptacles

Two outdoor receptacles (120V) with ground fault protection shall be provided at the flare/blower control panel rack.

2.5.3 Pushbutton/Selector Switches, Control Units, And Panel Lights

2.5.3.1 Manufacturers:

- Allen Bradley
- Cutler-Hammer
- Square D
- Or equal

2.5.3.2 Construction:

- Heavy duty
- Oiltight
- Base mounted or
- Flush panel mounted

2.5.3.3 Pushbuttons:

- Flush head unless otherwise specified elsewhere.
- Control blocks:
    - Double break silver contacts
    - AC ratings: 7200 make, 720 break
    - Single-pole-double-throw or double-pole-double-throw
    - Up to six (6) tandem blocks
- Maintained contact unless otherwise specified elsewhere.
- Non-illuminated.
- Legend plates as required for type of operation or as specified elsewhere.

2.5.3.4 Selector Switches

- Maintained position unless otherwise specified elsewhere.
- Contact blocks:
  - Double break silver contacts
  - AC ratings: 7200 make, 720 break
  - Single-pole-double-throw or double-pole, single-throw
  - Up to six (6) tandem blocks
- Operators:
  - Number of positions as required or specified elsewhere
  - Standard knob type of operation unless otherwise specified elsewhere

2.5.3.5 Panel Lights

- Transformer type
- LED
- Colored lenses as specified elsewhere
- Interchangeable lenses
- Legend plates as required or as specified elsewhere
- Press-to-test feature.

2.5.3.6 Nameplates:

- Engraved laminated plastic
- Letters 3/16-inch high
- White letters on black background
- Identity per equipment controlled

2.5.4 Power Supplies

- 120 VAC 60 HZ power input
- Integral PI filter
- On/off circuit breaker
- 0.2% load regulation
- Short-circuit limit protection
- Crowbar overvoltage protection

2.5.5 Control Relays

- Manufacturers:
  - Potter and Brumfield
  - IDEC
  - Or equal

- Operating Data:
  - Pickup time: 13 ms maximum
  - Dropout time: 10 ms maximum
  - Operating Temperature: -45 deg to 70 deg C
- Contacts:
  - Gold flashed fine silver, gold diffused
  - Form C
  - 110 VAC
  - Minimum 2 amp rating
- Rated at 10 million operations.
- Plug-in sockets.

2.6 IGNITION PROCEDURE

2.6.1 Controls

The pilot and main flame shall be controlled by the PLC, ultraviolet (UV) scanner (optional), thermocouples, solenoids, relays, and timers to perform the following functions:

2.6.1.1 Pilot

Spark ignition of propane gas creates pilot flame that ignites LFG main flame.

2.6.1.2 Activation

When pilot is successfully ignited, blower(s) and actuator valve on flare inlet are activated.

2.6.1.3 Propane Shut-off

When main flame is successfully ignited (as detected by a UV scanner or thermocouple), pilot propane gas is shut off.

2.6.1.4 Pilot Failure

If pilot is not ignited after three attempts within the pre-selected time interval (as set on the timer), the pilot is shut off, a trouble light is illuminated and alarm sent.

2.6.1.5 Flame Failure to Ignite

If main flame is not ignited within the pre-selected time interval, the pilot is shut off, and the trouble light is illuminated and alarm sent.

2.6.1.6 Flame Failure

If the main flame fails, the blower(s) is turned off, and the inlet valve is closed and alarm sent.

2.6.1.7 Delay

In the event of loss of flame, the flare and blower(s) shall automatically restart after an adjustable time delay of 5 to 15 minutes.

2.6.2 Power Failure

In the event of a power failure, the flare and blowers shall automatically restart when power resumes after an adjustable time delay of 5 to 15 minutes.

2.6.3 Restarts

The PLC shall be programmed to attempt four (4) restarts before an alarm notification is initiated.

2.6.4 Manual Operation

The PLC shall be programmed to allow only 4 hours/day of flare manual mode operation.

2.6.5 Operator Control

The PLC program shall be written to allow the operator to:

- Select flow and/or vacuum control.
- Select the thermocouple used for temperature control.
- The operator shall have the ability to adjust the set points.
- System shall monitor all points and provide control as required by the OWNER.

2.7 AUXILIARY EQUIPMENT

2.7.1 Gas Mass Flow Meter

2.7.1.1 Meter Operation

The mass flow meter shall consist of a single insertion type probe and remote electronics. The method of operation shall utilize a varying delta T signal with a fixed power source to separate the heating element. The flow meter shall have a digital LCD readout showing instantaneous (SCFM) flow located at the flare control panel and provide a record of gas flow to the flare continuously or at maximum intervals of 15 minutes. Flow shall be indicated on the same chart recorder as temperature. The unit shall be pressure and temperature corrected. The gas mass flow meter shall be manufactured by: Eldridge Products, Fluid Components, Thermal Instruments, or approved equal. The flow meter shall be installed per manufacturer's recommendation with a minimum of 10 diameters of straight piping with no obstructions upstream and 5 diameters downstream. The flow meter shall provide data to a remote recorder.

2.7.1.2 Digital Data Recorder

The digital data recorder shall continuously record temperature, flow, and knock-out pot inlet vacuum, record of alarms, at a minimum. It shall have USB flash drive capabilities and a minimum of 6 input channels. The digital recorder shall be manufactured by Yokogawa Model DX Advanced DX 1000, installed in the control panel unit.

2.7.1.3 Totalizer

A flow totalizer shall be included in the touch screen control panel.

2.7.2 Gauges

The system shall be equipped with the following gauges as a minimum:

2.7.2.1 Pressure, Vacuum, and Differential Gauges

Gauges shall be Capsuhelic gauges as manufactured by Dwyer Instruments, Inc., Marietta, Georgia, or equal. Gauges shall read "INCHES OF WATER." Graduations shall be at intervals of 1 inch of water.

2.7.2.1.1 Flame arrester pressure drop indicator

Gauge shall be capable of measuring 0 to 15 in-w.c., differential pressure.

2.7.2.1.2 Moisture separator pressure drop indicator.

Gauge shall be capable of measuring 0 to 15 in-w.c., differential pressure.

2.7.2.1.3 Blower vacuum and pressure indicators.

Vacuum gauges shall be capable of measuring 0 to 80 in-w.c. Pressure gauges shall be capable of measuring 0 to 30 in-w.c.

2.7.2.1.4 System vacuum indicator.

A vacuum gauge shall be mounted upstream of the knock-out pot as indicated on the PLANS. It shall be capable of measuring 0 to 80 in-w.c.

2.7.2.1.5 System pressure indicator.

A pressure gauge shall be mounted downstream of the blowers' outlet valves as indicated on the PLANS. It shall be capable of measuring 0 to 30 in-w.c.

2.7.2.2 Blower inlet and outlet temperature indicators.

Dial-type temperature gauges shall be provided at the inlet and outlet of each blower. The gauges shall range from 0 to 200 degrees F.

2.8 SPARE PARTS

The Vendor shall provide the following spare parts:

- 20 ounces of LAMSON No. 5 Grease, if Lamson blower is used, or equal.
- One each vacuum, pressure and temperature gauge.
- One shaft coupling.
- Two thermocouples.
- Indicator light package.

- 1 ultraviolet scanner.
- One set fuses/relays.
- Two igniter assemblies.

3.0 EXECUTION

3.1 INSTALLATION

3.1.1 Supplied Items

The manufacturer/supplier shall install the following items on the main skid:

- Blower-Motor Assemblies.
- Moisture Separator Assembly (knock-out pot).
- Piping and fittings.
- Valves.
- Control Panels.

3.1.2 Flame Arrestor

The flame arrester and inlet control valve shall be installed on the flare inlet pipe, supported by the candlestick flare skid and pipe support.

3.1.3 Manufacturer's Recommendations

All equipment shall be installed in strict accordance with the manufacturer's recommendations and codes and standards.

3.1.4 Piping

All skid-mounted equipment shall be installed plumb and perpendicular to piping.

3.1.5 Surface Defects

Marred or abraded surfaces of equipment shall be cleaned and refinished to match original finish.

3.1.6 Electrical Work

The CONTRACTOR shall coordinate the electrical work with the equipment manufacturer and panel fabricator to provide a complete, integrated, and automatic system.

3.2 START-UP AND TESTING

3.2.1 Factory Test

The controls for the landfill gas blower/flare system shall be tested at the supplier's plant before shipment. Complete test reports shall be provided to the ENGINEER which show that all system controls operated correctly prior to shipment.

3.2.2 Factory Representative

A factory representative with complete knowledge of proper operation and maintenance shall be provided for a minimum of two (2) 8-hour days to instruct representatives of the Owner and/or the ENGINEER on proper operation and maintenance of the blower/flare system. If there are difficulties in operation of the equipment due to CONTRACTOR's or manufacturer's design or fabrication, additional service shall be provided at no cost to the Owner.

3.2.3 Functional and Validation Tests

Upon completion of the installation, functional and validation tests shall be performed by the CONTRACTOR with the assistance of the supplier's representative, in the presence of the ENGINEER.

3.3 DEMONSTRATIONS

3.3.1 Separation

Demonstrations shall be separate from the installation, startup, and equipment adjustment services described in 3.2 above. System operations under all alarm conditions shall be demonstrated. Some of these alarm conditions may be simulated (e.g., via electrical jumpers) for demonstration purposes.

3.3.2 Test

The Demonstration Test shall demonstrate that all items of these Specifications have been met by the equipment as installed and shall include, but not be limited to, the following tests:

- That the system has been properly installed and all parts are in correct alignment.
- That the system performs satisfactorily during continuous operation for at least 3 consecutive days.
- That there are no mechanical or electrical defects in any of the parts.
- That the controls perform satisfactorily, including automatic starting and stopping, manual operation, safety shutdowns, autodialer operation, and under all alarm conditions.

Equipment is not considered ready for use by the owner until testing is complete.

3.4 CLEANING

3.4.1 Surfaces

The CONTRACTOR shall clean exposed surface of all greases, dirt, and other foreign materials.

3.4.2 Surface Defects

The CONTRACTOR shall touch up all marred or abraded surfaces as specified herein.

3.5 SAFETY

The blower, flare, and associated equipment shall be designed and constructed to comply with applicable safety standards.

END OF SECTION 44 11 20

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract.

1.2 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. RoHS: Restriction of Hazardous Substances.

B. VFC: Variable-frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

D. Conductor Insulation:

1. Type THWN-2: Comply with UL 83.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: One hole with standard barrels.
3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

D. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THWN-2, single conductors in raceway.

B. Exposed Feeders: Type THWN-2, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THWN-2, single conductors in raceway.

D. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements:

3. Perform each of the following visual and electrical tests:

    a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    b. Test bolted connections for high resistance using one of the following:

        1) A low-resistance ohmmeter.
        2) Calibrated torque wrench.
        3) Thermographic survey.

    c. Inspect compression-applied connectors for correct cable match and indentation.
    d. Inspect for correct identification.
    e. Inspect cable jacket and condition.
    f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
    g. Continuity test on each conductor and cable.
    h. Uniform resistance of parallel conductors.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 05 19

SECTION 26 05 23

CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. UTP cabling.
2. Low-voltage control cabling.
3. Control-circuit conductors.
4. Identification products.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

C. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PERFORMANCE REQUIREMENTS

A. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.3 UTP CABLE

A. Description: 100-ohm, four-pair UTP.

1. Comply with ICEA S-102-700 for mechanical properties of Category 6 cables.
2. Comply with TIA-568-C.1 for performance specifications.
3. Comply with TIA-568-C.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with NFPA 70 for the following types:

    a. Communications, General Purpose: Type CM or Type CMG.

2.4 UTP CABLE HARDWARE

A. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-C.2, IDC type. Cables shall be terminated with connecting hardware of same category or higher.

B. Patch Cords: Factory-made, four-pair cables in [36-inch (900-mm)] [48-inch (1200-mm)] lengths or lengths as required to connect from busplug to busplug; terminated with eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.

C. Legend:

1. Machine printed, in the field, using adhesive-tape label.

2.5 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CMG.

1. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

2.6 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One Multi-]pair, twisted, [No. 16 AWG, stranded (19x29)or No. 18 AWG, stranded (19x30) tinned-copper conductors as required per the manufacturer.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

2.7 CONTROL-CIRCUIT CONDUCTORS

A. Class 1-3 Control Circuits: Stranded copper, Type THWN-2, in raceway, complying with UL 44.

2.8 SOURCE QUALITY CONTROL

A. Factory test UTP cables according to TIA-568-C.2.

B. Cable will be considered defective if it does not pass tests and inspections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Test cables on receipt at Project site.

1. Test each pair of UTP cable for open and short circuits.

3.2 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.

B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.

C. Install manufactured conduit sweeps and long-radius elbows if possible.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1 and NFPA 70.

B. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems.Terminate all conductors; no cable shall contain unterminated elements.
3. Cables may not be spliced.
4. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems". Install lacing bars and distribution spools.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems". Monitor cable pull tensions.
8. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.

C. UTP Cable Installation:

1. Comply with TIA-568-C.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) at the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."

3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.5 GROUNDING

A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

B. For low-voltage control wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.6 IDENTIFICATION

A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Identify data and communications system components, wiring, and cabling according to TIA-606-A; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Visually inspect UTP cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

B. End-to-end cabling will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 26 05 23

SECTION 26 05 25

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

B. Related Sections include the following:

1. Section 264115 “Lightning Protection System.”

2, Section 26054305 "Underground Ducts and Raceways" for ground test wells.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Article on FIELD QUALITY CONTROL, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.

C. Qualification Data: For testing agency and testing agency’s field supervisor.

D. Field quality-control test reports.

E. Operation and Maintenance Data: Include the following in operation and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at test wells based on NFPA 70B.

    a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
    b. Include recommended testing intervals.

1.3 QUALITY ASSURANCE

A. Grounding & Lightning Protection System. The system shall meet the requirements as listed on the plan drawings for UL 96.

B. Comply with UL 467.

C. Comply with the Electrical Code (NFPA 70, “National Electrical Code”).

D. Comply with NFPA 780 “Standard for the Installation of Lightning Protection Systems.”

E. Comply with UL 96 when interconnecting with lightning protection system; see Section 264115 “Lightning Protection System.”

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

A. For insulated copper conductors, comply with Section 260518 "Low-Voltage Electrical Power Conductors and Cables."

B. Equipment Grounding Conductors: Insulated with green-colored insulation.

C. Grounding Electrode Conductors: Stranded copper cable.

D. Underground Conductors: Bare copper, tinned, stranded, unless otherwise indicated.

E. Bare Copper Conductors: Comply with the following:

1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

F. Copper Bonding Conductors: As follows:

1. Bonding Cable: 95 mm^2 copper conductor.
2. Bonding Conductor: 25 mm^2 or 16 mm^2, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 42 mm wide and 1.5 mm thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 42 mm wide and 1.5 mm thick.

2.2 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel.

B. Ground Rods

1. Size: 20 mm diameter by 3000 mm long.

C. Test Wells: Provide handholes as specified in Section 260543 "Underground Ducts and Raceways."

PART 3 - EXECUTION

3.1 APPLICATION

A. In raceways, use insulated equipment-grounding conductors.

B. Connections: Connections shall be made by one of the following methods:

1. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
2. Irreversible Mechanical Connections (IMC): Use for any connections. Mechanical connection shall be made by specialized tool for irreversible mechanical connections which shall apply permanent marking to connector to identify that connection was made.

C. Equipment Grounding Conductor Terminations: Exothermic or irreversible Mechanical connection.

D. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.

E. Underground Grounding Conductors: Use bare-copper conductor, 95 mm^2 minimum. Bury at least 450 mm below grade or bury 300 mm above duct bank when installed as part of the duct bank.

F. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors or IMC, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with Article 250 of the Electrical Code for types, sizes, and quantities of equipment grounding conductors, unless more restrictive specific types, larger sizes, or more conductors are indicated on Drawings.

B. Install equipment grounding conductors in all feeders and circuits.

C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by the Electrical Code:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.

D. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

E. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized the same as power system grounding electrode conductor, and install in conduit. See Section 264115 "Lightning Protection System."

3.3 COUNTERPOISE

A. Ground the steel framework of the building with a driven ground rod at the base of every corner post and at intermediate exterior posts at distances not more than 18 m apart. Provide a grounding conductor (counterpoise), electrically connected to each ground rod and to each steel member, extending around the perimeter of the fence/transformer/generator. Use tinned-copper conductor not less than 95 mm^2 for counterpoise and for tap to structural steel. Bury counterpoise not less than 450 mm below grade and 600 mm from the foundation/pad.

3.4 INSTALLATION

A. Ground Rods: Install ground rods as indicated on the drawings.

1. Drive ground rods until tops are 300 mm below finished floor or final grade, unless otherwise indicated.
2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors or IMC for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

D. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade.

3.5 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with bi-metal stainless-steel separators and mechanical clamps approved for application.
4. Make aluminum-to-galvanized steel connections with bi-metal tin-plated copper jumpers and mechanical clamps approved for application.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surface indicating improper cleaning are not acceptable.

C. Irreversible Mechanical Connection (IMC): Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make visible indication that each connector has been adequately compressed on grounding conductor.

D. Equipment Grounding Conductor Terminations: For 10 mm^2 and larger, use pressure-type grounding lugs. 10 mm^2 and smaller grounding conductors may be terminated with winged pressure-type connectors.

E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.

F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.6 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

A. Duct Banks: Install grounding conductor with at least 50 percent ampacity of largest phase conductor in duct bank. See Section 260543 "Underground Ducts and Raceways."

B. Handholes: Install a driven ground rod close to wall and set rod depth so 100 mm will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a 70 mm^2 bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 50 mm above to 150 mm below concrete. Seal floor opening with waterproof, non-shrink grout.

C. Pad-Mounted Transformers and Switches: Install two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than 35 mm^2 for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 600 mm below grade and 150 mm from the foundation.

3.6 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
2. Test completed grounding system at each electric service entrance, generator system, and lightning protection system where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Tests at each ground rod before any conductors are connected are not required if a clamp-on ground tester is used. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.
3. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results. Maximum value of acceptable system ground resistance is 10 ohms.
4. Excessive Ground Resistance: If resistance to ground exceeds specified values, drive additional ground rods until resistance meets specified values.

END OF SECTION 26 05 25

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract.

1.2 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Slotted support systems, hardware, and accessories.
b. Clamps.
c. Hangers.
d. Sockets.
e. Eye nuts.
f. Fasteners.
g. Anchors.
h. Saddles.
i. Brackets.

2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support for vertical raceway systems.

1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.

C. Delegated-Design Submittal: For hangers and supports for electrical systems.

1. Include design calculations and details of hangers for vertical raceways.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, to design the vertical hanger and support system.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- diameter holes at a maximum of 8 inches o.c. in at least one surface.

1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
2. Material for Channel, Fittings, and Accessories: Galvanized steel.
3. Channel Width: Selected for applicable load criteria
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and structural materials where used.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and structural materials where used.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA 101

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for RMC as required by scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb .

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To New Concrete: Bolt to concrete inserts.
2. To Existing Concrete/Stone: Expansion anchor fasteners.
3. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
4. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
5. To Light Steel: Sheet metal screws.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi , 28-day compressive-strength concrete.

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION 26 05 29

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, and underground utility construction.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways and fittings, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. GRC: Comply with ANSI C80.1 and UL 6.
3. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:

1. Comply with NEMA FB 1 and UL 514B.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Fittings, General: Listed and labeled for type of conduit, location, and use.
4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.

5. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
6. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

C. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Fiberglass:

   a. Comply with NEMA TC 14.
   b. Comply with UL 2420 for belowground raceways.

3. RNC: Type EPC-40-PVC and Type EPC-80-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
4. LFNC: Comply with UL 1660.

B. Nonmetallic Fittings:

1. Fittings, General: Listed and labeled for type of conduit, location, and use.
2. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

   a. Fittings for LFNC: Comply with UL 514B.

3. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

D. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

E. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

F. Gangable boxes are allowed.

G. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R > with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

H. Cabinets:

1. NEMA 250, Type 3R > galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.4 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of fiberglass.

1. Standard: Comply with SCTE 77.
2. Color of Frame and Cover: Gray.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

6. Cover Legend: Molded lettering, "ELECTRIC.".
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.5 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC, RNC, Type EPC-40-PVC, RNC, Type EPC-80-PVC.
2. Concealed Conduit, Aboveground: GRC, , , .
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.

B. Minimum Raceway Size: 3/4-inch trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

D. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

E. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F

3.2 INSTALLATION

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Complete raceway installation before starting conductor installation.

D. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

E. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

F. Support conduit within 12 inches of enclosures to which attached.

G. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

H. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

J. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

K. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

M. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

O. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

Q. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

R. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

S. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

T. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom for pipe less than 6 inches in nominal diameter.
2. Install backfill.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install handholes with bottom below frost line, <Insert depth of frost line below grade at Project site> below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 26 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.
2. Rigid nonmetallic duct.
3. Flexible nonmetallic duct.
4. Duct accessories.
5. Fiberglass handholes and boxes.
6. High-density plastic boxes.

1.3 DEFINITIONS

A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.

B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.

C. Duct Bank:

1. Two or more ducts installed in parallel, with or without additional casing materials.
2. Multiple duct banks.

D. GRC: Galvanized rigid (steel) conduit.

E. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include duct-bank materials, including spacers and miscellaneous components.

2. Include duct, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Include accessories for handholes, boxes.
4. Include underground-line warning tape.

B. Shop Drawings:

1. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:

a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
b. Include duct entry provisions, including locations and duct sizes.
c. Include cover design.
d. Include grounding details.
e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For duct and duct bank. Show duct profiles.

1. Include plans and sections, drawn to scale.
2. Drawings shall be signed and sealed by a qualified professional engineer.

1.6 MAINTENANCE MATERIALS SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.8 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than **three** days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

C. Ground Water: Assume ground-water level is 36 inches below ground surface unless a higher water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND FITTINGS

A. GRC: Comply with ANSI C80.1 and UL 6.

B. Coated Steel Conduit: PVC-coated GRC.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch , minimum.

C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.2 RIGID NONMETALLIC DUCT

A. Underground Plastic Utilities Duct: Type EPC-80-PVC and Type EPC-40-PVC] RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.

B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

C. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 DUCT ACCESSORIES

A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.

B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

2.4 FIBERGLASS HANDHOLES AND BOXES

A. Description: Molded of fiberglass-reinforced polyester resin, with covers made of fiberglass.

B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.

C. Color: Gray.

D. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

G. Cover Legend: Molded lettering, "ELECTRIC.".

H. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.

I. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.

J. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

2.5 HIGH-DENSITY PLASTIC BOXES

A. Description: Injection molded of HDPE or copolymer-polypropylene. Cover shall be made of polymer concrete.

B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.

C. Color: Gray.

D. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

G. Cover Legend: Molded lettering, "ELECTRIC.".

H. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.

I. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.

J. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

2.6 SOURCE QUALITY CONTROL

A. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of duct, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Construction Manager if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of duct and duct-bank entrances into handholes, and boxes with final locations, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and will drain to handholes.

C. Clear and grub vegetation to be removed, and protect vegetation to remain.

3.2 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less:

1. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20, Polymer concrete, SCTE 77, Tier 15, Fiberglass enclosures with polymer concrete frame and cover, SCTE 77, Tier 15, Fiberglass-reinforced polyester resin, SCTE 77, Tier 15, High-density plastic, SCTE 77, Tier 15 structural load rating.
2. Cover design load shall not exceed the design load of the handhole or box.

3.3 EARTHWORK

A. Excavation and Backfill: Do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restoration: Replace area immediately after backfilling is completed or after construction vehicle traffic in immediate area is complete.

C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

E. Cut and patch existing pavement in the path of underground duct, duct bank, and underground structures according.

3.4 DUCT AND DUCT-BANK INSTALLATION

A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.

B. Install duct according to NEMA TCB 2.

C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.

D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.

1. Duct shall have maximum of two 90 degree bends or the total of all bends shall be no more 180 degrees between pull points.

E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.

F. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

G. Pulling Cord: Install 200-lbf test nylon cord in empty ducts.

H. Direct-Buried Duct and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct of trench bottoms for pipes less than 6 inches in nominal diameter.
2. Width: Excavate trench 3 inches wider than duct on each side.
3. Depth: Install top of duct at least 24 inches below finished grade unless otherwise indicated.
4. Set elevation of bottom of duct bank below frost line.
5. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

6. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
7. Install duct with a minimum of 2 inches between ducts for like services.
8. Elbows: Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
9. Install manufactured GRC elbows for stub-ups, and at changes of direction in duct.

    a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.

        1) Stub-ups shall be minimum 4 inches above finished grade and minimum 3 inches from conduit side to edge of slab.

10. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction..

    a. Place minimum 3 inches of sand as a bed for duct. Place sand to a minimum of 6 inches above top level of duct.

I. Underground-Line Warning Tape: Bury conducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inches (above all duct banks and approximately 12 inches below grade. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.5 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom below frost line, 30-inches below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.6 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Demonstrate capability and compliance with requirements on completion of installation of underground duct.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch-long mandrel equal to duct size minus 1/4 inch . If obstructions are indicated, remove obstructions and retest.
3. Test handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Prepare test and inspection reports.

3.8 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION 260543

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract.

1.2 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Cable ties.
6. Paint for identification.
7. Fasteners for labels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
2. Colors for 208/120-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.

3. Colors for 240-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.

4. Colors for 480/277-V Circuits:

    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.

5. Color for Neutral: White.
6. Color for Equipment Grounds: Bare copper or Green.

C. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

D. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

E. Equipment Identification Labels:

1. Black letters on a white field.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- thick, vinyl flexible label with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
2. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
3. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

a. 1-1/2 by 6 inches for raceway and conductors.
b. 3-1/2 by 5 inches for equipment.
c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameters and that stay in place by gripping action.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F . Comply with UL 224.

2.5 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

C. Tape and Stencil: 4-inch- wide black stripes on 10-inch centers placed diagonally over orange background and are 12 inches wide. Stop stripes at legends.

D. Underground-Line Warning Tape:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Brady Corporation.
   b. Seton Identification Products; a Brady Corporation company.

2. Tape:

   a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical lines.
   b. Printing on tape shall be permanent and shall not be damaged by burial operations.
   c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:

   a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
   b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, LOW VOLTAGE" .

4. Tag: Type I :

   a. Pigmented polyolefin, bright colored, compounded for direct-burial service.
   b. Width: 3 inches .
   c. Thickness: 4 mils .
   d. Weight: 18.5 lb/1000 sq. ft. .
   e. Tensile according to ASTM D 882: 30 lbf and 2500 psi .

5. Tag: Type II:

   a. Multilayer laminate, consisting of high-density polyethylene scrim coated with pigmented polyolefin; bright colored, compounded for direct-burial service.
   b. Width: 3 inches .
   c. Thickness: 12 mils .
   d. Weight: 36.1 lb/1000 sq. ft. .
   e. Tensile according to ASTM D 882: 400 lbf and 11,500 psi .

6. Tag: Type ID:

   a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, compounded for direct-burial service.
   b. Width: 3 inches .
   c. Overall Thickness: 5 mils .
   d. Foil Core Thickness: 0.35 mil .
   e. Weight: 28 lb/1000 sq. ft. .

f. Tensile according to ASTM D 882: 70 lbf and 4600 psi .

7. Tag: Type IID:

a. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright-colored, compounded for direct-burial service.
b. Width: 3 inches.
c. Overall Thickness: 8 mils.
d. Foil Core Thickness: 0.35 mil.
e. Weight: 34 lb/1000 sq. ft.
f. Tensile according to ASTM D 882: 300 lbf and 12,500 psi.

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.6 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch .
2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi .
3. Temperature Range: Minus 40 to plus 185 deg F .
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

G. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

H. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

I. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

J. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

K. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

L. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

M. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

N. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

O. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

P. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench [exceeds 16 inches overall.
2. Limit use of underground-line warning tape to direct-buried cables.
3. Install underground-line warning tape for direct-buried cables and cables in raceways.

Q. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 20A and 120V to Ground: Identify with self-adhesive raceway labels.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, and handholes, use self-adhesive vinyl tape to identify the phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

E. Locations of Underground Lines: Underground-line warning tape for power and lighting.

F. Arc Flash Warning Labeling: Self-adhesive labels.

G. Operating Instruction Signs: Laminated acrylic or melamine plastic signs.

H. Emergency Operating Instruction Signs: Laminated acrylic or melamine plastic signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

I. Equipment Identification Labels:

1. Outdoor Equipment: Stenciled legend 2 inches high.
2. Equipment to Be Labeled:

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.
    d. Switchgear.
    e. Switchboards.
    f. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
    g. Enclosed switches.

END OF SECTION 260553

SECTION 26 22 13

LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Distribution, dry-type transformers with nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
b. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of field connections.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
3. Include diagrams for power, signal, and control wiring.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

1.3 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:

1. Transformer temporary heating, working clearances, anchoring, torque values, and insulation-resistance testing.

B. Source quality-control reports.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inspection: On receipt, inspect for and note shipping damage to packaging and transformer.

1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.

B. Storage: Store in warm, dry, and temperature-stable location in original shipping packaging.

C. Temporary Heating: Apply temporary heat in accordance with manufacturer's published instructions within enclosure of ventilated-type units, throughout periods during which equipment is not energized and when transformer is not in space that is continuously under normal control of temperature and humidity.

D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain transformer from single source from single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60 Hz service.

B. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

C. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

A. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

1. One leg per phase.
2. Grounded to enclosure.

B. Coils: Continuous windings without splices except for taps.

1. Coil Material: Copper.
2. Internal Coil Connections: Brazed or pressure type.
3. Terminal Connections: Welded.

C. Encapsulation: Transformers smaller than 30 kVA must have core and coils completely resin encapsulated.

D. Enclosure: Totally enclosed, nonventilated.

1. Core and coil must be encapsulated within resin compound to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.
4. Environmental Protection:

a. Outdoor: UL 50EType 4X, Stainless Steel.

5. Finish Color: Gray weather-resistant enamel..

E. Taps for Transformers 3 kVA and Smaller: One 5 percent tap above normal full capacity.

F. Taps for Transformers 7.5 to 24 kVA: Two 5 percent taps below rated voltage.

G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

H. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with maximum of 115 deg C rise above 40 deg C ambient temperature.

I. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with maximum of 150 deg C rise above 40 deg C ambient temperature.

J. Grounding: Provide ground-bar kit or ground bar installed on inside of transformer enclosure.

2.4 IDENTIFICATION

A. Nameplates:

1. Engraved, laminated-acrylic or melamine plastic signs for distribution transformers, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Factory Tests and Inspections: Test and inspect assembled system, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, in accordance with IEEE C57.12.01 and IEEE C57.12.91 before delivering to site. Affix label with name and date of manufacturer's certification of system compliance on control units.

1. Resistance measurements of windings at rated voltage connections and at tap connections.
2. Ratio tests at rated voltage connections and at tap connections.
3. Phase relation and polarity tests at rated voltage connections.
4. No load losses, and excitation current and rated voltage at rated voltage connections.
5. Impedance and load losses at rated current and rated frequency at rated voltage connections.
6. Applied and induced tensile tests.
7. Regulation and efficiency at rated load and voltage.
8. Insulation-Resistance Tests:

    a. Line-side to ground.
    b. Load-side to ground.
    c. Line-side to load-side.

9. Temperature tests.

B. Nonconforming Work:

1. System equipment that does not pass tests and inspections will be considered defective.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for transformers.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's published instructions.

C. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance must be 5 Ω at location of transformer.

D. Environment: Enclosures must be rated for environment in which they are located. Covers for UL 50E, Type 4X enclosures may not cause accessibility problems.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install pad-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.

B. Secure transformer to concrete base in accordance with manufacturer's published instructions.

C. Secure covers to enclosure and tighten bolts to manufacturer-recommended torques to reduce noise generation.

D. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals in accordance with manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at conduit and conductor terminations and supports to eliminate sound and vibration transmission to building structure.

3.4 FIELD QUALITY CONTROL

A. Field tests and inspections must be witnessed by Owner.

B. Tests and Inspections:

1. Small (Up to 167 kVA Single-Phase or 500 kVA Three-Phase) Dry-Type Transformer Field Tests:

    a. Visual and Mechanical Inspection.

        1) Inspect physical and mechanical condition.
        2) Inspect anchorage, alignment, and grounding.
        3) Verify that resilient mounts are free and that shipping brackets have been removed.
        4) Verify that unit is clean.

5) Perform specific inspections and mechanical tests recommended by manufacturer.
6) Verify that as-left tap connections are as specified.
7) Verify presence of surge arresters and that their ratings are as specified.

b. Electrical Tests:

1) Measure resistance at windings, taps, and bolted connections.
2) Perform insulation-resistance tests winding-to-winding and windings-to-ground. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: value of index may not be less than 1.0.
3) Perform turns-ratio tests at tap positions. Test results may not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.
4) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

C. Test Labeling: On completion of satisfactory testing of units, attach dated and signed "Satisfactory Test" label to tested components.

D. Nonconforming Work:

1. Transformer will be considered defective if it does not pass tests and inspections.
2. Remove and replace units that do not pass tests or inspections and retest as specified above.

E. Assemble and submit test and inspection reports.

3.5 ADJUSTING

A. Record transformer secondary voltage at unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.7 MAINTENANCE

A. Infrared Scanning: Two months after Substantial Completion, perform infrared scan of transformer connections.

1. Use infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
2. Prepare certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

END OF SECTION 262213

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. MCCB: Molded-case circuit breaker.

E. SPD: Surge protective device.

F. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.

3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Include evidence of NRTL listing for series rating of installed devices.
7. Include evidence of NRTL listing for SPD as installed in panelboard.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals.

1. Manufacturer's written instructions for testing overcurrent protective devices.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry..

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F (plus 40 deg C).
    b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than three days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 12 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

D. Enclosures: Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

    a. Outdoor Locations: NEMA 250, Type 4X.

2. Height: 84 inches maximum.

3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
7. Finishes:

    a. Panels and Trim: Stainless Steel , factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Same finish as panels and trim.

E. Incoming Mains:

1. Location: Convertible between top and bottom.
2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

F. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

    a. Plating shall run entire length of bus.
    b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

G. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Compression type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.

H. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

I. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

1. Percentage of Future Space Capacity: 20percent, or as indicated on the Construction Drawings.

J. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.

1. Panelboards rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

K. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 POWER PANELBOARDS

A. Panelboards: NEMA PB 1, distribution type.

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

C. Mains: Circuit breaker.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.
b. Instantaneous magnetic trip element for short circuits.

2. MCCB Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Breaker handle indicates tripped status.
c. UL listed for reverse connection without restrictive line or load ratings.
d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

2.4 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

D. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that is supported by them, including electrical and other types of equipment, raceways, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NEMA PB 1.1.

D. Equipment Mounting:

1. Install panelboards on cast-in-place concrete equipment base(s).
2. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 72 inches above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount surface-mounted panelboards to steel slotted supports 1 1/4 inch in depth. Orient steel slotted supports vertically.

I. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

J. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

K. Install filler plates in unused spaces.

L. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Field Service: Inspect components, assemblies, and equipment installations, including connections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
2. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A.

2.4 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

A. Available Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.

2.5 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.6 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

C. Pilot-Light Switches, 20 A:

1. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant*, die-cast aluminum* with lockable cover.

2.7 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: Almond unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pig-tailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 26 27 26

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:

a. Enclosed switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than[three of each size and type.

1.5 FIELD CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 104 deg F (40 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
2. Type J: 600-V, zero- to 600-A rating, 200 kAIC, time delay.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance: Class J, fast acting.

2. Feeders: Class J, time delay.

3. Motor Branch Circuits: Class RK1, time delay.

4. Large Motor Branch (601-4000 A): Class L, time delay.

5. Power Electronics Circuits: Class J, high speed.

6. Other Branch Circuits: Class RK1, time delay.

7. Control Transformer Circuits: Class CC, time delay, control transformer duty.

8. If retaining subparagraph below, verify open indication is available in the fuse type or fuse covers included in the Specifications. If indication is desired for some fuse types and not others, include a list of fuses that require indication.

9. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 28 13

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F) and not exceeding 104 deg F
2. Altitude: Not exceeding 6600 feet.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Comply with NFPA 70.

2.2 FUSIBLE SWITCHES

A. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 600-V ac.
4. 200 A and smaller.

B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Compression type, suitable for number, size, and conductor material.
4. Service-Rated Switches: Labeled for use as service equipment.

2.3 NONFUSIBLE SWITCHES

A. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Compression type, suitable for number, size, and conductor material.
4. Service-Rated Switches: Labeled for use as service equipment.

2.4 ENCLOSURES

A. Enclosed Switches: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steelNEMA 250 Type 4-4X stainless steel.

C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts..

D. Enclosures designated as NEMA 250 Type 4, 4X stainless steel shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than three days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner's written permission.
4. Comply with NFPA 70E.

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches: Provide enclosures at installed locations with the following environmental ratings.

1. Outdoor Locations: NEMA 250, Type 4X.

3.4 INSTALLATION

A. Coordinate layout and installation of switches, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NFPA 70 and NECA 1.

3.5 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections..

B. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, grounding, and clearances.
c. Verify that the unit is clean.
d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
e. Verify that fuse sizes and types match the Specifications and Drawings.
f. Verify that each fuse has adequate mechanical support and contact integrity.
g. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
i. Verify correct phase barrier installation.
j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
c. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.

C. Enclosed switches will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 26 28 16

SECTION 26 29 13.03

MANUAL AND MAGNETIC MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Combination full-voltage magnetic motor controllers.
2. Enclosures.
3. Accessories.
4. Identification.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. NC: Normally closed.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SCPD: Short-circuit protective device.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each type of magnetic controller.

1. Include plans, elevations, sections, and mounting details.
2. Indicate dimensions, weights, required clearances, and location and size of each field connection.
3. Wire Termination Diagrams and Schedules: Include diagrams for signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
4. Include features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Product Schedule: List the following for each enclosed controller:

1. Each installed magnetic controller type.
2. NRTL listing.
3. Factory-installed accessories.
4. Nameplate legends.
5. SCCR of integrated unit.
6. For each combination magnetic controller include features, characteristics, ratings, and factory setting of the SCPD and OCPD.

    a. Listing document proving Type 2 coordination.

7. For each series-rated combination state the listed integrated short-circuit current (withstand) rating of SCPD and OCPDs by an NRTL acceptable to authorities having jurisdiction.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For magnetic controllers to include in operation and maintenance manuals.

1. include the following:

    a. Routine maintenance requirements for magnetic controllers and installed components.
    b. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
    c. Manufacturer's written instructions for setting field-adjustable overload relays.
    d. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
    e. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.8 FIELD CONDITIONS

A. Ambient Environment Ratings: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than 23 deg F (minus 5 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 2000 feet (610 m) for electromagnetic and manual devices.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. UL Compliance: Fabricate and label magnetic motor controllers to comply with UL 508 and UL 60947-4-1.

C. NEMA Compliance: Fabricate motor controllers to comply with ICS 2.

2.2 COMBINATION FULL-VOLTAGE MAGNETIC MOTOR CONTROLLER

A. Description: Factory-assembled, combination full-voltage magnetic motor controller consisting of the controller described in this article, indicated disconnecting means, SCPD and OCPD, in a single enclosure.

B. Standard: Comply with NEMA ICS 2, general purpose, Class A.

C. Configuration: Non-reversing.

D. Contactor Coils: Pressure-encapsulated type.

1. Operating Voltage: Manufacturer's standard, unless indicated.

E. Control Power:

1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.

a. Spare CPT Capacity as Indicated on Drawings: 50 VA.

F. Overload Relays:

1. Thermal Overload Relays:

a. Inverse-time-current characteristic.
b. Class 10 tripping characteristic.
c. Heaters in each phase shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
d. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

G. Digital communication module, using RS-485 Modbus to transmit the following to the LAN:

1. Instantaneous rms current each phase, and 3-phase average.
2. Voltage: L-L for each phase, L-L 3-phase average, L-N each phase and L-N 3-phase average - rms.
3. Active Energy (kWh): 3-phase total.
4. Power Factor: Each phase and 3-phase total.

H. MCP Disconnecting Means:

1. UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

2.3 ENCLOSURES

A. Comply with NEMA 250, type designations as indicated on Drawings, complying with environmental conditions at installed location.

B. The construction of the enclosures shall comply with NEMA ICS 6.

C. Controllers in hazardous (classified) locations shall comply with UL 1203.

2.4 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty or oil-tight.

a. Push Buttons: As indicated on drawings.
b. Pilot Lights: As indicated on drawings.

2. Elapsed Time Meters: Heavy duty with digital readout in hours.

B. Motor protection relays shall be with solid-state sensing circuit and isolated output contacts for hardwired connections.

1. Phase-failure.
2. Phase-reversal, with bicolor LED to indicate normal and fault conditions. Automatic reset when phase reversal is corrected.
3. Under/overvoltage, operate when the circuit voltage reaches a preset value, and drop out when the operating voltage drops to a level below the preset value. Include adjustable time-delay setting.

2.5 IDENTIFICATION

A. Controller Nameplates: Baked enamel signs, as described in Section 260553 "Identification for Electrical Systems," for each compartment, mounted with corrosion-resistant screws.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and space conditions for compliance with requirements for motor controllers, their relationship with the motors, and other conditions affecting performance of the Work.

3.2 INSTALLATION

A. Comply with NECA 1.

B. -Grade Mounted Controllers: Install magnetic controllers on pads with tops at uniform height indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems" unless otherwise indicated.

C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections .Tests and Inspections:

1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.
2. Visual and Mechanical Inspection:

    a. Compare equipment nameplate data with drawings and specifications.
    b. Inspect physical and mechanical condition.
    c. Inspect anchorage, alignment, and grounding.
    d. Verify the unit is clean.
    e. Inspect contactors:

        1) Verify mechanical operation.
        2) Verify contact gap, wipe, alignment, and pressure are according to manufacturer's published data.

    f. Motor-Running Protection:

        1) Verify overload element rating is correct for its application.
        2) If motor-running protection is provided by fuses, verify correct fuse rating.

    g. Inspect bolted electrical connections for high resistance using one of the two following methods:

        1) Use a low-resistance ohmmeter. Compare bolted connection resistance values with values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
        2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

    h. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

3. Electrical Tests:

    a. For the contactor and circuit breaker, performinsulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Insulation-resistance values shall be according to manufacturer's published data or NETA ATS Table 100.1. In the absence of manufacturer's published data, use Table 100.5. Values of insulation resistance less than those of this table or manufacturer's recommendations shall be investigated and corrected.
    b. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
    c. Test motor protection devices according to manufacturer's published data.
    d. Test circuit breakers as follows:

        1) Operate the circuit breaker to ensure smooth operation.
        2) For adjustable circuit breakers, adjust protective device settings according to the coordination study. Comply with coordination study recommendations.

    e. Perform operational tests by initiating control devices.

4. Infrared Inspection: Perform the survey during periods of maximum possible loading. Remove all necessary covers prior to the inspection.

    a. Comply with the recommendations of NFPA 70B, "Testing and Test Methods" Chapter, "Infrared Inspection" Article.
    b. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of the electrical power connections of each motor controller.
    c. Report of Infrared Inspection: Prepare a certified report that identifies the testing technician and equipment used, and lists the following results:

        1) Description of equipment to be tested.
        2) Discrepancies.
        3) Temperature difference between the area of concern and the reference area.
        4) Probable cause of temperature difference.
        5) Areas inspected. Identify inaccessible and unobservable areas and equipment.
        6) Load conditions at time of inspection.
        7) Photographs and thermograms of the deficient area.
        8) Recommended action.

    d. Equipment: Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1 deg C at 30 deg C. The equipment shall detect emitted radiation and convert detected radiation to a visual signal.
    e. Act on inspection results and recommended action, and considering the recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.

B. Motor controller will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 SYSTEM FUNCTION TESTS

A. System function tests shall prove the correct interaction of sensing, processing, and action devices. Perform system function tests after field quality control tests have been completed and all components have passed specified tests.

1. Develop test parameters and perform tests for the purpose of evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.
2. Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.
3. Verify the correct operation of sensing devices, alarms, and indicating devices.

B. Motor controller will be considered defective if it does not pass the system function tests and inspections.

C. Prepare test and inspection reports.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the motor controllers.

END OF SECTION 26 29 13.03

SECTION 26 32 13.13

DIESEL-ENGINE-DRIVEN GENERATOR SETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Engine-generator assembly.
2. Diesel engine.
3. Diesel fuel-oil system.
4. Control and monitoring.
5. Generator overcurrent and fault protection.
6. Alternator, exciter, and voltage regulator.
7. Load bank.
8. Outdoor engine generator enclosure.
9. Vibration isolation devices.
10. Finishes.

B. Related Requirements:

1. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.2 DEFINITIONS

A. ECM: Engine control module.

B. EPS: Emergency power supply.

C. EPSS: Emergency power supply system.

D. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.

3. Include time-current characteristic curves for generator protective device.
4. Include fuel consumption in gallons per hour (liters per hour) at 0.8 power factor at 50, 75, and 100 percent of generator capacity.
5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
6. Include airflow requirements for cooling and combustion air in cubic feet per minute (cubic meters per minute) at 0.8 power factor at 104 deg F (40 deg C) cooling system rating. Provide radiator air flow restriction data for ambient rating.
7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.

B. Shop Drawings:

1. Include plans and elevations for engine generator and other components specified. Indicate access requirements affected by height of subbase fuel tank.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports.
4. Vibration Isolation Base Details: Detail including anchorages and attachments to structure and to supported equipment. Include base weights.
5. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for engine generators and functional relationship between all electrical components.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For[Installer.

B. Source Quality-Control Reports: Including, but not limited to, the following:

1. Certified Summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
4. Report of sound generation.
5. Report of exhaust emissions showing compliance with applicable regulations.
6. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in operation, and maintenance manuals.

1. Include the following:

a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
b. Training plan.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Replaceable Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
4. Tools: Each tool listed by part number in operations and maintenance manual.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. ISO 9001 certified for design, development, production and service complete product line.
2. Produced this type of equipment for a period of at least 10 years.
3. Actively maintaining a 24-hour parts and service organization regularly engaged in maintenance contract programs to perform preventive maintenance and service on equipment similar to that specified.
4. Furnish a service agreement that includes system operation under simulated operating conditions; adjustment to the generator set, transfer switch, and controls as required, and certification in the owner's maintenance log of repairs made and functional tests performed on all systems.
5. Engine-driven generator assembly furnished by a single manufacturer, responsible for design, coordination, and testing of the complete system.

B. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One (1) years from date of Substantial Completion.
2. The generator set to include a standard warranty covering three (3) years or unlimited hours standby (United States-only) or two (2) years or 8700 hours prime, whichever occurs first (hours or years), to warrant against defective material and

workmanship in accordance with the manufacturer's published warranty from the date of initial startup.

3. Extended limited warranties that can be obtained include: Stationary Standby five (5) year or 3000 hours, Stationary Standby five (5) year or 3000 hours comprehensive, and Stationary Standby ten (10) year or 3000-hour major components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kohler Power Systems; KD Series engine generator offerings or comparable product by one of the following:

1. Caterpillar, Inc.; Electric Power Division.
2. Cummins Power Generation.
3. MTU Onsite Energy Corporation.

B. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. B11 Compliance: Comply with B11.19.

B. NFPA Compliance:

1. Comply with NFPA 30.
2. Comply with NFPA 37.
3. Comply with NFPA 70.
4. Comply with NFPA 99.

C. UL Compliance: Comply with UL 2200 "Stationary Engine Generator Assemblies."

D. CSA Compliance: Comply with CSA.

E. Engine Exhaust Emissions: Comply with EPA Tier 2 requirements and applicable state and local government requirements.

F. Noise Emission:

1. Maximum exhaust isolated sound pressure emitted by engine generator 96.2 dBA at a distance of 23 ft. (7 m) while operating at 100 percent load and including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

G. Environmental Conditions: Engine generator system to withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 deg F (Minus 15 deg C) to 104 deg F (40 deg C).
2. Altitude: Sea level to 2000 ft. (610 m).

2.3 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, liquid-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Power Rating: Standby.

D. Overload Capacity: 110 percent of service load for 1 hour in 12 consecutive hours.

E. Tank Capacity Run Hours: 72 hours.

F. Nameplate Rating: 250 kW.

G. Power Factor: 0.8, lagging.

H. Frequency: 60 Hz.

I. Voltage: 480V ac.

J. Phase: Three-phase, four-wire, wye.

K. Governor: Adjustable isochronous, with speed sensing.

L. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

M. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries
2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of the component.

N. Engine Generator Performance:

1. Steady-State Voltage Operational Bandwidth: 0.5 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease and meets ISO8528-5, Class G2 for standard loads.

Voltage to recover and remain within the steady-state operating band within six seconds.

3. Steady-State Frequency Operational Bandwidth: 0.25 percent of rated frequency from no load to full load.
4. Transient Frequency Performance: Less than 10 percent variation for 50 percent step-load increase or decrease and meets ISO8528-5, Class G2 for standard loads. Frequency to recover and remain within the steady-state operating band within five seconds.
5. Output Waveform: At no load, harmonic content measured line to line or line to neutral may not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined in accordance with NEMA MG 1, may not exceed 50.
6. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system to supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
7. Start Time:

    a. Comply with NFPA 110, Type 10 system requirements.

2.4 DIESEL ENGINE

A. Fuel: ASTM D975, diesel fuel oil, Grade 2-D S15.

B. Rated Engine Speed: 1800 rpm.

C. Minimum Standby Load Factor Rating: 85 percent.

D. Lubrication System: Engine or skid-mounted.

1. Filter and Strainer: Rated to particles that may damage engine per manufacturer's written instructions while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit to be capable of full flow and is designed to be fail-safe.
3. Closed Crankcase Ventilation: System: Prevents crankcase oil vapor from draining or escaping the engine.
4. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Jacket Coolant Heater: Electric-tank type, factory installed in coolant jacket system. Comply with UL 499.

F. Integral Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator set mounting frame and integral engine-driven coolant pump.

1. Modular radiator cores for ease of maintenance, repair, or replacement.
2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

3. Size of Radiator: Adequate to contain expansion of total system coolant to 110 percent of capacity.
4. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
5. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
6. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant material.

    a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 215 deg F (102 deg C), and non-collapsible under vacuum.

G. Muffler/Silencer:

1. Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

    a. Minimum sound attenuation of 25 dB at 500 Hz.

H. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

I. Starting System: 24-V dc electric, with negative ground.

1. Redundant Starting System: Supply with redundant starting motor, battery, and battery charger fully independent from the main starting system. Generator controls to alternate between starting systems six times before entering a fault condition. Best battery system is not an acceptable alternative.
2. Cranking Cycle: 60 seconds.
3. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least twice without recharging.
4. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
5. Battery Heater: Thermostatically controlled heater to be arranged to maintain battery above 50 deg F (10 deg C) regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
6. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and continuous rating per manufacturer's standard.

J. Battery Charger:

1. Source Limitations: Obtain battery charger from engine-driven generator manufacturer.
2. UL Compliance: Comply with UL 1236 for Category BBHH.
3. CE Certified.
4. NFPA Compliance: Comply with NFPA 110.

5. Environmental Conditions: Battery charger to withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

    a. Ambient Temperature: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C) with full charger output available up to 122 deg F (50 deg C).
    b. Relative Humidity: 0 to 95 percent.
    c. Altitude: Meets full performance requirements from sea level to 2000 ft. (610 m). Chargers installed at higher altitudes may automatically derate output power to prevent overheating of internal components but remain operable.

6. Charger Operation: Current-limited, constant-voltage, automatic-boost-type charger designed for lead-acid batteries, with the following features:

    a. Automatic three-stage charge cycle for up to three independent batteries simultaneously per charger.
    b. Output Voltage Regulation: Charger regulates output to within plus or minus 0.5 percent of manufacturer-provided voltage settings despite variations of input voltage, input frequency, and output current.
    c. Battery Thermal Compensation: Battery temperature compensation with adjustable slope, factory set at minus 0.18 percent per degree C, and equipped for sensing battery temperature.
    d. AC Input: Charger operates from any 45- to 65-Hz ac source with voltage ranging from 105- to 264-V rms.

7. LCD Digital Display: AC input voltmeter, DC output voltmeter, and ammeter (1 percent accuracy).
8. LED Lamp Indicators: Current limit, AC ON, and charger fail.
9. Charger Fail Alarm Contact: Voltage-free (dry type) form "C" output.
10. Filtered output for type VRLA AGM batteries.
11. Charger Enclosure: NEMA 250, Type 1 (IP20), wall mounted and rated for generator duty with charger enclosure vibration resistance.

2.5 DIESEL FUEL-OIL SYSTEM

A. Piping: Fuel-oil piping to be Schedule 40 black steel. Cast iron, aluminum, copper, and galvanized steel may not be used in the fuel-oil system.

B. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.

C. Fuel Filtering: Remove water and contaminants larger than 1 micron.

D. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

E. Subbase-Mounted, Double-Wall, Fuel-Oil Tank: Complying with UL 142 and including the following features:

1. Steel Channel Support System: Reinforced steel box channel for generator support. Full height gussets at either end of channel and at generator mounting locations.
2. Fuel Level Gauge: Direct-reading, UL-listed, magnetic fuel level gauge with a hermetically sealed, vacuum-tested dial.
3. Low-Fuel Alarm Contact: Float-type switch for remote or local annunciation of a low-fuel-level condition.
4. Fill Tube: 2-inch (25-mm) NPT opening with lockable cap.
5. Leak detection in interstitial space.
6. Vandal-resistant fill cap.
7. Fill-pipe spill containment, minimum capacity 5 gal. (19 L).
8. Emergency inner- and outer-tank UL-listed relief vents sized in accordance with American Petroleum Institute Standard No 2000 with an opening pressure of 0.5 psig (3.5 kPa) and full opening pressure of 2.5 psig (17 kPa).
9. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.6 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of the same switch initiates engine generator shutdown. When the engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

B. Configuration:

1. Operating and safety indications, protective devices, basic system controls, and engine gauges to be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method to isolate the control panel from engine generator vibration. Panel must be powered from the engine generator battery.

C. Control and Monitoring Panel:

1. Digital engine generator controller with integrated graphical touch screen TFT display, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
2. Controller Face Ingress Protection: IP 65.
3. Operating Temperature: Minus 40 to plus 70 deg F (Minus 40 to plus 21 deg C).
4. Maximum Operating Humidity: 95 percent non-condensing.
5. Corrosion Resistant: Tested in accordance with ASTM B117 (salt spray test).
6. Controller Features:

    a. Mode Selector: Allowing selection of one of the following modes:

        1) Off/Reset: Prohibits the generator from starting and resets shutdowns. In this mode the controller does not respond to remote start and stop commands.

2) Manual: Allows user to locally start and stop to operate the generator. In this mode the controller does not respond to remote start and stop commands.
3) Auto: Allows generator to start and stop based on remote commands. In this mode the generator does not respond to manual start and stop commands.

b. Emergency Stop Switch: Latch-type remote stop switch, red in color with mushroom-type head. Depressing the stop button will immediately stop the generator set and lock out any automatic remote starting.
c. Audible Alarm: Horn sounds for specific warning and shutdown conditions.
d. Alarm Silence/Lamp Test Pushbutton: Silences audible alarm when depressed. All controller indicating lights are simultaneously illuminated while actuated.
e. Fault Light: LED indicating abnormal conditions:

1) Yellow: Active warning condition or mode selector switch not in automatic.
2) Red: Active shutdown condition.

f. Real-time clock and calendar for time stamping events.
g. Load Management:

1) Programmable outputs to command the connect and disconnect of loads based on system state:

a) Loads connected based on available capacity.
b) Loads disconnected at system startup.
c) Loads disconnected based on a maximum kW setting or under frequency setting.

2) Support up to 16 load steps.

h. Engine Control Features:

1) Programmable engine start delay.
2) Programmable engine cool-down delay.
3) Programmable warm-up delay based on time or engine temperature.
4) Programmable idle speed.
5) Programmable cyclic cranking with adjustable on time, off time, and number of cycles.

i. Event Logging:

1) Maintain record of a minimum of 1,000 events with date and time locally for warning and shutdown faults.
2) Event log easily available for download onto USB storage device or PC.
3) Event Snapshot: Capture 15 seconds of critical data around the time of a fault or warning. Data to be viewable on the controller and downloadable.

j. Data Logging: Capable of time-based recording of customized parameters.

1) Parameters selectable from all monitored parameters.
2) Sample period configurable from one second to one day.
3) Collected data stored on USB storage device plugged into the control panel.

k. Minimum of three user access levels.
l. Password protection to prevent unauthorized modification to system parameters.
m. Customizable Interface:

1) Overview Screen: Dedicated screen allowing user to display up to 16 parameters for immediate access.
2) Favorites: User customizable menu set up for enhanced usability.

7. Monitoring Instruments: Accessible through the digital engine generator controller and viewable during operation.

a. Engine-coolant temperature.
b. Battery voltage.
c. Running-time meter.
d. Engine speed.
e. Oil pressure.
f. Fuel level (with optional sensor).
g. Fuel pressure.
h. Fuel consumption rate.
i. Crankcase pressure.
j. Oil temperature.
k. Coolant level.
l. Coolant pressure.
m. Common rail fuel pressure.
n. Fuel temperature.
o. Intake air temperature.
p. Exhaust temperature (with optional sensor).
q. Charge air pressure.
r. Charge air temperature.
s. Ambient temperature.
t. AC output voltage including all phase-to-phase and phase-to-neutral quantities, 0.25 percent accuracy.
u. AC output current for each phase, 0.25 percent accuracy.
v. AC frequency, 0.25 percent accuracy.
w. Power factor total and per phase with leading/lagging indication.
x. kW total and per phase, 0.5 percent accuracy.
y. kVARS total and per phase, 0.5 percent accuracy.
z. kVA total and per phase, 0.5 percent accuracy.
aa. kW hours.
bb. Generator duty level (actual kW loading divided by kW nameplate).

8. Service Data: Stored in the controller and available for display.

a. Generator model number and serial number.
b. ECM serial number.

c. Alternator part number.
d. Engine model number and serial number.
e. Controller serial number and firmware version.

9. Operational Records: Stored in controller beginning at system startup.

a. Total run-time hours.
b. Total loaded hours.
c. Total unloaded hours.
d. Total kW hours.
e. Controller hours.
f. Controller run-time hours.
g. ECM run-time hours.
h. Number of starts.
i. Number of crank attempts.
j. Last crank duration.
k. Last start runtime duration.
l. Last start date and time.
m. Last stop date and time.

10. Maintenance Records: Stored in controller beginning at system startup, user resettable to zero.

a. Total run-time hours since last maintenance.
b. Total loaded hours since last maintenance.
c. Total unloaded hours since last maintenance.
d. Total kW hours since last maintenance.

11. Controls and Protective Devices: Controls, shutdown devices, and common alarm indication, including the following:

a. Mode selector switch not in automatic position.
b. Overcrank shutdown.
c. Low lubricating-oil pressure warning.
d. Low lubricating-oil pressure shutdown.
e. Low coolant temperature warning.
f. High engine temperature warning.
g. High engine temperature shutdown.
h. Overspeed shutdown.
i. High fuel level warning.
j. Low fuel main tank.

1) Low-fuel-level alarm to be initiated when the level falls below that required for operation for duration required in "Fuel Tank Capacity" Subparagraph in "Diesel Fuel-Oil System" Article.
2) Critically low-fuel-level warning.

k. Coolant low-level shutdown device.
l. Coolant high-temperature warning.
m. Coolant high-temperature shutdown.
n. ECM Digital Trouble Codes warnings.

o. ECM Digital Trouble Codes shutdown.
p. Loss of ECM Communications shutdown.
q. ECM mismatch shutdown.
r. Battery high-voltage warning.
s. Battery-charger malfunction warning.
t. Battery low-voltage warning.
u. Remote manual stop shutdown.
v. Local manual stop shutdown.
w. Alternator protection shutdown.
x. Overcurrent warning.
y. Overcurrent shutdown.
z. Under frequency warning.
aa. Under frequency shutdown.
bb. Over frequency warning.
cc. Over frequency shutdown.
dd. Over power warning.
ee. Over power shutdown.
ff. Under voltage warning.
gg. Under voltage shutdown.
hh. Over voltage warning.
ii. Over voltage shutdown.
jj. User-defined input warning.
kk. User-defined input shutdown.
ll. No oil pressure signal shutdown.
mm. No speed sensor signal shutdown.
nn. Fail-to-start shutdown.

D. Connection to Datalink:

1. Provide connections for datalink transmission of indications to remote data terminals via ModBus TCP.

E. Supporting Items: Sensors, transducers, terminals, relays, and other devices located on engine or generator unless otherwise indicated.

F. Remote Emergency-Stop Switch: Wall mounted unless otherwise indicated. Push button must be permanently labeled and protected from accidental operation.

G. Remote Alarm Annunciator: LED indicator light labeled with proper alarm conditions must identify each alarm event, and a common audible signal must sound for each alarm condition in accordance with NFPA 110. The silencing switch in face of panel must silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Controls to include "Lamp Test" momentary switch wired to illuminate all LED indicator lights regardless of alarm state while switch is on. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

H. Start Signal Wiring Integrity Monitor: UL-listed modular system to monitor condition of generator remote start circuit(s), annunciate faults, and start generator in accordance with NFPA 70, Article 700.10(D)(4).

1. Output Contacts: Two form "C" contacts, one for engine start and one for start circuit alarm.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices to be coordinated to optimize selective tripping when a short circuit occurs.

1. Overcurrent protective devices for the entire EPSS to be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices considers both utility and EPSS as the voltage source.
2. Overcurrent protective devices for the EPSS to be accessible only to authorized personnel.

B. Generator Overcurrent Protective Device:

1. Molded-case circuit breaker, thermal-magnetic type; 100 percent rated; complying with UL 489:

a. Tripping Characteristic: Designed specifically for generator protection.
b. Trip Rating: Matched to generator output rating.
c. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
d. Mounting: Adjacent to, or integrated with, control and monitoring panel.

C. Generator Protector: Microprocessor-based unit to continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other engine generator protective devices, a shunt-trip device in the generator disconnect switch opens the switch to disconnect the generator from load circuits. Protector performs the following functions:

1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other engine generator malfunction alarms. Contacts to be available for load shed functions.
2. Tested to AC output short-circuit requirements in accordance with UL 6200.
3. Energy Reduction Maintenance Switch/Mode: In accordance with NFPA 70, Article 240.87.

D. Generator Protective Relay: Multifunctional, microprocessor-based relay systems complying with IEEE C37.90.

1. Standard generator protective functions for shutdown with user-adjustable limits and time delays:

a. Over Voltage (ANSI Device 59):

1) User-Adjustable Pickup: 100 to 130 percent.
2) User-Adjustable Time Delay: Zero to 120 seconds.

b. Under Voltage (ANSI Device 27):

1) User-Adjustable Pickup: 70 to 100 percent.
2) User-Adjustable Time Delay: Zero to 120 seconds.

c. Over Frequency (ANSI Device 810):

1) User-Adjustable Pickup: 100 to 140 percent.
2) User-Adjustable Time Delay: Zero to 120 seconds.

d. Reverse Power (ANSI Device 32R):

1) User-Adjustable Pickup: Zero to 50 percent.
2) User-Adjustable Time Delay: Zero to 120 seconds.

e. Over Power (ANSI Device 320):

1) User-Adjustable Pickup: 90 to 150 percent.
2) User-Adjustable Time Delay: Zero to 120 seconds.

f. Loss of Field (ANSI Device 40 Reverse VARS):

1) User-Adjustable Pickup: 10 to 100 percent.
2) User-Adjustable Time Delay: Zero to 120 seconds.

g. Overcurrent with Voltage Range:

1) User-Adjustable Range: 100 to 200 percent.
2) User-Adjustable Time Delay: Zero to 120 seconds.

E. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground fault.

1. Indicate ground fault with other engine generator alarm indications.
2. Trip generator protective device on ground fault.

2.8 ALTERNATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Maximum Temperature Rise: 80 deg C at full load.

C. Drive: Alternator shaft to be directly connected to engine shaft. Exciter to be rotated integrally with alternator rotor.

D. Electrical Insulation: Class H.

E. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

F. Construction to prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation.

G. Enclosure: Drip-proof.

H. Voltage Regulator: Microprocessor-based, high-speed digital voltage regulator, separate from exciter, with three-phase, true RMS sensing, providing performance as specified.

1. Maintain steady-state voltage within 0.25 percent from no load to full load.
2. Adjusting Feature on Control and Monitoring Panel: Provide plus or minus 10 percent adjustment of output-voltage operating band.

I. Alternator Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Sub-transient Reactance: 12 percent, maximum.

2.9 LOAD BANK

A. Description:

1. Permanent, radiator-mounted resistive unit capable of providing a balanced three-phase, delta-connected load to engine generator at 70 percent rated-system capacity. Unit to be capable of selective control of load in 25 percent steps of load-bank rating and with minimum step changes of approximately 5 and 10 percent available.

B. Regulatory Requirements:

1. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

C. General Characteristics:

1. Reference Standards: UL CCN NMTR and UL 508.

D. Resistive Load Elements: Corrosion-resistant chromium alloy with ceramic and stainless-steel supports. Elements to be double insulated and designed for repetitive on-off cycling. Elements to be mounted in removable aluminized-steel heater cases. Galvanized steel is prohibited. The element's maximum resistance to be between 100 and 105 percent of rated resistance.

E. Load-Bank Heat Dissipation: Integral fan with totally enclosed motor provides uniform cooling airflow through load elements. Airflow and coil operating current to be such that, at maximum load, with ambient temperature at the upper end of specified range, load-bank elements operate at not more than 50 percent of maximum continuous temperature rating of resistance elements.

F. Load-Element Switching: Remote-controlled contactors switch groups of load elements. Contactor coils are rated 120 V. Contactors to be located in a separate NEMA 250, Type 3R enclosure within load-bank enclosure, accessible from exterior through hinged doors with tumbler locks.

G. Contactor Enclosures: Heated by thermostatically controlled strip heaters to prevent condensation.

H. Load-Bank Enclosures: NEMA 250, Type 3R, aluminized steel complying with NEMA ICS 6. Louvers at cooling-air intake and discharge openings prevent entry of rain and snow. Openings for airflow to be screened with 1/2-inch- (13-mm-) square, galvanized-steel mesh. Reactive load bank includes automatic shutters at air intake and discharge. Components other than resistive elements to receive exterior epoxy coating with compatible primer.

I. Protective Devices: Power input circuits to load banks to be fused, and fuses selected to coordinate with generator circuit breaker. Fuse blocks to be located in contactor enclosure. Cooling airflow and overtemperature sensors automatically shut down and lock out load bank until manually reset. Safety interlocks on access panels and doors disconnect load power, control, and heater circuits. Fan motor to be separately protected by overload and short-circuit devices. Short-circuit devices to be noninterchangeable fuses with 200,000-A interrupting capacity.

J. Load-Bank Control Panel: NEMA 250, Type 3R enclosure with a control power switch and pilot light, and switches controlling groups of load elements.

K. Control Sequence: Control panel may be preset for adjustable single-step loading of generator during automatic exercising.

2.10 OUTDOOR ENGINE GENERATOR ENCLOSURE

A. Description:

1. Vandal-resistant, sound-attenuated, weatherproof aluminum housing with 0.125-inch- (3-mm-) thick walls; wind resistant. Multiple panels to be lockable and provide adequate access to components requiring maintenance, minimum two doors per side. Access to controller and main line circuit breaker in accordance with NFPA 70. Panels to be removable by one person without tools. Instruments and controls to be mounted within enclosure.
2. Prefabricated or pre-engineered, aluminum-clad, integral structural-steel-framed, walk-in enclosure; erected on concrete foundation.

B. Source Limitations: Obtain enclosure from engine-driven generator manufacturer.

C. Structural Design and Anchorage: Comply with ASCE/SEI 7 for wind loads up to 150 mph (241 kph).

D. Minimum Snow Load Rating: 70 psf (33.5 kPa).

E. Sloped roof to prevent pooling.

F. Stainless steel latches, hinges, and hardware on external panels of enclosure.

G. Access doors and panels rubber sealed to prevent water intrusion and minimize noise.

H. Hinged Doors: Lockable; keyed alike with recessed locks.

I. External, weatherproof, recessed-mounted emergency stop pushbutton.

J. Space Heater: Thermostatically controlled and sized to prevent condensation with adjustable louvers offering down flow and horizontal air tuning.

K. Load Center: 100three-phase, 120/208 V ac, 18 space with main circuit breaker.

L. Convenience Outlets: Two 20 A, 125 V ac, GFCI-protected duplex receptacles.

M. AC Lighting: Provide weather-resistant LED lighting with 30 fc (330 lx average maintained with control switches at each access door.

N. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine generator components.

O. Insulation Flammability Classification: UL 94 HF1.

P. Muffler Location: Complete exhaust system located within enclosure.

Q. Engine-Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits.

1. Inlet Plenum: Vertically louvered and acoustic-lined plenum, constructed from a minimum of 0.125-inch- (3-mm-) thick formed heavy-duty aluminum panels.
2. Louvers: Fixed-engine, cooling-air inlet and discharge. Stormproof and drainable louvers limiting entry of rain and snow.
3. Outlet Plenum: Acoustic-lined plenum, constructed from a minimum of 0.125-inch- (3-mm-) thick formed heavy-duty aluminum panels with 90-degree angle to discharge air up.
4. Automatic Dampers: Galvanized-steel, gravity-activated dampers at engine cooling-air inlet and discharge. Dampers to be closed to reduce enclosure heat loss in cold weather when unit is not operating.
5. Ventilation: Provide temperature-controlled, wall-mounted exhaust fan interlocked to prevent operation when engine is running.

R. Interior Lights with Switch: Factory-wired, vapor-proof luminaires within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.

1. AC lighting system and connection point for operation when remote source is available.
2. DC lighting system for operation when remote source and generator are both unavailable.

S. Convenience Outlets: Factory-wired, GFCI. Arrange for external electrical connection.

2.11 VIBRATION ISOLATION DEVICES

A. Elastomeric Vibration Isolators: Oil- and water-resistant elastomer neoprene or natural rubber, molded with a nonslip pattern and baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment. Compliant with ISO 8528.

B. Vibration isolation devices may not be used to accommodate misalignments or to make bends.

2.12 FINISHES

A. Outdoor Enclosures and Components: Heavy-duty, high-durability, fade-, scratch- and corrosion-resistant finish achieved through a multi-stage finishing process from the genset manufacturer including:

1. Pre-cleaning: Enclosure components cleaned with a two-stage alkaline cleaning process to remove grease, grit, and grime from parts then subjected to a Zirconium-based conversion coating process to prepare the metal for electrocoat (e-coat) adhesion.
2. Primer: All enclosure parts to receive 100 percent epoxy primer electrocoat (e-coat) with high-edge protection.
3. Finish Coating: Powder baked paint for superior finish, durability, and appearance.
4. Minimum Enclosure Corrosion Resistance: 3000 hours salt spray test in accordance with ASTM B117.
5. Powder coat for fading and abrasion resistance.

B. Subbase Tank: Polyurea-texturized rubber coating for corrosion protection and adequate surface grip from the genset manufacturer.

2.13 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine generator and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

C. this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test generator, exciter, and voltage regulator as a unit.
2. Load Test: 25, 50, 75 and 100 percent rated load.
3. Single-step load pickup.
4. Safety shutdown.
5. Overcrank.
6. Locked rotor.

7. Mechanical Readings: Oil pressure, ambient temperature, and coolant temperature.
8. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
9. Maximum power.
10. Voltage regulation.
11. Transient and steady-state governing.
12. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
13. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service in accordance with requirements indicated:

1. Notify Owner no fewer than three working days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

3.3 INSTALLATION

A. Comply with NECA 1 and NECA 404.

B. Comply with packaged engine generator manufacturers' written installation and alignment instructions.

C. Equipment Mounting:

1. Install engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

2. Coordinate size and location of concrete bases for engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
3. Install engine generator with a skin-tight enclosure.

D. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

E. Exhaust System: Install Schedule 40 black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping sized in accordance with allowable back pressure for the engine.
1. Install isolating thimbles where exhaust piping penetrates combustible surfaces with a minimum of 9 inches (225 mm) of clearance from combustibles.

F. Drain Piping: Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless steel flexible connector, and Schedule 40 black steel.

G. Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.4 CONNECTIONS

A. Connect exhaust-system piping adjacent to packaged engine generator to allow space for service and maintenance.

B. Connect engine exhaust pipe to engine with flexible connector.

C. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Provide flexible conduit routed to the engine generator from a stationary element.

E. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

3.5 IDENTIFICATION

A. Identify system components in accordance with Section 260553 "Identification for Electrical Systems."

B. Install a sign indicating the generator is installed as a separately derived source per NFPA 70.

3.6 FIELD QUALITY CONTROL

A. Testing Agency:

1. Perform tests and inspections.

B. Tests and Inspections:

1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in first two subparagraphs below, as specified in NETA ATS. Certify compliance with test parameters.

    a. Visual and Mechanical Inspection:

        1) Compare equipment nameplate data with Drawings and the Specifications.
        2) Inspect physical and mechanical condition.
        3) Inspect anchorage, alignment, and grounding.
        4) Verify that the unit is clean.

    b. Electrical and Mechanical Tests:

        1) Verify phase rotation, phasing, and synchronized operation as required by the application.
        2) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.
3. Battery Tests: Equalize charging of battery cells in accordance with manufacturer's written instructions. Record individual cell voltages.

    a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    c. Verify acceptance of charge for each element of the battery after discharge.
    d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wc (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
7. Exhaust Emissions Test: Comply with applicable government test criteria.

8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 percent step-load increases and decreases and verify that performance is as specified.
9. Noise Level Tests: Measure A-weighted level of noise emanating from engine generator installation, including engine exhaust and cooling-air intake and discharge, at four locations 23 ft. (7 m) from edge of the generator enclosure, and compare measured levels with required values.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments to have been calibrated within the past 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

E. Leak Test: After installation, inspect exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest as specified above.

I. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

K. Infrared Scanning: After Substantial Completion, but not more than 60 days after final acceptance, perform an infrared scan of each power wiring termination and each bus connection while running with maximum load.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.7 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service to include 12 months' full maintenance by skilled employees of manufacturer's authorized service representative. Include quarterly preventive maintenance and exercising to check for proper starting, load transfer, and running under load. Include routine preventive

maintenance as recommended by manufacturer and adjusting as required for proper operation. Parts to be manufacturer's authorized replacement parts and supplies.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 26 32 13.13

SECTION 26 36 00

TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Molded-case-type automatic transfer switches.
2. Transfer switch accessories.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Molded-case-type automatic transfer switches.
2. Transfer switch accessories.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for transfer switches.
2. Include rated capacities, operating characteristics, electrical characteristics, and accessories.

C. Shop Drawings:

1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
2. Include material lists for each switch specified.
3. Single-Line Diagram: Show connections between transfer switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.
4. Riser Diagram: Show interconnection wiring between transfer switches, annunciators, and control panels.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1. Include the following:

a. Features and operating sequences, both automatic and manual.
b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Member company of NETA.

a. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.6 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:

1. Notify Owner no fewer than three days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without the Owner's written permission.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 12 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA ICS 1.

C. Comply with NFPA 99.

D. Comply with NFPA 110.

E. Comply with UL 1008 unless requirements of these Specifications are stricter.

F. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

G. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
2. Short-time withstand capability for three cycles.

H. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

I. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

J. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.

K. Service-Rated Transfer Switch:

1. Comply with UL 869A and UL 489.
2. Provide terminals for bonding the grounding electrode conductor to the grounded service conductor.
3. In systems with a neutral, the bonding connection shall be on the neutral bus.
4. Provide removable link for temporary separation of the service and load grounded conductors.
5. Surge Protective Device: Service rated.

L. Neutral Switching: Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.

M. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.

1. Float type, rated 10 A.
2. Ammeter to display charging current.

3. Fused ac inputs and dc outputs.

N. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

O. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed markers at terminations. Color-coding and wire and cable markers are specified in Section 260553 "Identification for Electrical Systems."

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
4. Accessible via front access.

P. Enclosures: General-purpose NEMA 250, Type 4X, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.2 MOLDED-CASE-TYPE AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using contactor-based components are unacceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching.
4. Conductor Connectors: Suitable for use with conductor material and sizes.
5. Material: Hard-drawn copper, 98 percent conductivity.
6. Main and Neutral Lugs: Compression type.
7. Ground Lugs and Bus-Configured Terminators: Compression type.
8. Connectors shall be marked for conductor size and type according to UL 1008.

C. Automatic Delayed-Transition Transfer Switches: Pauses or stops in intermediate position to momentarily disconnect both sources, with transition controlled by programming in the automatic transfer-switch controller. Interlocked to prevent the load from being closed on both sources at the same time.

1. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals for alternative source. Adjustable from zero to six seconds, and factory set for one second.
2. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
3. Fully automatic break-before-make operation with center off position.

D. Transfer Switches Based on Molded-Case-Switch Components: Comply with UL 489 and UL 869A.

E. Automatic Transfer-Switch Controller Features:

1. Controller operates through a period of loss of control power.
2. Undervoltage Sensing for Each Phase of Normal and Alternative Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts:

    a. Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
b. Push-button programming control with digital display of settings.
c. Integral battery operation of time switch when normal control power is unavailable.

F. Large-Motor-Load Power Transfer:

1. Motor Disconnect and Timing Relay Controls: Designated starters in loss of power scenario shall disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters shall be through wiring external to automatic transfer switch. Provide adjustable time delay between 1 and 60 seconds for reconnecting individual motor loads. Provide relay contacts rated for motor-control circuit inrush and for actual seal currents to be encountered.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

B. Prepare test and inspection reports.

1. For each of the tests required by UL 1008, performed on representative devices, for standby systems. Include results of test for the following conditions:

a. Overvoltage.
b. Undervoltage.
c. Loss of supply voltage.
d. Reduction of supply voltage.
e. Alternative supply voltage or frequency is at minimum acceptable values.
f. Temperature rise.
g. Dielectric voltage-withstand; before and after short-circuit test.
h. Overload.
i. Contact opening.
j. Endurance.
k. Short circuit.
l. Short-time current capability.
m. Receptacle withstand capability.
n. Insulating base and supports damage.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Pad-Mounting Switch: Anchor to pad by bolting.

1. Install transfer switches on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
3. Provide workspace and clearances required by NFPA 70.

B. Identify components according to Section 260553 "Identification for Electrical Systems."

C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

D. Comply with NECA 1.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Wiring Method: Install cables in raceways and cable trays except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.

1. Comply with requirements for raceways specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

F. Connect twisted pair cable according to Section 260523 "Control-Voltage Electrical Power Cables."

G. Route and brace conductors according to manufacturer's written instructions, and Section 260529 "Hangers and Supports for Electrical Systems." Do not obscure manufacturer's markings and labels.

H. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than 18 inches in length.

3.3 FIELD QUALITY CONTROL

A. Administrant for Tests and Inspections:

1. Administer and perform tests and inspections.

B. Tests and Inspections:

1. After installing equipment, test for compliance with requirements according to NETA ATS.
2. Visual and Mechanical Inspection:

    a. Compare equipment nameplate data with Drawings and Specifications.
    b. Inspect physical and mechanical condition.
    c. Inspect anchorage, alignment, grounding, and required clearances.
    d. Verify that the unit is clean.
    e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
    f. Verify that manual transfer warnings are attached and visible.
    g. Verify tightness of all control connections.
    h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:

        1) Use of low-resistance ohmmeter.
        2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.

    i. Perform manual transfer operation.
    j. Verify positive mechanical interlocking between normal and alternate sources.
    k. Perform visual and mechanical inspection of surge arresters.
    l. Inspect control power transformers.

        1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
        2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
        3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.

3. Electrical Tests:

    a. Perform insulation-resistance tests on all control wiring with respect to ground.
    b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
    c. Verify settings and operation of control devices.
    d. Calibrate and set all relays and timers.
    e. Verify phase rotation, phasing, and synchronized operation.
    f. Perform automatic transfer tests.
    g. Verify correct operation and timing of the following functions:

        1) Normal source voltage-sensing and frequency-sensing relays.
        2) Engine start sequence.
        3) Time delay on transfer.
        4) Alternative source voltage-sensing and frequency-sensing relays.
        5) Automatic transfer operation.
        6) Interlocks and limit switch function.
        7) Time delay and retransfer on normal power restoration.

8) Engine cool-down and shutdown feature.

4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

   a. Check for electrical continuity of circuits and for short circuits.
   b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
   c. Verify that manual transfer warnings are properly placed.
   d. Perform manual transfer operation.

5. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.

   a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
   b. Simulate loss of phase-to-ground voltage for each phase of normal source.
   c. Verify time-delay settings.
   d. Verify pickup and dropout voltages by data readout or inspection of control settings.
   e. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

E. Transfer switches will be considered defective if they do not pass tests and inspections.

F. Remove and replace malfunctioning units and retest as specified above.

G. Prepare test and inspection reports.

H. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.

B. Training shall include testing ground-fault protective devices and instructions to determine when the ground-fault system shall be retested. Include instructions on where ground-fault sensors are located and how to avoid negating the ground-fault protection scheme during testing and circuit modifications.

C. Coordinate this training with that for generator equipment.

END OF SECTION 26 36 00

SECTION 26 41 15

LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes lightning protection for the generator enclosure located on the site.

B. Related Sections include the following:

1. Section 260525 “Grounding and Bonding for Electrical Systems.”

1.2 SUBMITTALS

A. Product Data: For air terminals and mounting accessories.

B. Shop Drawings: Detail lightning protection system, including air-terminal locations, conductor routing and connections, and bonding and grounding provisions. Include calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.

C. Field inspection reports from Special Inspector indicating compliance with specified requirements.

1.3 QUALITY ASSURANCE

A. Lightning Protection shall conform to the requirements of the Electrical Code.

1. System design shall be in accordance with NFPA 780, “Standard for the Installation of Lightning Protection Systems.”
2. Conform to UL 96, “Standard for Lightning Protection Components.”
3. Conform to UL 96A, “Installation Requirements for Lightning Protection System.”

1.4 COORDINATION

A. Coordinate installation of lightning protection with installation of other structural systems and components, including electrical wiring, supporting structures and enclosure materials, metal bodies requiring bonding to lightning protection components, and enclosure finishes.

B. Coordinate installation of air terminals attached to enclosure roof systems with the manufacturer and Installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. East Coast Lighting Equipment Inc.
2. ERICO International Corporation.
3. Harger
4. Heary Bros. Lightning Protection Co. Inc.
5. Independent Protection Co.
6. Preferred Lightning Protection
7. Robbins Lightning Inc.
8. Thompson Lightning Protection, Inc.

2.2 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. Enclosure-Mounting Air Terminals: NFPA Class I, copper, solid or tubular, unless otherwise indicated.

B. Ground Rods, Ground Loop Conductors, and Concrete-Encased Electrodes: Comply with Section 260525 "Grounding and Bonding for Electrical Systems" and with standards referenced in this Section.

C. Aluminum Conductors: Aluminum conductors are not permitted except at aluminum clad buildings, where applicable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to NFPA 780. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops.

B. Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components, except those above single-ply membrane roofing.

C. Bond lightning protection components with intermediate-level interconnection loop conductors to grounded metal bodies of structure at 18-m intervals.

3.2 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

END OF SECTION 26 41 15