

County of York  
Department of Environmental and Development Services

Project Manual

Old Wormley Creek Road Lift Station #23



**IFB Number 1862**

September 2013



2809 S. Lynnhaven Road  
Reflections I, Suite 305  
Virginia Beach, VA 23452



County of York  
Department of Environmental and Development Services

Project Manual

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# ***REGIONAL CONSTRUCTION STANDARDS***

## ***Fifth Edition***

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## York County Modifications to Regional Construction Standards

The Hampton Roads Planning District Commission (HRPDC) Regional Construction Standards, fifth edition has been modified to meet the needs of York County for the “**Old Wormley Creek Road Lift Station #23**” and to accommodate certain provisions of the York County Procurement Ordinance.

Copies of the Regional Construction Standards can be purchased at the offices of the HRPDC at the following addresses:

723 Woodlake Drive  
Chesapeake, Virginia 23320  
(757-420-8300)

2101 Executive Drive  
Hampton, Virginia 23666  
(757-262-0094)

The document may also be accessed on the Internet electronically at [www.hrpdc.org](http://www.hrpdc.org).

**Copies of the Regional Construction Standards obtained directly from the HRPDC or accessed through the Internet will not contain the modifications made by York County with respect to this Project.**

Changes to the front-ends of the HRPDC Regional Construction Standards as applicable to this Project are shown using ~~strike-throughs~~ for deletions and with **bold text** utilized for additions. Certain Regional Construction Standards technical specifications have been changed or clarified for the needs of this Project and those changes and clarifications will be found in Section 110, Special Provisions, of the Bidding Documents. In the event of a conflict between the Regional Construction Standards and the Regional Construction Standards as modified by York County, the York County modifications shall control.

Bidders are cautioned that copies of the Bidding Documents (Drawings, modified Front-ends, and Special Provisions) acquired from the County of York for this Project are to be used when preparing Bids for this Project. However, it is the Bidder's responsibility to also acquire a copy(ies) of the HRPDC Regional Construction Standards (without York County modifications) for use in the preparation of Bids and for the execution of the Work.

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## SECTION 101

### DEFINITIONS OF TERMS

#### I. GENERAL DEFINITIONS

Wherever used in the Contract Documents, the following terms shall have the meanings indicated and shall be applicable to both the singular and plural thereof:

- 1.1 *Addenda* - Written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the Bid Documents or the Contract Documents.
- 1.2 *Agreement* - The written agreement between the Owner and the Contractor covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.
- 1.3 *Application for Payment* - The form provided in the Contract Documents which is to be used by the Contractor in requesting progress and final payments and which is to include such supporting documentation as is required by the Contract Documents.
- 1.4 *Bid* - The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
- 1.5 *Bid Documents* - Documentation issued prior to the bid date, including documentation accompanying the Bid (Drawings, Project Specifications, HRPDC *Regional Construction Standards*, Addenda, and Special Provisions) and any post-Bid documentation submitted prior to the Notice of Award.
- 1.6 *Bidder* - Any person, firm or corporation submitting a Bid for the Work.
- 1.7 *Bonds* - Performance and Payment Bonds furnished by the Contractor and the Contractor's surety in accordance with the Contract Documents.
- 1.8 *Bid Security* - Bid Bonds and other instruments of surety, furnished by the Contractor or the Contractor's surety in accordance with the Contract Documents.
- 1.9 *Change Order* - A written order to the Contractor authorizing an addition, deletion, or revision in the Work within the general scope of the Contract Documents that authorizes an adjustment in the Contract Price and/or Contract Time; issued on or after the Effective Date of the Agreement.
- 1.10 *Completion Date* - The date specified in the Notice to Proceed for final completion of the Work.
- 1.11 *Contract Documents* - The Agreement, including the Bid Documents, Notice of Award, Notice to Proceed, Field Orders, Change Orders, and modifications.
- 1.12 *Contract Price* - The total monies payable to the Contractor under the terms and conditions of the Agreement.

- 1.13 *Contract Time* - The number of calendar days stated in the Agreement for the completion of the Work. Calendar days shall be understood to be consecutive.
- 1.14 *Contractor* - The person, firm or corporation with whom the Owner has executed the Agreement.
- 1.15 *Day* - A calendar day of twenty-four hours measured from midnight to the next midnight. Calendar days shall be understood to be consecutive.
- 1.16 *Defective* - An adjective, which when modifying the word Work, refers to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to the Owner's acceptance.
- 1.17 *Drawings* - The plans that show the character and scope of the Work to be performed.
- 1.18 *Effective Date of the Agreement* - The date indicated in the introductory paragraph of the Agreement.
- 1.19 *Engineer* - The person, firm or corporation named as such in the Agreement. In the event the Owner should not require the services of the Engineer, then the powers, duties, and responsibilities conferred in the Contract Documents to the Engineer shall be construed to be those of the Owner.
- 1.20 *Field Order* - A verbal or written order effecting a change in the Work not involving an adjustment in the Contract Price or an extension of the Contract Time, issued by the Engineer or Owner to the Contractor during construction.
- 1.21 *Final Completion* - All work, including punch list items noted at the final inspection, is complete to the satisfaction of the Owner.
- 1.22 *Laws and Regulations* - Any and all applicable laws, rules, regulations, ordinances, codes and orders of any and all governmental bodies, agencies, authorities and courts having jurisdiction.
- 1.23 *Liens* - Liens, charges, security interests or encumbrances upon real or personal property.
- 1.24 *May* - The term "may" is permissive.
- 1.25 *Notice* - All written notices, demands, instructions, claims, approvals, and disapprovals required to obtain compliance with the Contract Documents. Any written notice by either party to the Agreement shall be sufficiently given if delivered to or at the last known business address of the person, firm or corporation constituting the party to the Agreement, or to his, their, or its authorized agent, representative or officer, or when enclosed in a postage envelope addressed to such last known business address and deposited in a United States mailbox. Notice shall be deemed received within 3 business days of U.S. Mail Service postmark date. ***Unless either party shall advise the other in writing to the contrary, the addresses of the parties set out in the Agreement shall be deemed to be valid for the purposes of the delivery of any Notice.***
- 1.26 *Notice of Award* - A written notice by the Owner to the apparent Successful Bidder stating that upon compliance by the apparent Successful Bidder with the conditions precedent enumerated therein, within the time specified, the Owner will sign and deliver the Agreement.

- 1.27 *Notice to Proceed* - A written notice given by the Owner to the Contractor (with a copy to the Engineer, if appropriate) fixing the date on which the Contract Time will commence to run and on which the Contractor shall start to perform its obligations under the Agreement.
- 1.28 *Owner – The County of York, Virginia.*
- 1.29 *Owner's Representative* - The person, firm or corporation named by the Owner to act as the Owner's agent.
- 1.30 *Partial Utilization* - Use by the Owner of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.
- 1.31 *Project* - The entire Work as described in the Contract Documents, including Work that is necessary and incidental to the furnishing of all materials, services, equipment, labor and supplies required to install, perform, and complete all items of Work in accordance with Contract Documents
- 1.32 *Reference Standards* - Those bulletins, standards, rules, methods of analysis or test, codes, and specifications of other agencies, engineering societies, or industrial associations referred to in the Contract Documents. These refer to the latest edition, including amendments in effect and published at the time the Project was advertised, unless specifically referred to by edition, volume, or date.
- 1.33 *Regional Construction Standards* - The construction standards, published by the Hampton Roads Planning District Commission (HRPDC) as amended from time to time. ***All references in the Bid Documents and in the Contract Documents to the Regional Construction Standards shall be to the Regional Construction Standards as modified by the Owner with respect to the Project.***
- 1.34 *Responsible Bidder* - A person or firm who, in the sole opinion of the Owner, has the capability in all respects, to fully perform the contractual requirements as well as the moral and business integrity and reliability to assure good faith performance.
- 1.35 *Responsive Bidder* - A person or firm who has submitted a bid that conforms in all material respects to the Bid Documents.
- 1.36 *Resident Project Representative* - The authorized representative of the Engineer or Owner who is assigned to the Project or any part thereof.
- 1.37 *Roadway Prism* - All of the land or area within the right of way that needs to be cut, filled, graded, or otherwise disturbed to produce the design cross section, including, but not limited to, areas for curbs, ditches, sidewalks, paths, and slopes to match existing grade.
- 1.38 *Rock* - Any indurated material with a minimum compressive strength of 200psi that requires drilling, wedging, blasting, or other methods of brute force for excavation.
- 1.39 *Shall* - The term "shall" is mandatory.
- 1.40 *Shop Drawings* - All drawings, diagrams, illustrations, schedules, specified design related submittals,

and other data or information which are specifically prepared or assembled by or for the Contractor and submitted by the Contractor to illustrate some portion of the Work.

- 1.41 *Special Provisions* - Requirements in addition to or modification of the HRPDC *Regional Construction Standards*.
- 1.42 *Specifications* - Those portions of the Contract Documents or HRPDC *Regional Construction Standards* consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto. ***To the extent of any disparity between the Standard Details set out in the unmodified Regional Construction Standards and those set out in the Drawings or other Contract Documents, the latter shall control.***
- 1.43 *Standard Details* - Those portions of the HRPDC *Regional Construction Standards* consisting of drawings, explanatory of another drawing, indicating in detail and at a larger scale, the design, location, composition and correlation of elements and materials.
- 1.44 *Subcontractor* - A person, firm or corporation having a direct contract with the Contractor or with any other Subcontractor for the performance of a part of the Work at the site.
- 1.45 *Substantial Completion* - That date certified by the Owner when the construction of the Project or a specified part thereof is sufficiently completed in accordance with the Contract Documents, including completion of all tests, so that the Project or specified part can be utilized for the purpose for which it is intended.
- 1.46 *Successful Bidder* - The lowest, responsible and responsive Bidder to whom the Owner (on the basis of the Owner's evaluation as hereinafter provided) makes an award.
- 1.47 *Supplier* - Any person or organization that supplies materials or equipment for the Work, including that fabricated to a special design.
- 1.48 *Underground Facilities* - All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.
- 1.49 *Work* - All labor, materials, equipment, transportation, supervision, or other facilities, duties or incidentals necessary for execution and completion of the Project in compliance with the Contract Documents.

End of Section

## SECTION 102

### BIDDING REQUIREMENTS AND CONDITIONS

#### I. INVITATION FOR BIDS

##### Long Form

PROJECT: **Old Wormley Creek Road Lift Station #23**  
LOCATION: **York County, Virginia**  
DATE: **October 17 2013**

The **County of York, Virginia**, will receive sealed Bids for the above titled Project at **the office of Central Purchasing, located at 120 Alexander Hamilton Boulevard, Yorktown, Virginia, 23690**, until **2:00 p.m.** local time on **November 7, 2013**, at which time the Bids will be publicly opened and read aloud. Any Bids received after the specified time and date will not be considered.

The Work under this Project consists of the **installation of approximately 15 linear feet of 8" Gravity Sewer Pipe, approximately 80 linear feet of 4" force main, new submersible duplex pump station with control building and generator, and also includes road overlay, traffic control, and all labor, materials and incidentals necessary to construct the Project.**

Bid Documents may be examined at the offices of **York County Department of Environmental and Development Services**, located at **105 Service Drive, Yorktown, Virginia, 23690** and have been provided to the following plan room services:

**Builder's and Contractor's Exchange**  
**1118 Azalea Garden Road,**  
**Norfolk, VA 23502-5612**  
**P. O. Box 11006**  
**Norfolk, VA 23517-0006**

**Isqft Plan Room**  
**c/o A&E Reprographics**  
**4505 Columbus Street**  
**Virginia Beach, VA 23462**

Bid Documents may be obtained from the office of **Central Purchasing** upon a non-refundable payment of \$ **75** for each set of documents. Neither the Owner nor any of its representatives shall be responsible for full or partial sets of Contract Documents, including addenda, obtained from any other source. Requests for Bid Documents to be mailed to the Bidder shall be made in writing and accompanied by a non-refundable check in the amount of \$ **25**. Checks shall be made payable to **Treasurer, County of York**.

The Hampton Roads Planning District Commission's *Regional Construction Standards, Fifth Edition*, December 2010, are hereby referenced and are part of the Bid Documents, except as may be modified by the Special Provisions of this Project or as may be shown by bold *italicized* type for additions and strike-throughs for deletions. Copies of the **unmodified** *Regional Construction Standards* may be purchased at the offices of the HRPDC, 723 Woodlake Drive, Chesapeake, VA 23320 (Telephone 757-420-8300) or Executive Tower, Suite 1-C, 2101 Executive Drive, Hampton, VA 23666 (Telephone 757-262-0094). The latest edition of the

Regional Construction Standards and Publication Updates may be downloaded at the HRPDC website [http://www.hrpdcva.gov/Regional\\_Construction\\_Stnds/REGCONST\\_Home.asp](http://www.hrpdcva.gov/Regional_Construction_Stnds/REGCONST_Home.asp)

**Bidders must be aware that these Bid Documents incorporate a number of changes, which supplement, modify, or replace language and/or Standard Details found in the HRPDC Regional Construction Standards. Details shown on the Drawings replace corresponding Standard Details found in the Regional Construction Standards. Changes from the Regional Standards that appear in these Bid Documents are shown as bold for additions, and ~~strikethroughs~~ for deletions. Also, see Section 110 for additional references to Special Technical Provisions incorporated into this Project.**

Bid Security in the amount of **five percent (5%)** of the Bid shall be submitted with each Bid.

A ~~MANDATORY~~/NON-MANDATORY PRE-BID CONFERENCE will be held on **October 25, 2013 at 9:30 a.m.** Local Time at **Environmental and Development Services, Multi-Purpose Room No. 136, 105 Service Drive, Yorktown, Virginia, 23690.**

Contractor registration in accordance with Title 2.2 Chapter 43, Code of Virginia is required. The Bidder shall include in its Bid the following notation: "Licensed Virginia Contractor No. \_\_\_\_\_."

Withdrawal of Bids due to error shall be subject to and in accordance with Section 2.2-4330 **method (ii)** of the Code of Virginia and the Contract Documents.

The Owner reserves the right to waive minor non-substantive informalities in the Bid, to reject any/or all Bids, to award any Bid in whole or in part and award the Bid considered to be in the best interest of the Owner. The Owner also reserves the right to negotiate with the lowest responsive, responsible Bidder should Bid exceed available funds.

The **County of York** does not discriminate in the solicitation or awarding of contracts on the basis of race, religion, faith-based organizations, color, national origin, age, disability or any other basis prohibited by state or federal law.

By: **T. W. Sawyer, CPPO**  
**Central Purchasing**  
**County of York, Virginia**

## 2. Short Form

*(This is an abbreviated version of the IFB intended for newspaper advertisement.)*

### **Invitation For Bids County of York, Virginia**

Project: **Old Wormley Creek Road Lift Station #23**

Date: **October 17, 2013**

Sealed bids are to be received at **the County of York, Virginia, office of Central Purchasing, 120 Alexander Hamilton Boulevard, Yorktown, Virginia, 23690** until **2:00 p.m., November 7, 2013**, for the above titled Project.

The Work under this Project consists of the **installation of approximately 15 linear feet of 8" Gravity Sewer Pipe, approximately 80 linear feet of 4" force main, new submersible duplex pump station with control building and generator, and also includes road overlay, traffic control, and all labor, materials and incidentals necessary to construct the Project.**

A ~~MANDATORY~~/NON-MANDATORY PRE-BID CONFERENCE will be held on **October 25, 2013**, at **9:30 am** local time at the **Environmental and Development Services, Multi-Purpose Room No. 136, 105 Service Drive, Yorktown, Virginia, 23690**.

The full Invitation For Bids is available at **the County of York, Virginia, office of Central Purchasing, 120 Alexander Hamilton Boulevard, Yorktown, Virginia, 23690** and the local office of

**Builder's and Contractor's Exchange, Inc.  
1118 Azalea Garden Road  
Norfolk, Va. 23502-5612  
P. O. Box 11006  
Norfolk, Va. 23517-0006**

**Isqft Plan Room  
c/o A&E Reprographics  
4505 Columbus Street  
Virginia Beach, VA 23462**

Associated Bidding Documents are open to inspection as conditioned in the full Invitation For Bids, at **the County of York, Virginia, office of Central Purchasing, 120 Alexander Hamilton Boulevard, Yorktown, Virginia, 23690**. For additional information concerning this project, please contact **T. W. Sawyer, CPPO, Purchasing Agent** at **(757) 890-3680**.

## **II. INSTRUCTIONS TO BIDDERS**

### **1. Bid Documents**

- 1.1. Complete sets of Bid Documents shall be used in preparing Bids. Neither the Owner nor the Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bid Documents.

- 1.2. The Owner, in making copies of the Bid Documents available on the above terms does so only for the purpose of obtaining Bids on the Work and does not confer or license or grant permission for any other use.
- 1.3. The Special Provisions for this Project as set forth in Section 110 were prepared by **the County of York** and are dated **September 2013**. Additional Special Provisions for this Project appear as modifications to the HRPDC *Regional Construction Standards* by strike-throughs for deletions and bold type for additions in Sections 100 through 109.
- 1.4. The Drawings for this Project, prepared by **O'Brien and Gere** and dated **September 2013**, are defined as follows:

<u>SHEET #</u>	<u>DESCRIPTION</u>
G-0	TITLE SHEET
G-1	KEY MAP, LEGEND & GENERAL NOTES
C-1	EROSION CONTROL DETAILS
C-2	LIFT STATION SITE, UTILITY AND GRADING PLANS/PLANTING DETAILS
C-3	LIFT STATION PLAN, SECTION AND DETAILS
C-4	LIFT STATION DETAILS
C-5	DETAILS
C-6	DETAILS
C-7	PLAN & PROFILE
S-1	LIFT STATION GENERAL NOTES & ABBREVIATIONS
S-2	LIFT STATION PLANS & ELEVATIONS
S-3	LIFT STATION SECTIONS & DETAILS
S-4	LIFT STATION TYPICAL SECTIONS & DETAILS
S-5	LIFT STATION TYPICAL SECTIONS & DETAILS
E-1	SYMBOLS & ABBREVIATIONS
E-2	DIAGRAMS & SCHEDULES
E-3	POWER, CONTROL & LIGHTING PLAN
E-4	TYPICAL DETAILS

**2. Examination of Contract Documents and Project Site.**

- 2.1. It is the responsibility of each Bidder before submitting a Bid:
  - A. to examine thoroughly the Bid Documents;
  - B. to visit the site to become familiar with and satisfy the Bidder as to the general, local and site conditions that may affect cost, progress, performance, or furnishing of the Work;
  - C. to study and carefully correlate the Bidder's knowledge and observations with the Bid Documents and such other related data; and,

- D. to promptly notify the Owner of all conflicts, errors, ambiguities or discrepancies which the Bidder has discovered in or between the Bid Documents and such other related documents or field/site conditions.
- 2.2 Reference is made to Sections 104 III and 104 IV, for information relating to reports, explorations, underground facilities, and easements. On request, at the discretion of the Owner, the Owner will provide each Bidder access to the site to conduct such examinations, investigations, explorations, tests and studies as each Bidder deems necessary for submission of a Bid. The Bidder shall fill all holes and clean up and restore the site to its former condition, including reseeding and/or resodding any disturbed areas upon completion of such explorations, investigations, tests and studies, and hold the Owner harmless from any damage to property or injury to persons resulting from or arising out of such exploration, investigation, tests, and studies. The Bidder shall obtain and comply with all local and state permitting requirements.

### 3. Interpretations and Addenda.

- 3.1. No oral explanation in regard to the meaning of the Contract Documents will be made, and no oral instructions will be given before the award of the Work. Discrepancies, omissions or doubts as to the meaning of the Contract Documents shall be communicated in writing to the Owner for interpretation. Bidders should act promptly and allow sufficient time for a reply to reach them before the submission of their Bids. Any interpretation made will be in the form of an addendum to the Contract Documents, which will be forwarded to all known Bidders, and its receipt shall be acknowledged on the Bid Form. All questions shall be received ~~no later than 7 days prior to the date for opening of Bids~~ **by 5:00 pm on October 31, 2013.**
- 3.2. Addenda may also be issued to modify the Contract Documents.

### 4. Bid Security.

- 4.1. Each bid shall be accompanied by a Bidder's bond issued by a company authorized and licensed to transact business as surety in the Commonwealth of Virginia, a certified check, or cash escrow, in an amount equal to not less than five (5) percent of the total amount of the bid, made payable to the **County of York, Virginia**. Upon approval of the Owner's attorney, in accordance with ~~Section 2.2 4338, Code of Virginia, 1950, as amended, and with Section 3-8 of the Code of the City/County of York County Purchasing Policy, Virginia, as amended,~~ a Bidder may furnish a personal bond, property bond, or bank or savings and loan association's letter of credit on certain designated funds for the amount required for the Bid Security. The Bid Security shall be accompanied by a certified copy of the power of attorney for the surety attorney-in-fact. Said bid security shall be left with the Owner, subject to the conditions specified herein, as a guarantee of good faith on the part of the Bidder that if the bid is accepted, the Bidder shall execute the contract.
- 4.2. The Bid Security shall be returned to all except the three (3) lowest Bidders within ten (10) days after the date of Bid opening. The Bid Security will be returned to the three (3) lowest Bidders within five (5) days after the execution of an Agreement and Performance and Payment Bonds and Certificates of Insurance have been approved by the Owner. None of the three (3) lowest Bids shall be deemed rejected, notwithstanding acceptance of one of the Bids, until the Agreement has been executed by both the Owner and the Successful Bidder.

**5. Liquidated Damages.**

5.1. Provisions for liquidated damages are set forth in Section 108-X and in Section 102 III (Bid Form).

**6. Preparation of Bid.**

6.1. All blanks on the Bid Form shall be completed in ink.

6.2. Bids by corporations shall be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature.

6.3. Bids by unincorporated organizations shall be executed in the organization's name and signed by an individual having authority to enter into a contract on behalf of such organization, whose title shall appear under the signature and the official address of the organization shall be shown below the signature. For example, if such organization is a Limited Liability Company, the Bid shall be signed by **a member or its manager in the case of a manager-led Limited Liability Company**, or if such organization is a Limited Partnership, the Bid shall be signed by a general partner.

6.4. All names shall be typed or printed in ink below the signature. All names shall be the legal name of the corporation, unincorporated organization and/or individual.

6.5. The Bid shall contain an acknowledgment of receipt of all Addenda (the numbers of which shall be filled in on the Bid Form).

6.6. The address, telephone number, e-mail address and fax number for communications regarding the Bid shall be provided.

6.7. It is understood and agreed that, in the event an Agreement is executed for the supplies, equipment or services included in the Bid, no indication of such sales or services to the Owner shall be used in any way in product literature or advertising without the written consent of the Owner.

**7. Quantities and Unit Prices.**

7.1. The Owner reserves the right to increase or decrease the amount of any class or portion of the Work. No such change in the Work shall be considered as a waiver of any condition of the Agreement nor shall such change invalidate any of the provisions thereof. Payment will be made at the unit or lump sum prices under the Agreement only for the work actually performed or materials furnished and accepted.

7.2. Bidders shall include in their Bid prices the entire cost of each item set forth in the Bid, and it is understood and agreed that there is included in each lump sum or unit price bid item the entire cost necessary or incidental to the completion of that portion of the work, unless such incidental work is expressly included in other lump sum or unit price bid items.

**8. General Equipment or Material Specification.**

- 8.1. When the Bid Documents specify one or more manufacturer's brand names or makes of materials, devices or equipment as indicating a quality, style, appearance or performance, with the statement "or equal," the Bidder shall base the Bid on either one of the specified brands or an alternate brand which the Bidder intends to substitute. Use of an alternate shall not be permitted unless it has been found to be equal or better by the Owner and at no additional cost to the Owner.
- 8.2. The burden of proof as to the comparative quality and suitability of alternative equipment, articles or materials shall be upon the Bidder. The Bidder shall furnish at its own expense, such information relating thereto as may be required by the Owner. The Owner shall be the sole judge as to the comparative quality and suitability of alternative equipment, articles or materials and the Owner's decisions shall be final. Any other brand, make or material, device or equipment which, in the opinion of the Owner is recognized to be the equal of that specified, considering quality, workmanship and economy of operation and is suitable for the purpose intended, shall be accepted. In the event of any adverse decision by the Owner, no claim of any sort shall be made or allowed against the Engineer or Owner. Samples, if requested by the Bidder, may be returned at the Bidder's expense.
- 8.3. If in the sole discretion of the Owner an item proposed by the Contractor does not qualify as an "or-equal" item it may be considered as a proposed substitute item. The Contractor shall furnish the Owner any such information as the Owner may request to evaluate the substitute item to include estimates of costs or credits, redesign, claims or schedule impacts, warranty or maintenance issues or payment of any license or royalty that could directly or indirectly result from acceptance of the substitute. Any cost or time impacts to the project schedule caused by the Contractor's submission of a substitute shall be borne by the Contractor. Any costs incurred by the Owner or by the Owner's Engineer in reviewing the suitability of the substitute item shall be borne by the Contractor. The Owner may refuse to accept a substitute unless an acceptable adjustment in the contract price is offered by the Contractor.

## **9. Proprietary Material and Equipment Specification.**

- 9.1 Where any item of equipment or material is specified by proprietary name, trade name, catalog reference, or name of one or more manufacturers, without the addition of such expressions as "or equal," it is to be understood that those items are so specified for reasons of standardization in maintenance and operation, or for reasons of obtaining desirable features best suited to the requirements of the Specifications. This specific equipment shall form the basis of the Bid and be furnished under the Agreement. Where two or more items of equipment or material are named, the Contractor has the option to use either.

## **Additive/Alternate Bids**

### **10.1. Additive Bids**

Additive bid items are those in addition to the base Bid items. Bidders shall submit additive Bids on all items as shown on the Bid form. Award shall be based on the lowest responsive and responsible Bid for base Bid plus all additive bid items listed and in accordance with any criteria in the Special Provisions.

### **10.2. Alternate Bids**

Alternate bid items are those where more than one type of improvement may be considered for a portion or all of the Work due to the character of the improvement and uncertainties which may be encountered during construction. If alternate Bids are requested for a portion of or all of the Work, Bidders shall submit alternate Bids for all alternate(s) the Bidder or its Subcontractor is qualified to perform. Award shall be based on the lowest responsive and responsible Bid for the base Bid plus the amount added or deleted for the alternate bid items selected by the Owner and in accordance with any criteria in the Special Provisions. The alternates selected shall be at the sole discretion and in the best interests of the Owner.

## **11. Submission of Bids.**

- 11.1 Bids shall be submitted at the time and place indicated in the Invitation for Bids and shall be sealed, marked with the Project title and name and address of the Bidder, and accompanied by the bid guarantee and other required documents. The Bid may not be changed by markings on the envelope. Only the amounts indicated on the Bid Form will be considered in determining the final Bid amount. **It will be the responsibility of Bidder to see that its bid is in the Purchasing Office by the specified time and date. There will be no exceptions. Date of postmark will not be considered. Phone or telegraphic bids (including FAX) will not be accepted.**
- 11.2. When a license is required, the Bidder shall include in its Bid over the Bidder's signature the following notation: "VIRGINIA LICENSED CONTRACTOR NO. \_\_\_\_\_" (Ref. Title 2.2, Chapter 43, and Title 54.1, Chapter 11, Code of Virginia).
- 11.3. When a license is not so required and a person who is not the holder of a License enters a Bid, such person shall include in its Bid over the Bidder's signature the following notation: "LICENSING NOT REQUIRED UNDER VIRGINIA STATE CODE."
- 11.4. The Contractor shall complete and submit the Debarment Certification form. A copy of the form is included in Section 102, VI at the end of this Section.
- 11.5. The Contractor shall complete and submit the Certificate of Compliance with Immigration Laws and Regulations form. A copy of the form is included in Section 102, VII in this section.
- 11.6. The Contractor shall complete and submit the Non Collusion Affidavit form. A copy of the form is included in Section 102, III.K in this section.

## **12. Receipt and Opening of Bids.**

- 12.1. Bids will be opened publicly at the time and place and under the conditions stated in the Invitation for Bids. The Owner's Representative whose duty it is to open Bids will decide when the specified time has arrived. No responsibility will be attached to any such person for the premature opening of a Bid not properly addressed and identified. It is the responsibility of the Bidder to assure that the Bid is delivered to the designated place of receipt prior to the time set for the receipt of Bids. No Bid received after the time designated for receipt will be considered.
- 12.2. Bids will be opened and read aloud publicly.

## **13. Bids to Remain Subject to Acceptance.**

- 13.1. All Bids shall remain subject to acceptance for 90 Days after the day of the Bid opening, but the Owner may, in its sole discretion, release any Bid and return the Bid Security prior to that date, or extend the acceptance period an additional 90 days with the consent of the apparent low bidder and surety.

**14. Withdrawal of Bids.**

- 14.1 Withdrawal of Bids filed with the Owner may be made only by a representative of the firm submitting the Bid, who shall appear in person prior to the deadline designated in the advertisement for receipt of Bids. Such representative shall furnish satisfactory identification and proof that they are authorized to withdraw the Bid. Telephone, e-mail, or facsimile notices will not be considered. Additions and/or deletions marked on the outside of the Bid envelope will not be considered.
- 14.2 In accordance with Section 2.2-4330(A)(i) ~~method (i)~~ **method (ii)** of the Code of Virginia, as amended, if the Bid price was substantially lower than the other Bids solely to a mistake therein, provided the Bid was submitted in good faith, and the mistake was a clerical mistake as opposed to a judgment mistake, and was actually due to an unintentional arithmetic error or an unintentional omission of a quantity of work, labor, or material made directly in the compilation of a bid, which unintentional arithmetic error or unintentional omission can be clearly shown by objective evidence drawn from inspection of original work papers, documents, and materials used in the preparation of the Bid sought to be withdrawn and provided further the Bidder shall give notice in writing of his claim of right to withdraw within two (2) business days after the Bid opening, then the Bid may be withdrawn. The Bidder shall, within the following two (2) business days provide the subjective data required in this section to satisfy the Owner's representative that the grounds for such withdrawal do exist.
- 14.3 Should the Bidder refuse to enter into the Agreement after notification of award, the Bid Security shall be forfeited.
- 14.4 No Bid may be withdrawn under this section when the result would be the awarding of the Agreement on another Bid to the same Bidder or to another Bidder in which the ownership of the withdrawing Bidder is more than five percent.
- 14.5 If a Bid is withdrawn under the authority of this section, the remaining Bids shall be evaluated to determine the lowest responsive and responsible Bidder.
- 14.6 No Bidder who is permitted to withdraw a Bid shall, for compensation, supply any material or labor to or perform any subcontract or other work agreement for the person or firm to whom awarded, or otherwise benefit, directly or indirectly, from the performance of the Project for which the withdrawn Bid was submitted.
- 14.7 If withdrawal of any Bid is denied, the Bidder shall be notified in writing stating the reasons for this decision. Any Bidder who desires to appeal a decision denying withdrawal of Bid shall, as sole remedy, institute legal action provided by Section 2.2-4358 and Section 2.2-4364(B), Code of Virginia, 1950, as amended, or Section(s) \_\_\_\_\_ of the Code of the City/County of \_\_\_\_\_ Virginia, as amended.

**15. Evaluation of Bids.**

- 15.1. In evaluating Bids, the Owner shall consider the qualifications of the Bidders, whether or not the Bids comply with the prescribed requirements, unit and lump sum prices, and additive/alternate bid items if requested in the Bid Form.
- 15.2. The Owner may consider the qualifications and experience of subcontractors and other persons and organizations (including those who are to furnish the principal items of material or equipment) proposed for those portions of the Work for which the identity of Subcontractors and other persons and organizations shall be submitted as specified in the Bid Documents.
- 15.3. The Owner may conduct such investigations as deemed necessary to establish the responsibility, qualifications and financial ability of the Bidders, proposed Subcontractors and other persons and organizations to do the Work in accordance with the Bid Documents to the Owner's satisfaction within the prescribed time.
- 15.4. Bids will be based upon the estimated quantities shown in the Bid Form. Bids will be compared on the basis of a total computed price; arrived at by taking the sum of the estimated quantities of each Bid Item, multiplied by the corresponding unit price bid, and any lump sum Bids on the individual items. Discrepancies between the multiplication of units of work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of words. The right to reject any or all Bids or to accept any Bid considered of advantage to the Owner is reserved.
- 15.5. Unless all Bids are canceled or rejected, the Owner reserves the right granted by ~~Section 2.2-4318 of the Code of Virginia and Section(s) \_\_\_\_\_ of the Code of the City/County \_\_\_\_\_ of Virginia, as amended;~~ **the County of York Purchasing Policy, procurement code section 3-15** to negotiate with the lowest responsible, responsive Bidder to obtain a Contract Price within the funds budgeted for the construction project. Negotiations with the lowest Bidder may include ~~both~~ modification of the Contract Price **but not** ~~and~~ the Scope of Work/Specifications to be performed. The Owner shall initiate such negotiations by Written Notice to the lowest responsible, responsive Bidder that its Bid exceeds the available funds and that the Owner wishes to negotiate a lower Contract Price. The Owner and the lowest responsive, responsible Bidder shall agree to the times, places, and manner of negotiations.
- 15.6. The acceptance of a Bid will be a notice in writing, signed by the Owner, and no other act shall constitute the acceptance of a Bid.
- 15.7. The Owner reserves the right to waive minor informalities in the Bid, to reject any/or all Bids, to award any Bid in whole or in part, and to award the Bid considered to be in the best interest of the Owner.

## **16. Qualifications of Bidders and Subcontractors.**

- 16.1. The Contractor's Questionnaire is included in the Bid Documents and shall be submitted upon request within 72 hours. This information will assist the Owner in investigations and determination of the Contractor's qualifications to perform the Work.
- 16.2. To demonstrate their qualification to perform the Work, each Bidder shall be prepared to submit further written satisfactory evidence that the Bidder has sufficient experience, necessary capital, materials, machinery and skilled workers to complete the Work. If financial statements are required

they shall be of such date as the Owner shall determine and shall be prepared on forms acceptable to the Owner. The Owner may make such investigations as deemed necessary to determine the ability of the Bidder to perform the Work. The Owner's decision or judgment on these matters shall be final, conclusive and binding.

- 16.3. The apparent low Bidder shall, within seven consecutive calendar days after the day of the Bid opening, submit to the Owner a list of all Subcontractors who will be performing work on the Agreement. Such list shall be accompanied by an experience statement with pertinent information as to similar projects and other evidence of experience and qualification for each such Subcontractor, person and organization. If the Owner, after due investigation, has reasonable objection to any proposed Subcontractor, other person or organization, the Owner may, before giving the Notice of Award, request the apparent low Bidder to submit an acceptable substitute without an increase in Bid price. If the apparent low Bidder declines to make any such substitution, the contract shall not be awarded to such Bidder, but his declining to make any such substitution will not constitute grounds for sacrificing his Bid Security. For any Subcontractors, other person or organization so listed and to whom Owner does not make written objection prior to the giving of the Notice of Award, it will be deemed the Owner has no objection.
- 16.4. By submitting their Bid, Bidders certify that they are not now debarred by the Federal Government or by the Commonwealth of Virginia or by any other state, or by any town, city, or county, from submitting Bids on contracts for construction covered by this solicitation, nor are they an agent of any person or entity that is now so debarred.
- 16.5. If the Bidder is organized as a stock or nonstock corporation, a limited liability company, a business trust, or a limited partnership, or is registered as a registered limited liability partnership, the Bidder must be authorized to transact business in the Commonwealth as a domestic or foreign entity if so required by Title 13.1 or Title 50 of the Code of Virginia, or as otherwise required by law. The Bidder shall include the identification number issued by the State Corporation Commission on the Bid form or describe why the Bidder is not required to be so authorized. Any Bidder failing to do so shall not be awarded the Contract unless the Owner issues a waiver of this requirement and administrative policies and procedures are established by the locality. If the Bidder allows its existence to lapse, or its certificate of authority or registration to transact business in the Commonwealth of Virginia to expire, or be revoked or cancelled, such will be deemed as an act of default enabling the Owner to all remedies for default, including but not limited to revocation of this Agreement.

**17. Sham or Collusive Bids.**

- 17.1. The Bids of any Bidder or Bidders who engage in collusive bidding shall be rejected. Any Bidder who submits more than one Bid in such a manner as to make it appear that the Bids submitted are on a competitive basis from different parties shall be considered a collusive Bidder.
- 17.2. The provisions contained in Sections 2.2-4367 through 2.2-4377, Code of Virginia, as amended, ~~and~~ ~~Section(s)~~ \_\_\_\_\_ of the Code of the City/County of \_\_\_\_\_ Virginia, as amended, shall be applicable to all contracts solicited or entered into by Owner. By submitting their Bids, all 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 they have not conferred with 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.

**18. Time of Essence**

18.1 As the provisions hereof relating to the time for performance and completion of the Work are for the purpose of enabling the Owner to proceed with the construction of public improvements in accordance with pre-planned programs, such provisions are of the essence.

**19. Immigration Reform and Control Act of 1986**

19.1 By submitting their proposal, Bidders/offerors certify that they do not, and will not during the performance of this contract, employ illegal alien workers or otherwise violate the provisions of the Federal Immigration Reform and Control Act of 1986.

19.2 All Bidders must submit a completed Certification of Compliance with Immigration Laws and Regulations form (See Section 102.VII) with their Bid.

**III. BID FORM**

Bids to be opened:	<b>2:00 p.m. November 7, 2013</b>
Work to be Completed in:	<b>Substantial Completion: 180 Days</b> <b>Final Completion: 210 Days</b>
Liquidated Damages:	\$ <b>1,000.00</b> per calendar day after time for Substantial Completion has expired. \$ <b>1,000.00</b> per calendar day after time for Final Completion has expired.
Performance Bond:	100%
Payment Bond:	100%
Bid Security:	<b>5%</b>

To: **County of York, Virginia**  
**105 Service Drive**  
**Yorktown, Virginia, 23690**  
**IFB No. 1862**

**Options A & B have been deleted for clarity**

**OPTION C - UNIT PRICE BID**

In compliance with the Bid Documents, titled **Old Wormley Creek Road Lift Station #23**, all Addenda issued to date all of which are part of this Bid, the undersigned hereby proposes to furnish all items including materials, supervision, labor, and equipment in strict accordance with, said Contract Documents, for the sum of:

NO.	ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
1	Mobilization (up to 5% of all other bid items)	LS	1		
2	Undercut Excavation with Bedding Backfill	CY	50		
3	Select Material Backfill (Sand)	TON	100		
4	Select Material Backfill (Stone)	TON	150		
5	Miscellaneous Unclassified Excavation	CY	50		
6	Construction Entrance	EACH	1		
7	Rock Check Dam	EACH	2		
8	Silt Fence	LF	400		
9	Culvert Inlet Protection	EACH	2		
10	Tree Protections	LF	50		
11	Clearing & Grubbing	LS	1		
12	Temporary Fence	LF	200		
13	Aggregate Base material	TON	40		
14	Asphalt Concrete Pavement Overlay	SY	250		
15	Milled Asphalt Pavement	SY	250		
16	Grass Lined Drainage Swale, Complete & In Place	LF	120		
17	8-inch C900 PVC Gravity Sewer	LF	15		
18	8-inch Gravity Sewer Tie-in to Existing Manhole	EACH	1		
19	6-inch Gravity Sewer Service Laterals	LF	55		

NO.	ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
20	6-inch PVC Gravity Sewer Service Cleanouts	EACH	2		
21	4-inch D.I. Force Main	LF	80		
22	4-inch Force Main Isolation Valve	EACH	2		
23	4-inch Air Relief Valve Assembly	EACH	1		
24	4-inch Force Main Tie-in to Existing Force Main	EACH	1		
25	Emergency Pump connection	EACH	1		
26	Old Wormley Creek Road Lift Station Complete and In Place	LS	1		
27	Bio-Retention BMP	LS	1		
TOTAL OF ALL PRICES					\$ _____
TOTAL OF ALL PRICES (IN WORDS) _____					

Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities provided, determined as provided in the Contract Documents. The prices quoted shall include without exception all materials, supervision, labor, equipment, appliances, clean-up, incidental items, applicable sales, use and other taxes, insurance, building permit or fees, and the Contractor's labor, overhead, profit, mobilization and other mark-ups, and in full accordance with the Contract Documents. Include allowance for waste where appropriate. The unit prices shall be maintained throughout the Contract Time. Unit prices shall be used in determining additions or deductions from the total Contract Price in the event of changes due to unforeseen conditions in the Work.

B. ADDENDA

The undersigned acknowledges receipt of the following addenda:

Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_.

Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_.

Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_.

C. We agree to enter into an Agreement with the **County of York**, Virginia within ten (10) days of the award of same to us for the price named in our Bid.

D. It is expressly agreed by us that the **County of York**, Virginia shall have the right to reject any and all Bids and to waive any minor non-substantive errors in the Bid and accept the Bid in the **County of York's** best interests.

E. In default of the performance on our part of the conditions of Bid, our failure to enter into an Agreement with the **County of York**, Virginia, within the time above set, we herewith furnish a Bid Security in the amount of \$ \_\_\_\_\_, which shall be absolutely forfeited to the **County of York**, Virginia, but otherwise the said Bid Security shall be returned.

F. We agree to begin Work at any time we may be notified by the Owner, and complete all of the Work embraced in the Agreement within \_\_\_\_\_ Days;

G. *[This applies to projects over \$200,000 unless otherwise indicated].* I/We elect to utilize the Escrow Account Procedure described in the provision of this bid if determined to be the successful low Bidder. \_\_\_\_\_ (write "Yes" or "No").  
\_\_\_\_\_ Bid total does not qualify for escrow account option

H. The undersigned has read all sections under "Instructions to Bidders."

I. By signing, each signatory acknowledges any strike-throughs contained herein, unless hand-written.

J. CONTRACTOR'S REGISTRATION, SCC NUMBER AND SIGNATURE

Registered Virginia Contractor Class and No. \_\_\_\_\_

Registration Expires \_\_\_\_\_

State Corporation Commission (SCC) Number \_\_\_\_\_

*(NOTE: FAILURE TO INCLUDE CONTRACTOR'S REGISTRATION and SCC NUMBER ARE GROUNDS FOR REJECTION OF THE BID.)*

Contractor \_\_\_\_\_ Signed \_\_\_\_\_



Date \_\_\_\_\_ Title \_\_\_\_\_

NOTE: If Bidder is a corporation, write state of incorporation under signature.

MAILING ADDRESS AND TELEPHONE/E-Mail/FAX NUMBER OF BIDDER:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
( ) [Telephone] E-mail \_\_\_\_\_; FAX \_\_\_\_\_

IF CORPORATION, PROVIDE NAME AND MAILING ADDRESS AS REQUIRED BELOW.

PRESIDENT	SECRETARY	TREASURER
_____	_____	_____

IF PARTNERSHIP, PROPRIETORSHIP, LIMITED LIABILITY COMPANY OR OTHER FIRM, PROVIDE NAME AND MAILING ADDRESS OF EACH PARTNER, PROPRIETOR, OR MEMBER OF FIRM.

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

K. NON COLLUSION AFFIDAVIT

The County of York, Virginia project: Old Wormley Creek Road Lift Station #23

Bid Date: \_\_\_\_\_, 2013

COMMONWEALTH OF VIRGINIA  
(City/County)

This day personally appeared before the undersigned, a Notary Public in and for the City/County and State aforesaid,

\_\_\_\_\_ who having been first duly sworn according to law, did depose and aver as follows:

(a) That he/she is \_\_\_\_\_  
(Owner, Partner, President, etc.)

of \_\_\_\_\_  
(insert name of Bidder)

(b) That he/she is personally familiar with the Bid of \_\_\_\_\_  
(Insert Company Name)  
submitted in connection with the above captioned Owner's project.

(c) That said Bid was formulated and submitted in good faith as the true bid of said Bidder.

1. In preparation and submission of this Bid, the Bidder did not either directly or indirectly, enter into any combination or agreement with any person, firm or corporation or enter into any agreement, participate in any collusion, or otherwise take any action in the restraint of free, competitive bidding in violation of the Sherman act (15 U.S.C. Section 1) or sections 59.1-9.1 through 59.1-9.17 or sections 59.1-68.6 through 59.1-68.8 of the Code of Virginia.
2. The undersigned Bidder hereby certifies that neither this Bid nor any claim resulting therefrom, is the result of, or affected by, any act of collusion with, or any act of another person or persons, firm or corporation engaged in the same line of business or commerce; and that no person acting for or employed by the Owner has any personal interest in this Bid.
3. The undersigned hereby further agrees that upon request of the Owner, the records and books pertaining to this Bid will be voluntarily supplied, furnished, and released to the Owner.
4. The undersigned hereby further certifies that the Bidder has not knowingly falsified, concealed, misled, or covered up by any trick, scheme, or device a material fact in connection with this bid. The undersigned also certifies that the Bidder has not made any false, fictitious or fraudulent statements or representations or made or used any false writing or documents knowing the same to contain any false, fictitious or fraudulent statement or entry in connection with this Bid.

5. The undersigned further agrees that the Bidder will comply with section 2.2-4374 of the Code of Virginia, 1950, as amended, and has not bought or purchased any equipment from any person employed by the Owner as an independent contractor to furnish architectural or engineering services for this Project, nor from any partnership, association or corporation in which such architect or engineer has a pecuniary interest.
6. The undersigned further agrees to inform and require compliance by the following persons and entities with this anti-collusion statement as a condition of payment: all subcontractors, consultants, subconsultants, or any person, corporation, or legal entities that provide or furnish labor, material, equipment, or work related to this project.
7. All Covenants and Agreements made by the Contractor are made by it on behalf of the Contractor and its successors, personal representatives and assigns, the same as if they had been specifically named in each instance.

And further this deponent saith not.

\_\_\_\_\_  
Name of Company/Bidder

\_\_\_\_\_  
Title (Owner, Partner, President)

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_

My commission expires: \_\_\_\_\_, 20\_\_

\_\_\_\_\_  
Notary Public

**IV. BID BOND**

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, \_\_\_\_\_ as Principal, and \_\_\_\_\_ as Surety, are hereby held and firmly bound unto \_\_\_\_\_ as OWNER in the penal sum of \_\_\_\_\_ (Five Percent) for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns.

Signed, this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

The Condition of the above obligation is such that whereas the Principal has submitted to the OWNER a certain BID, attached hereto and hereby made a part hereof to enter into an Agreement in writing, for the

NOW, THEREFORE,

- (a) If said BID shall be rejected, or
- (b) If said BID shall be accepted and the Principal shall execute and deliver an Agreement in the Form of Agreement attachment hereto (properly completed in accordance with said BID) and shall furnish a BOND for faithful performance of said Agreement, and for the payment of all persons performing labor or furnishing materials in connection therewith, then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its BOND shall be in no way impaired or affected by any extension of the time within which the OWNER may accept such BID; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year set forth above.

\_\_\_\_\_  
Principal

\_\_\_\_\_  
Surety

By: \_\_\_\_\_  
Attorney-in-Fact

IMPORTANT - Surety companies executing BONDS shall appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the Commonwealth of Virginia.



**V. QUESTIONNAIRE**

If requested by the Owner, the following questions shall be answered in full by the Bidder, and returned to the Owner within 72 hours.

- 1. Name of Company: \_\_\_\_\_  
Trade Name (if different from Company Name): \_\_\_\_\_  
Principal Office Address: \_\_\_\_\_  
\_\_\_\_\_  
Telephone No(s): \_\_\_\_\_  
Fax No(s): \_\_\_\_\_

a. If a Corporation, answer the following:

When Incorporated: \_\_\_\_\_

In What State: \_\_\_\_\_

Names and Addresses of Directors: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Names and Addresses of Shareholders: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

b. If an Unincorporated Organization, answer the following:

Date of Organization: \_\_\_\_\_

Names and Addresses of Owners or Members: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Type and State of Organization: \_\_\_\_\_

c. If a Partnership, state whether Partnership is General or Limited: \_\_\_\_\_

Names and Addresses of Owners or Partners:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. a. How many years has this Bidder been in business as a Contractor under its present business name? \_\_\_\_\_

b. What are prior names of this Bidder, if any? \_\_\_\_\_  
\_\_\_\_\_

3. How many years' experience in this type of construction work has this Bidder had:

1) As a Contractor \_\_\_\_\_ 2) As a Subcontractor \_\_\_\_\_

4. Provide a list of uncompleted Contracts at present held by this Bidder (attach supplemental sheet if necessary):

<u>Contract</u>	<u>Type of Work</u>	<u>Amount</u>	<u>Percentage Completed</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

5. List the Bidder's crew foremen and supervisors proposed for this Project and their years of related experience:

<u>Name</u>	<u>Years of Experience</u>	<u>Dates of Employment with Bidder</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____

6. What construction equipment does this Bidder own that is available for the proposed work (attach supplemental sheet if necessary)?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

7. Does this Bidder plan to subcontract any part of this work? If so, list name, address, years experience, and type and amount of work to be performed by each subcontractor:

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8. Provide a list of projects similar in character and scope to the Work specified under this Contract which have been successfully completed by this Bidder during the past three years (attach supplemental sheet if necessary).

(The term "completed" means accepted and final payment received from the Owner or authorized representative).

Location & Type of Work	Owner's Name/ Address	Contact Person (Name and Telephone)	Date Completed	Contract Price

9. Have you ever performed work for a municipal corporation, local governing body, or similar agency previously? (If all such bodies are listed under 8, this question need not be completed).



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10. a. Has this Bidder ever failed to complete any work awarded to it? \_\_\_\_\_ If yes, give name of Owner, name of Bonding Company and circumstances:

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b. Is this Bidder debarred by the Federal Government or by the Commonwealth of Virginia or by any other state, or by any town, city, or county?

Yes \_\_\_\_\_ No \_\_\_\_\_ If yes, please provide details:

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c. Has this Bidder ever had any judgments entered against it for the breach of contract for construction? \_\_\_\_\_ If yes, please provide details:

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d. Give a summary of your financial statement. (List assets and liabilities, use an insert sheet, if necessary).

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11. State approximate largest dollar volume of work performed by this Bidder in one year:

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12. Give two (2) Banking Institution References:

a. Name: \_\_\_\_\_

Address: \_\_\_\_\_

Credit Available: \_\_\_\_\_

b. Name: \_\_\_\_\_

Address: \_\_\_\_\_

Credit Available: \_\_\_\_\_

13. List three material suppliers and amount of credit available:

_____	_____
_____	_____
_____	_____

14. List insurance coverage and amount (or attach certificate of insurance):

_____	_____
Liability-Property	
_____	_____
Liability-Personal Injury	
_____	_____
Vehicle and Equipment	
_____	_____
Other - Identify	

15. Bonding reference - List surety company and highest coverage:

\_\_\_\_\_

16. Have you or your authorized representative, personally inspected the location of the proposed Work, and do you have a clear understanding of the requirements of the Bid Documents?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

The undersigned hereby authorizes and consents to any person, firm or corporation to furnish any information requested by the Owner in verification of this statement of contractor's qualifications. Also, if it is the apparent low Bidder, the undersigned hereby agrees to furnish the Owner upon request, a complete and current financial statement:

Contractor: \_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**VI. CERTIFICATION REGARDING DEBARMENT**

This is to certify that this person/firm/corporation is not now debarred by the Federal Government or by the Commonwealth of Virginia or by any other state, or by any town, city, or county, from submitting Bids on contracts for construction covered by this solicitation, nor are they an agent of any person or entity that is now so debarred.

\_\_\_\_\_  
Name of Official

\_\_\_\_\_  
Title

\_\_\_\_\_  
Firm or Corporation

\_\_\_\_\_  
Date

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## VII. CERTIFICATION OF COMPLIANCE WITH IMMIGRATION LAWS AND REGULATIONS

Section 2.2-4311.1 \_\_\_\_\_ of the Code of Virginia requires \_\_\_\_\_ every public body to provide in every written contract that the contractor does not, and shall not, during the performance of the contract knowingly employ an unauthorized alien in violation of ~~City/County Code requires that any person or entity doing business with the City/County of \_\_\_\_\_, including its boards and commissions, shall include a sworn certification by the Contractor of compliance with all~~ federal immigration laws and regulations. These laws include the Federal Immigration Reform and Control Act, which makes it unlawful for a person or other entity to hire, recruit or refer for a fee for employment in the United States, an alien knowing the alien is unauthorized, and Section 40.1-11.1 of the Code of Virginia, which makes it unlawful for any employer to knowingly employ an alien who cannot provide documents indicating that he or she is legally eligible for employment in the United States. The state law, in particular, places an affirmative duty on employers to ensure that aliens have proof of eligibility for employment.

Accordingly this certification shall be completed and attached to all contracts and agreements for goods and services made by the ~~City/County of~~ **York, Virginia** or any of its boards and commissions. Failure to attach a completed certification shall render the contract or agreement void.

***Type or print legibly when completing this form.***

Legal Name of Contractor: (Note: This is your name as reported to the IRS. This should match your Social Security card or Federal ID Number.)

Type of Business Entity:

Sole proprietorship (Provide full name and address of owner):

Limited Partnership (Provide full name and address of all partners):

General Partnership (Provide full name and address of all partners):

Limited Liability Company (Provide full name and address of all managing members):

Corporation (Provide full name and address of all officers):

Doing Business As:

If Applicable (Note: This is the name that appears on your invoices but is not used as your reporting name.)

Name and Position of Person Completing this Certificate:

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Physical Business Address:

Primary Correspondence Address (If different from physical address):

Number of Employees:

**Are all Employees Who Work in the United States Eligible for Employment in the United States?**

Under penalties of perjury, I declare on behalf of the Contractor listed above that to the best of my knowledge and based upon reasonable inquiry, each and every one of the Contractor's employees who work in the United States are eligible for employment in the United States as required by the Federal Immigration Reform and Control Act of 1986 and Section 40.1-11.1 of the Code of Virginia. I further declare on behalf of the Contractor that it shall use due care and diligence to ensure that all employees hired in the future who will work in the United States will be eligible for employment in the United States. I affirm that the information provided herein is true, correct, and complete.

Sworn this \_\_\_ day of \_\_\_\_\_, 201\_ on behalf of \_\_\_\_\_ as evidenced by the following signature and seal:

Name of Contractor: \_\_\_\_\_

Printed Name of Signatory: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

COMMONWEALTH OF VIRGINIA:

CITY/COUNTY OF \_\_\_\_\_, to-wit:

The foregoing instrument was acknowledged before me this \_\_\_ day of \_\_\_\_\_, 201\_\_, by \_\_\_\_\_.

\_\_\_\_\_  
Notary Public

Registration No.: \_\_\_\_\_

My commission expires: \_\_\_\_\_

End of Section

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## SECTION 103

### AWARD AND EXECUTION OF AGREEMENT

#### I. AWARD AND EXECUTION OF AGREEMENT

##### 1. Notice of Award.

- 1.1. A Notice of Award will be issued by the Owner, or the Bids rejected as soon as reasonably possible, but no later than 90 Days after the date of the opening of Bids. The Owner may, in its sole discretion, release any Bid and return the Bid Security prior to that date, or extend the acceptance period an additional 90 days with the consent of the apparent low bidder and surety.
- 1.2. The Owner reserves the right to waive any minor informalities, to reject any and all Bids in whole or in part, and may advertise for new Bids if, in its judgment, the best interests of the Owner will be served.
- 1.3. **Bid results are posted on the County of York web page at [www.yorkcounty.gov/purchasing](http://www.yorkcounty.gov/purchasing).**

##### 2. Signing of Agreement.

- 2.1. When the Owner gives a Notice of Award to the Successful Bidder, it will be accompanied by 4 original copies of the Agreement, with all other written Contract Documents attached. Within 10 Days thereafter the Contractor shall sign and deliver all the original copies of the Agreement and attached documents to the Owner with the required Bid Security and Certificate of Insurance. Within 30 Days thereafter the Owner shall deliver one fully signed copy to the Contractor.
- 2.2. If the Successful Bidder fails to execute the Agreement within the time specified, the amount of Bid Security shall be paid to the Owner. In such case the Owner, at its discretion, may award the Work to the second Successful Bidder, or reject all Bids.

##### 3. Performance and Payment Bonds.

- 3.1. The Successful Bidder shall execute and provide to the Owner, within 10 Days following Notice of Award, Performance and Payment Bonds with surety in an amount equal to 100% of the accepted Bid. The sureties of all Bonds shall be of such surety company or companies as are approved by the Owner and are authorized to transact business in the Commonwealth of Virginia. If the execution is by an attorney-in-fact, a power of attorney evidencing the authority of such attorney shall be attached to the Bond. Such power of attorney shall bear the same date as the Bond to which it is attached.
- 3.2. All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws and Regulations and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff, Bureau of Government Financial Operations, U. S. Treasury Department **and licensed to do business in Virginia.**
- 3.3. Performance and Payment Bonds shall remain in full force during the warranty period defined in Section 107, VII.

#### 4. Contractor's Insurance.

4.1. The Contractor shall provide and keep in full force and affect during the performance of the Work the kinds and amounts of insurance specified in Section 4.3 below and shall comply with all other provisions of this Section. Such insurance shall be provided and kept in full force by insurance companies authorized to do business in the Commonwealth of Virginia, and regulated by the Virginia Bureau of Insurance. All premiums and other costs of such insurance shall be paid by the Contractor. It will be assumed that the consideration paid or to be paid to the Contractor for the performance of the Work includes the premiums and other such costs of such insurance, and the Owner shall not be responsible therefore. Each insurance policy and certificate of insurance shall be signed by duly authorized representatives of such insurance companies in the State and shall be countersigned by duly authorized agents of such companies. The Contractor shall not be required to furnish the Owner with copies of the insurance contracts required by this Section unless requested from time to time by the Owner; but the Contractor shall provide on forms furnished by the Insurance Company or Owner a Certificate of Insurance issued by such Insurance Companies, in which the company shall irrevocably warrant that the insurance is provided to enable the Contractor to comply with and provide the required insurance; (provided, however, that in no event shall the insurance contract be expanded to afford coverage which is greater than the maximum coverage approved for writing in the Commonwealth of Virginia) and that it will not be canceled unless at least thirty days' prior written Notice to the effect is given to the Owner, anything in such insurance contract to the contrary notwithstanding, and that the insurance contract has been endorsed accordingly.

4.2. The Contractor shall provide the certificate of insurance to the Owner within 10 Days following the Notice of Award.

4.3. Insurance Requirements:

A. The Contractor shall purchase and maintain during the life of this Agreement such Comprehensive General Liability Insurance including product and completed operations liability insurance as will provide protection from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether such performance is by Contractor, or by Subcontractor, by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable and shall otherwise bear responsibility therefore. The Contractor further agrees that all limits will be made available which are excess of the amounts below:

(1) Workers Compensation and Employers Liability

Coverage A - Statutory

Coverage B - \$100,000/\$100,000/\$500,000

A broad form of all states endorsement shall be attached.

(2) Commercial Auto Liability Including Hired and Non-Owned Car Liability Coverage

Limit of Liability - \$1,000,000 Per Occurrence

The Contractor shall purchase and maintain during the life of this Agreement such commercial automobile liability insurance including employer's non-ownership liability and hired car liability insurance to protect him and any Subcontractors performing Work covered

by this Agreement from claims for damages, whether such operations be by him or any Subcontractor, or by anyone directly or indirectly employed by either of them.

- (3) Commercial General Liability Including Contractual and Completed Operations.

Limit of Liability - \$1,000,000 Per Occurrence

- (4) Excess Liability Including Employers Liability, Commercial Auto Liability and Commercial General Liability.

Limit of Liability - \$1,000,000 Per Occurrence  
\$3,000,000 Aggregate

- B. The Contractor shall be responsible for securing the Work site and shall assume all risk for vandalism or other damage that may occur, to project components, during construction.
- C. The Owner, **its Officers, agents and employees** shall be named as an additional insured on the Commercial General Liability, **Commercial Auto Liability, and Excess Liability policies**, per ISO 2010 on a primary basis. The Contractor shall obtain a waiver of subrogation from its insurers on Worker's Compensation and All Risk Insurance policies. This requirement may be satisfied by obtaining appropriate endorsements to any master or blanket policy of insurance maintained. Owner's Commercial General Liability shall not contribute in any loss payment insured under the Contractor's Commercial General Liability policy
- D. Contingent liability and property damage insurance to protect the Owner (or his employees and agents, including the Engineer) shall be provided by endorsements to general liability or property damage policies. All aforesaid policies shall be endorsed to provide that the insurance company shall notify the Owner if policies are to be terminated or altered during the life of the contract.
- E. The General Liability insurance shall carry a contractual liability endorsement covering the hold harmless agreements contained in the Owner standard contract and the certificates filed with the Owner shall show that the contractual liability coverage has been obtained.
- F. Insurance coverage for personal injury and property damage, including insurance on vehicles and equipment, shall be in the same company.
- G. The Contractor shall also be required to submit to the Owner evidence of insurance coverage or self-insurance for all claims arising under the Worker's Compensation Laws of the State of Virginia.
- H. The Contractor will indemnify and hold harmless the Owner, and the Owner's officers, agents, employees, and other representatives, against any liability, loss or expense (including the loss of use of the Project), due to any act or omission of Contractor or any of their Subcontractors or of any of their respective employees in connection with the Work of the Contractor hereunder or due to any omissions or supervisory acts of the Owner in connection with the Work performed by the Contractor.

**II. NOTICE OF AWARD**

TO: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**PROJECT TITLE: Old Wormley Creek Road Lift Station #23**

The Owner has considered the Bid submitted by you for the above described Work in response to its Invitation for Bids dated \_\_\_\_\_, 20\_\_\_, and Instructions to Bidders.

You are hereby notified that your Bid has been accepted for the Work in the amount of \$\_\_\_\_\_.

You are required by the terms of the Bid Documents to fully execute and return \_\_\_\_\_ copies of the Agreement along with the required Contractor’s Performance Bond, Payment Bond, and Certificates of Insurance within \_\_\_\_\_ Days from the date of this Notice of Award.

If you fail to execute the Agreement and to furnish said Bonds and Certificate of Insurance within \_\_\_\_\_ Days from the date of this Notice, said Owner will be entitled to consider all your rights arising out of the Owner’s acceptance of your Bid as abandoned and as a forfeiture of your Bid Security. The Owner will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this Notice of Award to the Owner. The notice of award shall not be construed as notice to proceed.

Dated this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_.

**OWNER**

**CONTRACTOR**

\_\_\_\_\_  
*Owner*  
By: \_\_\_\_\_  
*Name*  
Title: \_\_\_\_\_

\_\_\_\_\_  
*Contractor*  
By: \_\_\_\_\_  
*Name*  
Title: \_\_\_\_\_



### III. AGREEMENT

This AGREEMENT, dated this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, by and between \_\_\_\_\_ the hereinafter called the Owner; and \_\_\_\_\_ (a corporation or a nonincorporated organization organized and existing under the laws of the State of \_\_\_\_\_ or, an individual trading under the above name) hereinafter called the Contractor.

WITNESSETH: The Owner and Contractor, for the consideration stated herein, agree as follows:

#### A. Scope of Work

The Contractor shall perform all required Work and shall provide and furnish all labor, materials, necessary tools, expendable equipment and utility and transportation service and all else required to complete the construction of the **Old Wormley Creek Road Lift Station #23** project all in strict accordance with the Drawings and Specifications, including any and all Addenda, and in strict compliance with the Contract Documents, the terms of which are incorporated herein by reference.

It is understood and agreed that said labor, materials, tools, equipment and service shall be furnished and said Work performed and completed under the direction and supervision of the Contractor and subject to the approval of the Owner or its authorized representative.

#### B. Engineer

This Project has been designed by **O'Brien and Gere Engineers** (Engineer) who is hereinafter called the Engineer and who is to act as the Owner's Representative, assume all duties and responsibilities, and have the rights and authority assigned to the Engineer in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents. In the event the Owner should not require the services of the Engineer for any or all parts of the project, the power, duties, and responsibilities conferred hereto to the Engineer shall be construed to be those of the Owner or its authorized representative.

**Wherever references are made in these Bid Documents to the Virginia Department of Transportation (VDOT) specifications, unless otherwise noted, references in the VDOT specifications to "State", "Chief Engineer", or "Department", shall be interpreted as referring to the Owner.**

#### C. Guarantee

All materials and equipment, furnished by the Contractor, and all construction involved in this Agreement are hereby guaranteed by the Contractor to be free from defects owing to faulty materials or workmanship for a period of one year after date of Substantial Completion of the Work. All Work that proves defective, by reason of faulty material or workmanship within said period of one year, shall be replaced by the Contractor free of cost to the Owner. These guarantees shall not operate as a waiver of any of the Owner's rights and remedies for default under or breach of the Agreement which rights and remedies may be exercised at any time within the period of any applicable statute of limitations.

**In accordance with the Virginia Department of Transportation Special Provision for Underground Installation, the Contractor shall provide a three (3) year warranty against pavement settlement or failure.**

D. Contract Price

The Owner shall pay the Contractor as just compensation for the satisfactory performance of the Work, subject to any additions or deductions as provided in the Contract Documents, the unit and/or lump sum price as contained in the Bid Schedule attached hereto.

The Contract Price is \_\_\_\_\_ (\$ \_\_\_\_\_) based upon unit and/or lump sum prices extended as herein contained.

Change Orders that individually or in aggregate increase the Contract Price by more than 25% of the above stated Contract Price must be approved by the locality's governing body prior to the performance of the Work by the Contractor.

E. Payments

The Owner will pay the Contract Price to the Contractor in the manner and at such times as set forth in Section 109 of the Hampton Roads Planning District Commission *Regional Construction Standards*, Fifth Edition, as referenced in Section I. below and as specifically revised for this Project.

F. Time

The undersigned Contractor agrees to commence Work within **10** Days after the date of Notice to Proceed and further agrees to substantially Complete all Work under this Agreement within **180** Days from the date of the Notice to Proceed and to reach Final Completion of all Work under this Agreement within **210** Days from the date of the Notice to Proceed.

G. Applicable Law/Compliance

(1) Applicable Law

This Agreement shall be deemed to be a Virginia contract and shall be governed as to all matters of validity, interpretations, obligations, performance, or otherwise, exclusively by the laws of the Commonwealth of Virginia, and all questions arising with respect thereto shall be determined in accordance with such laws. Regardless of where actually delivered and accepted, this Agreement shall be deemed to have been delivered and accepted by the parties in the Commonwealth of Virginia.

(2) Compliance with all Laws

Contractor shall comply with all federal, state and local statutes, ordinances, and regulations, now in effect or hereafter adopted, in the performance of Work set forth herein. Contractor represents that it possesses all necessary licenses and permits required to conduct its business and will acquire any additional license and permits necessary for performance of this Agreement prior to the initiation of Work. [If the Contractor is a corporation] Contractor further expressly represents that it is a corporation in good standing in the Commonwealth of Virginia and will remain in good standing throughout the term of the contract. Contractor shall at all times observe all health and safety measures and precautions necessary for the sanitary and safe performance of the contract Work.

(3) Venue

Any and all suits for any claims or for any breach or dispute arising out of these Contract Documents shall be maintained in the appropriate court of competent jurisdiction in the **County of York, Virginia.**

(4) Environmental Considerations

Any cost or expense associated with environmentally related violations of the law, the creation or maintenance of a nuisance, or releases of hazardous substance, including but not limited to, the cost of any clean up activities, removals, remediation, responses, damages, fines, administrative or civil penalties or charges imposed on the Owner, whether because of actions or suits by any governmental or regulatory agency or by any private party, as a result of the release of any hazardous substances, or any noncompliance with or failure to meet any federal, state or local standards, requirements, laws, statutes, regulations or the law of nuisance by the Contractor (or its agents, officers, employees, subcontractors, consultants, subconsultants, or any other persons, corporations, or legal entities employed, utilized, or retained by the Contractor) in the performance of this Agreement or related activities, shall be paid by the Contractor.

(5) Non-Discrimination/Drug-Free Workplace Provisions

(a) Employment discrimination by Contractor shall be prohibited. During the performance of this Agreement, Contractor agrees as follows:

- (i) Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, 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/consideration reasonably necessary to the normal operation of Contractor. Contractor will conform to the provisions of the Federal Civil Rights Act of 1964, as amended, as well as the Virginia Fair Employment Act of 1975, as amended, where applicable, the Virginians With Disabilities Act, the Americans With Disabilities Act, and the Code of Virginia § 2.2-4311. 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 Agreement 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 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. Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.
- (ii) Contractor, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, will state that Contractor is an equal opportunity employer.

- (iii) Notices, advertisements and solicitations placed in accordance with federal law, rule or regulations shall be deemed sufficient for the purpose of meeting the requirements of this section.
  - (iv) Contractor will include the provisions of the foregoing subsections (i) and (ii), and (iii) in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.
- (b) During the performance of this Agreement, Contractor agrees as follows:
- (i) Contractor will provide a drug-free workplace for Contractor's employees.
  - (ii) Contractor will 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 Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition.
  - (iii) Contractor will state in all solicitations or advertisements for employees placed by or on behalf of Contractor that Contractor maintains a drug-free workplace.
  - (iv) Contractor will include the provisions of the foregoing subsections (i), (ii) and (iii) in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.
  - (v) 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 a Contractor, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession, or use of any controlled substance or marijuana during the performance of the contract."

H. Liquidated Damages

The damage and loss to the Owner resulting from failure of the Contractor to complete the Work within the time specified in this Agreement, plus any extension of time granted, shall be stipulated in Section 108.X, and Section 102.III, Bid Form. Damage monies may be withheld on partial and final payment to the Contractor. (See Section 102.III Bid Form and Section 108.X for explanation and specified dollar amounts.)

I. Component Parts of the Contract

This Agreement includes all completed components of the Bid and Contract Documents as defined in Section 101 of the HRPDC *Regional Construction Standards* (Latest Edition indicated in the Invitation For Bids), as revised for this Project all of which are incorporated herein by reference.

J. Binding

This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns.

K. Changes to the Agreement

No provision of this Agreement shall be changed, amended, modified, waived, or discharged except as agreed to in writing by the Owner and the Contractor.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed as of the day and first above written in ( ) counterparts each of which shall for all purposes be deemed an original.

**OWNER**

**CONTRACTOR**

\_\_\_\_\_  
*Owner*

\_\_\_\_\_  
*Contractor*

By: \_\_\_\_\_  
*Name*

By: \_\_\_\_\_  
*Name*

Title: \_\_\_\_\_

Title: \_\_\_\_\_

Attest: \_\_\_\_\_

Attest: \_\_\_\_\_

Address: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Contractor's Registration No.: \_\_\_\_\_

(If Contractor is a corporation or an unincorporated organization, attach evidence of authority to sign)

*[Corporate Seal]*

APPROVED AS TO FORM:

\_\_\_\_\_  
City/County Attorney



**IV. PERFORMANCE BOND**

Bond No. \_\_\_\_\_  
Amount: \$ \_\_\_\_\_

KNOW ALL PERSONS BY THESE PRESENTS, that \_\_\_\_\_ of \_\_\_\_\_, hereinafter called the Contractor and \_\_\_\_\_ a corporation duly organized and existing under and by virtue of the laws of the State of \_\_\_\_\_, hereinafter called the Surety, and authorized to transact business within the Commonwealth of Virginia as the Surety, are held and firmly bound unto \_\_\_\_\_ as Owner, in the sum of \_\_\_\_\_ dollars (\$ \_\_\_\_\_), lawful money of the United States of America, for payment of which, well and truly be made to the Owner, the Contractor and the Surety bind themselves and each of their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents as follows:

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT:

WHEREAS, the Contractor has executed and entered into a certain Agreement, hereto attached, with the Owner dated \_\_\_\_\_, 20\_\_\_\_, for \_\_\_\_\_

NOW THEREFORE, if the Contractor, and its successors and assigns, shall at all times duly, promptly, and faithfully perform the Work and any alteration in or addition to the obligations of the Contractor arising thereunder, including the matter of infringement, if any, of patents or other proprietary rights, and shall assure all guarantees against defective workmanship and materials, including the guarantee period following final completion by the Contractor and final acceptance by the Owner and comply with all the covenants therein contained in the Specifications, Drawings, and other Contract Documents required to be performed by the Contractor, in the manner and within the times provided in the Agreement, and shall fully indemnify and save harmless the Owner from all costs and damage which it may suffer by reason or failure to do so, and shall fully reimburse and repay it all outlay and expenses which it may incur in making good any default, and reasonable counsel fees incurred in the prosecution of or defense of any action arising out of or in connection with any such default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that the Surety, for value received, for itself and its successors and assigns, hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of the Contract Documents or to the Work to be performed thereunder, or payment thereunder before the time required therein, or waiver of any provision thereof, or assignment, subletting or transfer thereof or any part thereof, shall in any way affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration, addition to the terms of the Contract Documents or any such payment, waiver, assignment, subcontract or transfer.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

Whenever Contractor shall be declared by Owner to be in default under the Contract, the Owner having performed Owner's obligations thereunder, the Owner shall have the right, at its option, to require the Surety to promptly proceed to remedy the default within 30 days of notice by proceeding or procuring others to proceed with completing the Agreement with its terms and conditions; and all reserves, deferred payments,



and other funds provided by the Agreement to be paid to Contractor shall be paid to Surety at the same times and under the same conditions as by the terms of that Agreement such fund would have been paid to Contractor had the Agreement been performed by Contractor; and Surety shall be entitled to such funds in preference to any assignee of Principal of any adverse claimant. Notwithstanding the above, the Owner shall have the right, with the approval of the Surety which shall not be unreasonably withheld, to take over and assume completion of the Agreement and be promptly paid in cash by the Surety for the cost of such completion less the balance of the Contract price.

IN WITNESS WHEREOF, all above parties bounded together have executed this instrument this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, the name and corporate seal of each corporate party being hereto affixed and those presents duly signed by its undersigned representative, pursuant to authority of its governing body.

CONTRACTOR

\_\_\_\_\_

By: \_\_\_\_\_ (Seal)

Name: \_\_\_\_\_

Title: \_\_\_\_\_

\_\_\_\_\_  
Attest

SURETY

\_\_\_\_\_

By: \_\_\_\_\_ (Seal)

\_\_\_\_\_  
Attest

APPROVED AS TO FORM: \_\_\_\_\_, 20\_\_\_\_

\_\_\_\_\_  
OWNER

NOTE: Date of Bond shall not be prior to the date of the Agreement. If the Contractor is a partnership, all partners shall execute the Bond.

IMPORTANT: The Surety named on this Bond shall be one who is licensed to conduct business in the Commonwealth of Virginia, and named in the current list of Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies, as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department. All Bonds signed by an agent shall be accompanied by a certified copy of the authority to act for the Surety at the time of signing of this Bond.

**V. PAYMENT BOND**

Bond No. \_\_\_\_\_  
Amount: \$ \_\_\_\_\_

KNOW ALL PERSONS BY THESE PRESENTS, that \_\_\_\_\_  
of \_\_\_\_\_  
\_\_\_\_\_ hereinafter called the Contractor and \_\_\_\_\_ a corporation duly  
organized and existing under and by virtue of the laws of the State \_\_\_\_\_, hereinafter called  
the Surety, and authorized to transact business within the Commonwealth of Virginia as the Surety, are held  
and firmly bound unto \_\_\_\_\_ as Owner, in the sum  
of \_\_\_\_\_ dollars (\$ \_\_\_\_\_), lawful money of the United States of America, for  
payment of which, well and truly be made to the Owner, the Contractor and the Surety bind themselves and  
each of their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these  
presents as follows:

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT:

WHEREAS, the Contractor has executed and entered into a certain Agreement, hereto attached, with the  
Owner dated \_\_\_\_\_, 20 \_\_, for \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

NOW THEREFORE, if the Contractor shall promptly make payments to all persons, firms, subcontractors,  
and corporations furnishing materials for or performing labor in the prosecution of the Work provided for in  
the Agreement, and any authorized extension or modification thereof, including all amounts due for  
materials, lubricants, oil, gasoline, repairs on machinery, equipment, and tools consumed, used or rented in  
connection with the construction of the Work, and all insurance premiums on the Work, and for all labor  
performed in the Work, whether by Subcontractor or otherwise, then this obligation shall be void, otherwise  
to remain in full force and effect.

PROVIDED, HOWEVER, that the Surety, for value received, hereby stipulates and agrees that no change,  
extension of time, alteration, or addition to the terms of the Contract Documents or to the Work to be  
performed thereunder, shall in any way affect its obligation on this Bond, and it does hereby waive notice of  
any such change, extension of time, alteration, or addition to the terms of the Contract Documents.

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall abridge the  
right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, all above parties bounded together have executed this instrument this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, the name and corporate seal of each corporate party being hereto affixed and those presents duly signed by its undersigned representative, pursuant to authority of its governing body.

CONTRACTOR

By: \_\_\_\_\_ (Seal)

Name: \_\_\_\_\_

Title: \_\_\_\_\_

\_\_\_\_\_  
Attest

SURETY

\_\_\_\_\_  
By: \_\_\_\_\_ (Seal)

\_\_\_\_\_  
Attest

APPROVED AS TO FORM: \_\_\_\_\_, 20\_\_\_\_\_

\_\_\_\_\_  
OWNER

NOTE: Date of Bond shall not be prior to the date of the Agreement. If the Contractor is a partnership, all partners shall execute the Bond.

IMPORTANT: The Surety named on this Bond shall be one who is licensed to conduct business in the Commonwealth of Virginia, and named in the current list of Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies, as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department. All Bonds signed by an agent shall be accompanied by a certified copy of the authority to act for the Surety at the time of signing of this Bond.



**VI. NOTICE TO PROCEED**

TO: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

DATE: \_\_\_\_\_  
PROJECT: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

You are hereby notified to commence Work in accordance with the Agreement dated \_\_\_\_\_, 20\_\_\_\_, on or before \_\_\_\_\_, 20\_\_\_\_, and you are to substantially complete the Work within \_\_\_\_\_ Days thereafter and reach Final Completion of the Work within \_\_\_\_\_ Days thereafter. The date of Final Completion of all Work is therefore \_\_\_\_\_, 20\_\_\_\_.

Liquidated damages as stipulated in the Bid Form, in the amount of \$1,000.00 per Day for failure of the Contractor to substantially complete the Work by the date for Substantial Completion and \$1,000.00 per Day for failure to complete the Work by the date for Final Completion, will be assessed by the Owner as stated above or as may be modified by duly executed Change Orders.

OWNER: \_\_\_\_\_  
BY: \_\_\_\_\_  
TITLE: \_\_\_\_\_

ACCEPTANCE OF NOTICE:

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by:

\_\_\_\_\_

this the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_

CONTRACTOR: \_\_\_\_\_  
BY: \_\_\_\_\_  
TITLE: \_\_\_\_\_



**VII. NOTICE OF INTENT TO AWARD**

TO: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PROJECT TITLE: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

The Owner has considered all the Bids submitted for the above described Work in response to its Invitation for Bids dated \_\_\_\_\_, 20\_\_, and Instructions to Bidders.

This is to advise that the Owner intends to award the contract for this Work to \_\_\_\_\_.

Dated this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

**OWNER**

\_\_\_\_\_  
*Owner*  
By: \_\_\_\_\_  
*Name*  
Title: \_\_\_\_\_

End of Section

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## SECTION 104

### SCOPE OF WORK

#### I. INTENT OF AGREEMENT

- 1.1. The intent of the Agreement is to provide for completion of the Work specified therein.
- 1.2. If, during the performance of the Work, the Contractor finds a conflict, error or discrepancy in the Contract Documents, the Contractor shall so report to the Owner in writing at once and before proceeding with the Work affected thereby, except in the case of emergency or public safety, shall obtain a written interpretation or clarification from the Owner however, the Contractor shall not be liable to the Owner for failure to report any conflict, error or discrepancy in the Contract Documents unless the Contractor has actual knowledge thereof or should reasonably have known thereof.

#### II. AMENDING AND SUPPLEMENTING CONTRACT DOCUMENTS

- 2.1. The Contract Documents may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof by a Change or Field Order pursuant to Section 109 II.

#### III. EXPLORATIONS AND REPORTS

- 3.1. Reference is made to the Special Provisions for identification of those reports of explorations and tests of subsurface conditions at the site that have been utilized by the Owner in preparation of the Contract Documents.
- 3.2. The Contractor shall visit the site of the proposed Work and make such explorations as the Contractor determines to be necessary.

#### IV. UNDERGROUND FACILITIES

- 4.1. The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to the Owner or Engineer by the owners of such Underground Facilities or by others.
- 4.2. The Owner and Engineer shall not be responsible for the accuracy or completeness of any such information and data. The Contractor shall have full responsibility for reviewing and checking all such information and data, for locating all Underground Facilities shown or indicated in the Contract Documents, for coordination of the Work with the owner's of such Underground Facilities during construction, for the safety and protection of said facilities, and repairing any damage thereto resulting from the Work, the cost of all of which will be considered as having been included in the Contract Base Bid.
- 4.3. If an Underground Facility is uncovered or revealed at or contiguous to the site which was not shown or indicated in the Contract Documents and which the Contractor could not reasonably have been expected to be aware of, the Contractor shall, promptly after becoming aware thereof and before performing any Work affected thereby, identify and immediately notify the owner of such Underground Facility and give written Notice thereof to that owner and to the Owner. The Owner will promptly review the Underground Facility to determine the extent to which the Contract Documents should be modified to reflect and document the consequences of the existence of the

Underground Facility, and the Contract Documents will be amended or supplemented to the extent necessary. During such time the Contractor shall be responsible for the safety and protection of any such Underground Facility which is in service or which is to be placed in service. The Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, to the extent that they are attributable to the existence of any Underground Facility in service or which is to be placed in service, which directly and unavoidably impacts the installation of the Work, that was not shown or indicated in the Contract Documents and which the Contractor could not reasonably have been expected to be aware of.

- 4.4. If the existence of an Underground Facility described above unavoidably impacts the installation of the Work, the Contractor shall, to the fullest extent possible, continue the Work on other portions of the site. All delays must be shown by the Contractor to be directly attributable to said unforeseen conditions and limited to the time actually occasioned by such unforeseen conditions, and that the Contractor has prosecuted the other portions of the Work to the fullest extent possible.
- 4.5. The Contractor shall comply with the Underground Utility Damage Prevention Act, Section 56-265.14 through 56-26532, Code of Virginia of 1950, as enacted and amended, and shall be responsible for notifying the owners of utilities and requesting the locating and marking of all underground facilities before beginning any excavation.
- 4.6. The Contractor should be aware that in some instances buried cables, gas lines, sewer lines, and water lines 2-inches and smaller in diameter may have to be excavated by hand and slightly relocated to facilitate construction of the Work under this Agreement. This shall be considered incidental to the Work, and the Contractor will not be eligible for additional compensation.
- 4.7. At points where the Contractor's operations are adjacent to the properties of any utility, including railroads, and damage to which might result in considerable expense, loss, or inconvenience, Work shall not commence until arrangements necessary for the protection thereof have been completed.
- 4.8. The Contractor shall cooperate with owners of utility lines so that removal and adjustment operations may progress in a reasonable manner, duplication of adjustment work may be reduced to a minimum, and services rendered by those parties will not be unnecessarily interrupted.
- 4.9. If any utility service is interrupted as a result of accidental breakage or of being exposed or unsupported, the Contractor shall promptly notify the proper authority and shall cooperate with the authority in the restoration of service. If utility service is interrupted, repair work shall be continuous until service is restored. The Contractor shall be responsible for any damage to utilities that are attributable to his neglect or methods of performing the Work.

## **V. SUBSURFACE CONDITIONS**

- 5.1. The Contractor shall promptly, and if possible, before such conditions are disturbed, except in the event of an emergency, notify the Owner by written Notice of:
  - A. subsurface or latent physical conditions at the site differing materially from those indicated in the Contract Documents; or
  - B. unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in Work of the character provided for in the Contract Documents.

- 5.2. The Owner shall promptly investigate the conditions, and if it is confirmed that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the Work, an equitable adjustment shall be made and the Agreement shall be modified by a Change Order. Any claim of the Contractor for adjustment hereunder shall not be allowed unless the Contractor has given the required written Notice; provided that the Owner may, if the facts so justify, consider and adjust any such claims asserted before the date of final payment.
- 5.3 All required written Notices shall be submitted to the Owner within 20 Days after occurrence of the event giving rise to such claim, or within 20 Days after the claimant recognizes the condition, whichever is later.

## **VI. SITE SECURITY**

- 6.1. The Contractor shall be responsible for the security and safety of all project facilities including, but not limited to, all equipment, materials, site structures, and construction thereon. All security measures deemed necessary by the Contractor to comply with this requirement shall be at the Contractor's expense at no additional cost to the Owner. The Contractor shall be responsible for all site security until final acceptance of the Work by the Owner.

## **VII. CLEAN-UP, DISPOSAL AND RESTORATION**

- 7.1. The Contractor shall maintain the site of the project in an orderly and clean condition and shall at intervals of no more than three (3) working days and at its expense, remove and legally dispose of accumulations of rubbish or refuse materials, surplus concrete, mortar and excavated materials not required or suitable for backfill from public and private property and rights-of-way. Washings from concrete mixers or mixing boxes shall not be deposited directly or indirectly in the drainage or sewer system or on paved streets. The Contractor shall keep the site, inclusive of vehicular and pedestrian traffic routes through the site, free of dirt and dust by periodic blading, power brooming, watering or other approved means. Road surfaces adjacent to the work area shall be cleaned of soil with mechanical brooms or other approved methods at the end of each working day. Road shoulders and driveways shall be stabilized so as to allow traffic flow (including mail and paper delivery vehicles, school buses and emergency vehicles) by the end of each working day.
- 7.2. The Contractor shall confine all equipment, the storage of materials and equipment, and the operations of workmen to areas permitted by law, ordinances, permits, or the requirements of the Contract Documents, and shall not unreasonably encumber the premises with materials or equipment.
- 7.3. The Contractor shall not load nor permit any part of any structure to be loaded with weights that will endanger the structure, nor shall any part of the work be subjected to stresses or pressures that will endanger it.
- 7.4. Upon completion and before final acceptance of the Work performed under the Agreement, the Contractor shall remove and legally dispose of all rubbish, surplus or discarded materials, false work, forms, temporary structures, field offices, signs, temporary erosion and siltation control measures, and equipment and machinery, and shall leave the site and ground occupied in connection with the performance of the Work in the conditions existing before the Work was started, to the satisfaction of the Owner.
- 7.5. All waste materials, including but not limited to excavated materials, demolished pavement, arboreal (landscaping) waste and other debris, that are not suitable for Project related purposes (e.g., backfill) or are surplus to the needs of the Project, both as determined by the Owner, shall become the

property of the Contractor. The Contractor shall dispose of all such material in accordance with his accepted Disposal Plan, as specified below, at no additional cost to the Owner.

- A. The Contractor shall submit a Disposal Plan for review and acceptance by the Owner prior to performing any Work that might generate waste materials. The plan shall include a complete description of the materials that are expected to be encountered and their proposed disposal site(s). The Contractor may change his Disposal Plan only by written notice to the Owner. The acceptance of a plan and/or any related notice to the Owner must be evidenced by a written response from the Owner.
- B. The Contractor shall insure that all permits related to his disposal operations have been obtained, and the Contractor shall comply with all requirements of those permits. The Contractor shall show evidence that all required permits have been obtained for all disposal sites by submitting a copy of all such permits to the Owner as part of the Contractor's Disposal Plan.

End of Section

## SECTION 105

### CONTROL OF WORK

#### I. REUSE OF CONTRACT DOCUMENTS

- 1.1. Neither the Contractor nor any Subcontractor or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with the Owner shall have or acquire any title to or ownership rights in any of the Contract Documents (or copies thereof) prepared by or bearing the seal of the Engineer; and, they shall not reuse any of the Contract Documents on extensions of the Project or any other project without written consent of the Owner and Engineer and specific written verification by the Owner.

#### II. COPIES OF CONTRACT DOCUMENTS

- 2.1. The Owner will furnish to the Contractor up to **five (5)** copies of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction.

#### III. CONTRACT DOCUMENTS

- 3.1. The Contract Documents will govern the Work set forth therein.
- 3.2. In cases of conflicts, Special Provisions shall govern over the *Regional Construction Standards*; Specifications shall govern over Drawings; figure dimensions shall govern over scaled dimensions; and, detailed Drawings shall govern over general Drawings; unless, the interpretation would result in a violation of any law or regulation applicable to the performance of the Work. **Standard Details contained in the Drawings shall govern over corresponding Standard Details contained in the Regional Construction Standards.**
- 3.3. The Contractor shall, upon discovering any error, omission, or discrepancy in the Contract Documents, immediately notify the Owner.

#### IV. SHOP DRAWINGS AND SUBMITTALS

- 4.1. The Contractor shall compile a complete and comprehensive schedule of all the submittals anticipated to be made during the progress of the Work. The schedule shall include a list of each type of item for which the Contractor's drawings, Shop Drawings, material affidavits, material samples, **certificates, warranties, guarantees, operations and maintenance manuals, testing and adjustment reports, plans, schedules,** or other types of submittals required by the Contract Documents.
- 4.2. Prior to each submittal, the Contractor shall carefully review and coordinate all aspects of each item or sample submitted with any other item or sample being submitted and verify that each item and sample adheres in all respects with the requirements of the Contract Documents.
- 4.3. The Contractor shall certify that all materials used in the Work are in complete compliance with all specified provisions. Certification shall not be construed as relieving the Contractor from its responsibility of furnishing satisfactory materials. At the time of each submission, the Contractor shall in writing call the Owner's attention to any deviations that the Shop Drawings or samples may

have from the requirements of the Contract Documents. **By making a submission for approval, the Contractor shall be deemed to have certified that he has checked the items in the shop drawings before submitting them and that he is satisfied that, in their present state, they not only meet the requirements of the Contract Documents, but will present no difficulties in the performance and completion of the Work. The Contractor shall clearly note his approval on the shop drawings prior to submission to the Owner. Failure of the Contractor to note his approval will be reason for the Owner to return such submission to the Contractor unchecked.**

**A. If it appears to the Owner that the shop drawings submitted by the Contractor have not been properly checked, even though the Contractor's approval has been noted thereon, Owner may return such submission to the Contractor unchecked.**

**B. Markings, written or otherwise, made by the Contractor or by his suppliers or manufacturers must be made on the Submittal in a color other than red. RED is reserved for the exclusive use of the reviewer in marking Submittals.**

- 4.4. The Contractor shall submit ~~four (4)~~ **two (2)** copies, plus the number of copies desired to be returned, of Shop Drawings or submittals that are required by Section 105 or the Special Provisions. Each submission shall be accompanied by letter of transmittal in duplicate, listing the contents of the submission and identifying each item by reference to specification section or Drawing. The data shown on the Shop Drawings shall be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to show the Owner the materials and equipment the Contractor proposes to provide.
- 4.5. The Contractor shall also submit samples to the Owner for review and approval in accordance with the accepted schedule of submittals. Each sample shall be identified clearly as to material, supplier, pertinent data such as catalog numbers and the use for which intended and otherwise as the Owner may require for review. The review of a separate item or sample will not indicate approval of any assembly in which the separate item or sample functions.
- 4.6. The Contractor is responsible for submitting all Shop Drawings and schedules in a timely manner to avoid delaying the Work. The Owner shall within 21 days after receipt, return Shop Drawings and schedules to the Contractor indicating approval or disapproval.
- 4.7. Review and/or approval of Shop Drawings will be for general conformance with the Contract Documents and shall not relieve the Contractor from the responsibility of furnishing materials and equipment of proper dimension, size, quality, quantity, and all performance characteristics to efficiently perform the requirements and intent of the Contract Documents. Approval shall not be construed as permitting any departure from the Project requirements, authorization of any increase in price, or approval of departures from additional details or instructions previously furnished by the Owner.
- 4.8. Before submitting each Shop Drawing or sample, the Contractor shall have determined and verified:
- A. All field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar information with respect thereto;
- B. All materials with respect to the intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the work; and

- C. All information relative to the Contractor's sole responsibility in respect of means, methods, techniques, sequences and procedures of construction and safety precautions and progress incident thereto.
- 4.9. Each Shop Drawing and sample submission shall bear a stamp or specific written indication that the Contractor has satisfied Contractor's obligation under the Contract Documents with respect to the Contractor's review and approval of that submission. The Contractor's Shop Drawing stamp shall be as follows (or as otherwise approved by the Owner and Engineer):

<p><i>(Owner's Name)</i>  <i>(Project Name)</i></p> <p>Shop Drawing No.: _____</p> <p>Specification Section: _____</p> <p><i>With respect to this Shop Drawing or Sample, I have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar data with respect thereto and reviewed or coordinated this Shop Drawing or Sample with other Shop Drawings and samples and with the requirements of the Work and the Contract Documents.</i></p> <p>_____ <i>No variation from Contract Documents</i></p> <p>_____ <i>Variation from Contract Documents as shown</i></p> <p><i>(Contractor's Name and Address)</i></p> <p>By: _____</p> <p>Date: _____</p>
--

- 4.10. The Engineer will review and approve or disapprove or return as incomplete Shop Drawings and samples in accordance with the schedule of submittals submissions accepted by the Engineer. The Engineer's review and approval or disapproval will not extend to means, methods, techniques, sequences or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The Contractor shall make corrections required by the Engineer, and shall return the requested number of copies of Shop Drawings and samples for review and approval. The Contractor shall direct specific attention in writing to revisions other than the corrections called for by the Engineer on previous submittals. Upon approval, two marked copies will be returned to the Contractor.
- 4.11. No progress payments will be made to the Contractor until the schedules are submitted to and acceptable to the Engineer. The progress schedule shall be acceptable to the Engineer as being the Contractor's schedule for the orderly progression of the Work to completion within any specified Contract Times, but such acceptance will neither impose on the Engineer responsibility for the sequencing, scheduling or progress of the Work nor interfere with or relieve the Contractor from the Contractor's full responsibility therefor.

- 4.12. The Engineer will record time required by the Engineer or Engineer's consultants for excessive submittal review occasioned by the Contractor's re-submission, in excess of one re-submission of a required submittal, caused by unverified, unchecked or un-reviewed, incomplete, inaccurate or erroneous, or nonconforming submittals. The Engineer's costs will be an estimated average billing rate for labor plus related expenses.
- 4.13. Within ten (10) days after the Effective Date of the Agreement, the Contractor shall submit to the Engineer for approval a schedule listing the manufacturer of the items of equipment and materials proposed for the construction. Following approval of the schedule, no changes in material or equipment from those listed will be allowed except in unusual or extenuating circumstances. When such circumstances arise, the Contractor shall request, in writing, the Owner's approval of the proposed change, stating the circumstances necessitating such a change. The intent of this schedule is to name the manufacturers of material specified by a product standard and to designate which manufacturer will be used when more than one has been named for an item. The schedule shall not be interpreted as allowing any change from base Bid items or those substitute items offered with the Bid and accepted in the Agreement.
- 4.14. **Submittals shall be made in logical groupings representing all submittals from a technical specification section and/or, where appropriate, related section(s). Shop drawing submissions lacking all required submittals under a technical specification section(s) will be returned without review.**
- 4.15. **The approval of shop drawings shall not relieve the Contractor from the responsibility for proper fitting and construction of the Work nor from furnishing materials and work required by the Contract which may not be indicated on the shop drawings when approved.**
- 4.16. **Where a shop drawing or sample is required by the Specifications, and related work is performed prior to the Owner's review and approval of the pertinent submission, such work will be the sole responsibility of the Contractor. Owner shall have the right to inspect any such Work, but failure of Owner to inspect such Work shall not be deemed an acceptance by the Owner.**
- 4.17. **In proposing alternate materials or construction methods or in requesting Owner determination of alternate materials, submittals must clearly demonstrate that the proposed alternate items clearly meet, in all respects, the requirements of the Contract Documents, design intent of the Project, and offer finished product superiority and/or cost savings to the Owner. The burden of proof in all such determinations is up to the Contractor and the Owner's determination is un-reviewable and final. All such proposals count as submittals in determining the cost of additional reviews in accordance with paragraph 4.12 above.**
- 4.18. **Manufacture's Certificates**
- A. **The Contractor shall furnish at the time of submitting shop drawings the manufacturer's certificates for items of equipment and products in the various sections of these Specifications.**
- B. **The manufacturer's warranty and certification submitted for equipment, a product, or component of a product shall indicate that the manufacturer has examined the Contract Documents and the equipment, product or component of a product provided will meet the performance criteria and conforms in all respects to the requirements of the Contract Documents.**

- C. **A statement originating from the Contractor, or any of his Subcontractors, suppliers, or any other agent, which merely indicates that a particular item of equipment, product, or component of a product, meets the requirements of the Contract Documents, shall not be considered a certificate. Any such submittal made in this manner will not be approved and the corresponding equipment, product, or component of a product, shall not finally accepted.**

## V. RECORD DRAWINGS

- 5.1 The Contractor shall keep one record copy of all Special Provisions, Specifications, Drawings, Addenda, Written Amendments, Change Orders, Shop Drawings, Owner-approved submittals, and samples at the site in good order and annotated to show all changes made during the construction process. These documents shall be available to the Owner for examination and shall be submitted to the Owner upon completion of the Work. As-built information (including dimensions, materials, existing utilities) shall also be included on the Drawings. Progress payments may be withheld for failure to keep neat, accurate and complete record drawings.
- 5.2 The Contractor shall include any field changes, deviations from the Drawings due both to field conditions and Change Orders.
- 5.3 Record information for projects shall include the following as a minimum:
- A. Size, horizontal and vertical location of all existing utilities uncovered during the course of the work. This shall include telephone cables and conduits, TV cables and conduits, electrical cables and conduits, gas lines, water line, sewer force mains, sanitary sewers, storm sewers and the like.
  - B. Horizontal and vertical location of the water, force main, sanitary and storm sewer installed at every 100-foot station, at interconnections, and at fittings, tees, bends and offsets. The frequency and location of survey shots will match the proposed grade elevations shown on the Drawings.
  - C. Location of lines plugged or capped, blowoffs, and air vents.
  - D. Location of all restraining devices used; for example, thrust blocks, retainer glands, tie rods, etc.
  - E. Location of all valves, ends of all lines and other fittings shall be accurately located by triangulation from two permanent structures, which will be visible on the ground surface.
  - F. Location and size of all taps and service line connections made, including corporation stops (if any) used for testing purposes.
  - G. Size (if greater than 3/4"), material, depth and location of both ends of the water service lines are required.
  - H. Rim elevations of manholes and invert elevations of pipes entering and exiting the manhole.
  - I. Size, material, depth and location of sewer laterals including:

1. Measurements taken from the nearest downstream manhole, then measure over perpendicular from that point on the main to the end of the lateral. All measurements are taken from the center of the manhole cover.
  2. If lateral comes out of a manhole in a cul-de-sac; triangulation from that manhole will be required.
  3. Measured depth from the finished grade at the end of the lateral.
- J. Information required for public storm drain systems:
1. Size, material and location of all storm sewer lines.
  2. Elevations shall be provided for all ditch, pipe and structure inverts and rims.
- 5.4 The Record Drawings shall include the following minimum accuracy for survey measurements and field measurements.
- A. Horizontal accuracy:
1. Both surface and subsurface gravity sanitary sewer systems shall be measured in a survey to +/- 1.0 foot at the structure location.
  2. Both surface and subsurface pressure systems shall be measured in a survey to +/- 1.0 foot at the structure location.
  3. Curb/curb and gutter shall be measured in a survey to +/- 1.0 foot at high points, low points, curb returns, and various other positions following good engineering, construction and surveying practices.
  4. Storm Water Management Facilities (SWMF) shall be measured in a survey to +/- 1.0 foot, including the top of bank, bottom of bank, edge of water, pipes, structures, and setback distances to property lines and/or right-of-way lines and any unusual feature of each SWMF.
  5. Utility system components including, but not limited to, fire hydrants, meter vaults, meter boxes, water services, corporation stops, fittings, thrust restraint, laterals, cleanouts, valves, blowoff assemblies, air vent assemblies, water sampling stations, etc. shall be measured in a survey to +/- 1.0 foot.
  6. Project landscaping shall be measured in a survey to +/- 1.0 foot. Only large significant features, such as trees, will be surveyed. The species and caliper (size) shall be noted.
  7. Street signs and light poles shall be measured in a survey to +/- 1.0 foot.

B. Vertical accuracy:

	Survey Accuracy	Field Measurement
Manhole Rim	+/- 0.01 ft.	
Manhole Invert	+/- 0.01 ft.	
Gravity Sewer Slope	+/- 0.02%	
Valve Depth	+/- 0.1 ft.	
Pressure/vacuum systems	+/-0.05 ft.	
SWMF	+/- 0.01 ft.	
Curb/curb and gutter	+/- 0.01 ft.	
Offset		+/- 1.0 ft.
Lateral Depth		+/- 0.25 ft.

The Contractor shall provide on the record drawings, coordinate values (northing's and easting's based on York County, Virginia, monumentation) for the following:

**Vacuum Sewer**

- Valve pits
- Division valves and tracer wire boxes
- Cleanouts including wye fittings on dual service connections
- Lifts
- Horizontal bends 45-degrees (and greater if allowed) and combinations of fittings equaling 45-degrees or greater, spaced no greater than 10-feet of the start of the bends to the bend's terminus
- Wye fittings and mainline branch connections
- Access points
- Reducers
- Ends of stubs

**Gravity Sewer**

- Manholes
- Cleanouts and connections to the main

**Force Mains**

- Valves and tracer wire boxes
- Air release assemblies
- Horizontal bends 45-degrees (and greater if allowed) and combinations of fittings equaling 45-degrees or greater, spaced no greater than 10-feet of the start of the bends to the bend's terminus
- Offsets (vertical and horizontal)
- Connections (tees and taps)
- Limits of lined pipe

**Grinder Pump and Low Pressure Systems**

- Grinder pump
- Control panel
- Air release/cleanout assemblies
- Valves
- Connections to force mains (taps, corporation stops, etc.)

**Water Systems**

- Water meters
- Hydrants
- Valves and tracer wire boxes
- Connections and intersections (taps, etc.)
- Air release assemblies
- Corporation stops/taps to mains
- Offsets (vertical and horizontal)
- End of line blow-off assemblies
- Sample stations

The Contractor shall provide all information on all valves installed as part of the project in the chart provided below and is to be included on the Record Drawings.

Item No.	Data	Valve				
1	Project Name					
2	Date Installed					
3	Branch ID					
4	Station No. (0+00)					
5	Valve No. (IMS); to be provided by County					
6	Size (diameter)					
7	Material of Construction (DI, PVC, Brass, etc.)					
8	No. of Turns					
9	Opens (L, R)					
10	Operating Status (NO/NC)					
11	Depth (Elevation from finish grade to operator)					
12	Manufacturer & Model No.					
13	Type *					
14	Casting Date					
15	End Conn. **					
16	Coordinates (northing/easting)					
<p>* FMV = Force Main Valve, ARV = Air Release Valve, FP = Flush Point, FMCV = Force Main Check Valve, WB = Wire Box, NRS = Non Rising Stem, GV = Gate Valve, BFV = Butterfly Valve, BV = Ball Valve, GA = Gear Actuated, H = horizontal, V = Vertical. NO = Normally Open; NC = Normally Closed</p> <p>** (MJ x type, Flange x type, Restrained, Glue, Threaded, Other)</p>						

*Note: provide no information on Check Valves for items 8 – 10.*

5.5 Record Drawings shall be provided in an electronic format acceptable to the Owner.

**VI. ACCESS TO PROJECT**

6.1. The Owner, the Owner’s Representatives, the Engineer, testing agencies and governmental agencies with jurisdictional interests shall have access to the Project at all times for their observations, inspecting, and testing. The Contractor shall provide proper and safe conditions for such access.



**VII. SURVEYS AND REFERENCE POINTS**

- 7.1. The Owner shall furnish all necessary Drawings showing property lines and/or easements and the location of the Work. The Contractor shall provide a land surveyor licensed in the Commonwealth of Virginia to execute the Work in accordance with the Contract Documents and shall be responsible for the accuracy of this Work.
- 7.2. The Owner has established or will establish such general reference and control points and benchmarks on or about the Project site as will enable the Contractor to proceed with the Work. Prior to issuance of the Notice to Proceed, if the Contractor finds that any previously established reference points have been destroyed or misplaced, the Contractor shall promptly notify the Owner, and the Owner shall replace such general reference points and benchmarks at the Owner's expense.
- 7.3. The Contractor shall protect and preserve the established control points, bench marks and monuments and shall make no changes in locations without the written approval of the Owner. Any of these which may be lost or destroyed or which require shifting because of necessary changes in grades or locations shall, subject to prior approval of the Owner, be replaced and accurately located by the Contractor, at no expense to the Owner.

**VIII. WORKING HOURS**

- 8.1. Normal working hours shall be **7:30** a.m. to **5:30** p.m., Monday through Friday, except that Work shall not start any earlier than one-half hour after sunrise or continue beyond one-half hour prior to sunset. If the Contractor desires to perform Work outside the normal working hours, on Holidays, or on weekends, the Contractor shall request permission, in writing, 48-hours in advance to allow arrangements to be made. The Contractor may be charged an inspection fee by the Owner if such work is approved. Where the Owner specifically directs the Contractor to work outside of normal working hours, no inspection fee will be imposed. The Owner may refuse the Contractor permission to work outside the normal working hours. The Contractor shall make reasonable efforts to avoid undue noise during the night and on weekends, including, but not limited to, fireproof covering necessary to dampen excessive noise from engines or pumps which operate before 7:00 a.m. and after 9:00 p.m., if it is necessary to work at those times.
- 8.2. The Contractor shall designate a representative and furnish a telephone number at which the representative may be contacted at any time after working hours. This representative shall be empowered and authorized to provide such personnel and equipment as may be required to remedy emergency situations that may develop after normal working hours, or on weekends and holidays.
- 8.3. The Contractor shall receive approval of the Owner, in advance, of any work to be performed on Holidays. The Owner reserves the right to deny permission to work on Sundays and/or Holidays without cause.

Holidays are as listed below:

New Years Day	1 <sup>st</sup> day of January
Martin Luther King's Birthday	3 <sup>rd</sup> Monday in January
President's Day	3 <sup>rd</sup> Monday in February
Memorial Day	Last Monday in May
Independence Day	4 <sup>th</sup> day in July
Labor Day	1 <sup>st</sup> Monday in September
<b>Yorktown Day</b>	<b>19<sup>th</sup> day of October</b>

Veteran's Day	11 <sup>th</sup> day of November
Thanksgiving Day	4 <sup>th</sup> Thursday in November
Day after Thanksgiving	Friday after 4 <sup>th</sup> Thursday in November
Christmas Eve	24 <sup>th</sup> day of December
Christmas Day	25 <sup>th</sup> day of December
<b>New Year's Eve</b>	<b>31<sup>st</sup> day of December</b>

If January 1, July 4, **Yorktown Day**, Veterans Day or Christmas fall on a Sunday, the following Monday shall be considered the Holiday. If these dates fall on a Saturday, the previous Friday shall be considered the Holiday. **If any part of a two-day holiday (i.e. Christmas Eve and Christmas Day, New Year's Eve and New Year's Day) falls on a weekend day, the observance of the holidays shall be scheduled at the Owner's discretion in such a way as to result in a four-day weekend.**

The Contractor's attention is called to Section 109-1.5.C.1.d. regarding Owner compensation by the Contractor for overtime work performed outside normal working hours.

## **IX. PROJECT COORDINATION**

### 9.1 Coordination with Owner

- A. The Contractor shall coordinate all construction activities with the Owner and shall obtain the Owner's approval as to schedule of Work, permits, temporary work, and traffic control.
- B. Progress meetings shall be held monthly on a date to be set by the Owner. The Contractor shall be present at all progress meetings. If progress is not made as scheduled, or if the Owner desires to discuss revised progress schedules or the quality of workmanship or other aspects of the work, additional progress meetings can be required.
- C. The Owner may construct or reconstruct any utility service in the highway or street or grant a permit for the same at any time. The Contractor shall not be entitled to any damages occasioned thereby other than a consideration of an extension of time.
- D. When authorized by the Owner, the Contractor shall allow any person, firm, or corporation to make an opening within the limits of the Project upon presentation of a duly executed permit from the Owner. When directed by the Owner, the Contractor shall satisfactorily repair portions of the Work disturbed by the openings. The necessary Work will be paid for as extra Work in accordance with these specifications and shall be subject to the same conditions as the original Work performed.

### 9.2 Coordination with Utilities

- A. The Owner and Contractor agree that disruption to public services shall be avoided whenever possible and minimized when it is not avoidable. In cases where the disruption of existing facilities could adversely impact public service delivery, acceptable duration(s) and time(s) of the outages shall be coordinated between the Contractor and Owner, so as to explicitly minimize disruption to public service delivery.
- B. Before the initiation of any excavation, the Contractor shall locate all existing utilities, culverts, and other structures. Work shall be coordinated with affected utility companies.

Prior to excavation, the Contractor shall contact MISS UTILITY at **811** or (800) 552-7001 and comply with all MISS UTILITY requirements.

- C. All existing utilities, both public and private (including sewer, gas, water, electrical services, etc.), shall be protected and their operation shall be maintained throughout the course of the Work. Any temporary shutdown of an existing service shall be arranged by the Contractor between the Contractor and the responsible agency. The Contractor shall assume full responsibility and defend and hold the Owner harmless from the result of any damage that may occur as a result of the Contractor's activities.
- D. If any utility service is interrupted as a result of accidental breakage or of being exposed or unsupported, the Contractor shall promptly notify the proper authority and shall cooperate with the authority in the restoration of service. If utility service is interrupted, repair work shall be continuous until service is restored. The Contractor shall be responsible for any damage to utilities that are attributable to his neglect or methods of performing the work.
- E. The Owner shall provide Utility companies with copies of the construction plans and or scope of work prior to construction. If requested by the Owner, the Contractor shall provide each affected utility company with a copy of the proposed schedule of progress prior to commencing work.
- F. Existing facilities (such as water and sewer valves) shall be operated only by the facility owner or under the direct supervision of the facility owner's personnel. The Contractor shall inform the owner at least 48-hours in advance of the need for the operation of existing facilities.
- G. At points where the Contractor's operations are adjacent to the properties of any utility, including railroads, and damage to which might result in considerable expense, loss, or inconvenience, Work shall not commence until arrangements necessary for the protection thereof have been completed.
- H. The Contractor shall cooperate with owners of utilities so that location, removal and adjustment operations may progress in a reasonable manner; duplication of adjustment work may be reduced to a minimum; and, services rendered by those parties will not be unnecessarily interrupted.
- I. The Contractor should be aware that in some instances buried cables, gas lines, water lines, etc., two inches and smaller in diameter may have to be excavated by hand and slightly relocated to facilitate construction of the Work under this contract. This shall be considered incidental to the Work, and shall be performed at no additional cost to the Owner.
- J. Should the location of any pipe or conduit greater than two-inches in diameter, pole, or other structures, above or below the ground be such that in the opinion of the Owner or his representative its removal, realignment, or change will be required due to work to be performed under this Contract, the removal, realignment, or change will be done as a Change Order, or will be done by the Owner of the obstructions, without cost to the Contractor. The Contractor shall maintain at his own expense the structures until such removal and before and after such realignment or change. The Contractor shall not be entitled to any claim for damages or extra compensation because of the presence of said structure, or because of any delay in the removal or relocation of the same.

## **X. SUPERVISION**

- 10.1. The Contractor shall supervise and direct the Work, and shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. The Contractor shall employ and maintain on the Project a qualified supervisor who shall have been designated in writing by the Contractor as the Contractor's representative at the site. The supervisor shall have full authority to act on behalf of the Contractor and all communications given to the supervisor shall be the same as if mailed to the business address of the Contractor. The supervisor or a designated representative shall be present on the site at all times as required to perform adequate supervision and coordination of the Work. The Contractor shall notify the Owner in writing prior to any change of supervisor, and receive the Owner's approval for the replacement.
- 10.2. Upon notification to the Contractor, the Owner reserves the right to suspend the Work until such time as a supervisor satisfactory to the Owner is assigned to the project. Contract Time shall not be extended for such suspension nor shall the Contractor be entitled to any additional payment of any kind whatsoever as a result of such suspended work.
- 10.3. Any employee of the Contractor or Subcontractor who is deemed unsuitable may be removed from the job site by the Owner, provided that Written Notice and just cause is given to the Contractor. Said employee shall be removed immediately upon receipt of said Notice.

## **XI. UNCOVERING WORK**

- 11.1. If any work has been covered or concealed without the Owner's approval prior to being covered or concealed, the Owner may request to see such work and it shall be exposed by the Contractor. The Contractor shall pay the cost of opening or uncovering and replacement and shall, in addition, at no cost to the Owner, make the necessary corrections to bring the work into accord with the Contract Documents.
- 11.2. Uncovering work shall be at the Contractor's expense unless the Contractor has given the Owner timely notice of the Contractor's intention to cover the same and the Owner has not acted with reasonable promptness in response to such notice.
- 11.3. If the Owner considers it necessary or advisable that covered Work previously approved be re-inspected or tested by others, the Contractor, at the Owner's request, shall uncover, expose or otherwise make available for observation, inspection or testing as the Owner may require, that portion of the Work in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such Work is defective, the Contractor shall bear all the expenses of such uncovering, exposure, observation inspection and testing and of satisfactory reconstruction. If, however, such Work is not found to be defective, the Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time or both directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate Change Order shall be issued.

## **XII. REMOVAL OF UNACCEPTABLE WORK**

- 12.1. All Work that does not conform to the requirements of the Contract Documents shall be unacceptable.
- 12.2. The Contractor shall remove or correct all unacceptable and defective Work or materials. The replacement of Work and materials shall conform to the Contract Documents or be in a manner

acceptable to the Owner. The Contractor shall bear all costs of such correction and/or removal and replacement.

- 12.3. Work done contrary to or regardless of the instructions of the Owner, Work done beyond the lines shown or as directed, except as herein provided, or any extra Work done without authority, will be considered unauthorized and will not be paid for under the provisions of the Agreement. Work so done may be ordered removed or replaced at no cost to the Owner.
- 12.4. If the Work is defective, or the Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, the Owner may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the Owner to stop the Work shall not give rise to any duty on the part of the Owner to exercise this right for the benefit of the Contractor or any surety or other party. If the Contractor does not remedy, remove, or replace the rejected or condemned Work as instructed by the Owner within the time period stated by the Owner but in no case to exceed 30 Days after receiving written Notice, such remedy, removal, or replacement may be accomplished by the Owner at the Contractor's expense.

### **XIII. SUBSTANTIAL COMPLETION**

- 13.1. Prior to Final Payment, but following completion of all required tests and inspections, the Contractor may request in writing that the Owner certify that the entire Project or any phase of the Project is Substantially Complete and request the Owner issue a Certificate of Substantial Completion. Within fourteen (14) working days the Owner will conduct an inspection of the Project with the Contractor and either issue a Certificate of Substantial Completion or notify the Contractor in writing of the incomplete items. The Certificate and attachments shall include the following:
  - A. A listing of responsibilities for the security, operation, safety, maintenance, utilities and insurance on the substantially completed portion;
  - B. A tentative list of items to be completed or corrected prior to final payment; and,
  - C. The maximum time for items to be completed or corrected prior to final payment.
- 13.2. The Owner shall have the right to exclude the Contractor from the Project or phase of the Work certified to be Substantially Complete; however, the Owner will allow the Contractor reasonable access to complete or correct the Work.

### **XIV. USE OF COMPLETED PORTIONS**

- 14.1. The Owner shall have the right to take possession of and use any completed or partially completed portions of the Work, notwithstanding that the time for completing the entire Work or such portions may not have expired, but such taking possession and use shall not be deemed an acceptance of any Work not completed in accordance with the Contract Documents. If such prior use increases the cost of or delays the Work, the Contractor shall be entitled to such extra compensation or extension of time or both as the Owner and the Contractor may agree.

## **XV. FINAL INSPECTION**

- 15.1. Upon receiving written Notice from the Contractor that the entire Work or an agreed upon portion is complete, the Owner will make a final inspection with the Contractor, and will notify the Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. The Contractor shall immediately take such measures as are necessary to complete such work or remedy such deficiencies.
- 15.2. This procedure shall be repeated until all items are corrected to the satisfaction of the Owner. Only written notification to the Contractor from the Owner will constitute final acceptance of any part of the Work under the Agreement.

## **XVI. CLAIMS**

- 16.1. All claims, disputes, demands and other matters in question arising out of or relating to the Agreement or the Contract Documents, except for claims which have been waived by the Contractor's acceptance of final payment, will be addressed in accordance with the provisions of the Virginia Public Procurement Act and as stated herein; provided, however, the provisions of Section 2.2-4366 of that Act will not be applicable without the separate express written consent of the Owner.
- 16.2. Early or prior knowledge by the Owner of an existing or impending claim for damages could alter the plans, scheduling, or other action of the Owner or result in mitigation or elimination of the effect of the act objected to by the Contractor. Therefore, a written statement describing the act of omission or commission by the Owner or its agents that allegedly caused damage to the Contractor and the nature of the claimed damage shall be submitted to the Owner at the time of occurrence or beginning of the Work upon which the claim and subsequent action are based. If such damage is deemed certain in the opinion of the Contractor to result from his acting on an order from the Owner, he shall immediately take written exception to the order. Submission of a notice of claim as specified shall be mandatory. Failure to submit such notice shall be a conclusive waiver to such claim for damages by the Contractor. An oral notice or statement will not be sufficient nor will a notice or statement after the event.

If the Contractor's claim contains data that cannot be verified by the Owner's records, the data shall be subject to a complete audit by the Owner or its authorized representative if they are to be used as a basis for claim settlement.

If the Contractor wishes to make claim for an increase in the Contract Price or Contract Time, he shall submit all supporting data to the Owner and Engineer within twenty (20) Days from the time of initial occurrence **of the event giving rise to the claim**. Failure to submit such data within twenty (20) Days shall be a conclusive waiver to such claim by the Contractor.

- 16.3 All Claims, disputes, and other matters relating to or arising out of the Agreement or the Contract Documents pertaining to the performance of the Work and claims in respect to changes in the Contract Price or Contract times shall be submitted to the Owner and Engineer in writing. Written Notice of each such claim, dispute or other matter shall be delivered by the Contractor to the Engineer and the Owner promptly (but in no event later than twenty (20) days) after the start of the occurrence or event giving rise thereto, and written supporting data shall be submitted to the Engineer and the Owner promptly, (but not later than twenty (20) days) after the start of such occurrence or event and monthly thereafter for continuing events unless the Owner and Contractor mutually agree to extend the time required to submit the written Notice to allow for the submission of additional accurate data in support of such claim, dispute or other matter. The Owner shall submit

any response to the Engineer and the Contractor within twenty (20) days after receipt of the Contractor's last submittal (unless the Owner requests reasonable additional time to evaluate the claim).

The Engineer shall render a non-binding and non-final written recommendation regarding the manner in which to resolve the dispute within twenty (20) days of receipt of the Owner's response. Engineer's written recommendation shall be used to assist the Owner and Contractor towards the expeditious and amicable resolution of their dispute.

Within ten (10) days of the delivery of Engineer's written recommendation, senior representatives of the Owner and the Contractor, having authority to settle the dispute, and the Engineer, shall meet at a mutually acceptable time and place, and thereafter as often as they reasonably deem necessary, to exchange relevant information and to exercise their reasonable and good faith efforts to expeditiously resolve the dispute. The Owner's and Contractor's representatives will participate in good faith during the negotiation and will each have authority to approve changes in the Contract Time and Price, if any.

In the event a mutually acceptable agreement cannot be reached through negotiation within twenty (20) days of the delivery of Engineer's written recommendation, (or mutually agreeable longer period), or if either party will not meet within ten (10) days of the delivery of said written recommendation, the Owner or Contractor may declare, by written Notice, delivered to the other party and to the Engineer, that the negotiation was unsuccessful. If Owner chooses non-binding mediation, it shall be a condition precedent to the institution of any further administrative, legal or equitable proceedings by either party.

In the event that the negotiation process is unsuccessful and upon the Owner's request that the parties participate in non-binding mediation, the parties shall endeavor to agree to a single mediator to mediate the dispute in a session not to exceed one-half day in length, unless extended by the agreement of both parties. If the parties cannot agree on a single mediator, they shall request the chief judge of the local state circuit court to designate a mediator. Unless the parties mutually agree otherwise, the mediation shall occur within ten (10) days of the mediator's selection. The costs of the mediation shall be paid by the parties on a pro rata basis.

The results of successful mediation will be implemented by a Change Order. Should the mediation be unsuccessful, it shall be terminated by written Notice to all involved by the mediator or Owner or Contractor.

In the event that the Owner does not elect mediation or the mediation is unsuccessful, A formal proceeding may then be instituted by either party in a forum of competent jurisdiction within the Owner's locality. The parties' Agreement, Contract Documents, and their performance obligations shall be governed, interpreted and enforced pursuant to the laws and regulations of the Owner's locality, and in accordance with the laws of the Commonwealth of Virginia without regard to the conflicts of law principles thereof.

All disputes arising out of or relating to this Agreement, the Contract Documents, or the performance obligations of the parties shall be brought in the Circuit Court or Federal Court in Virginia having jurisdiction over the location where the Work will be or has been performed. The Agreement and the Contract Documents shall be governed by, enforced and interpreted pursuant to the laws of the Commonwealth of Virginia without regard to conflicts of law principles.

- 16.5. The Contractor shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with the Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as the Owner and the Contractor may otherwise agree in writing.

## **XVII. ENGINEER'S STATUS**

- 17.1. All Work shall be performed under the general observation of the Engineer (if specified in the Special Provisions, otherwise, the Owner shall serve as the Engineer at its discretion). The Contractor shall carry out the Work in accordance with the Contract Documents. The construction means, methods, techniques, sequences of procedures, and safety precautions and programs in connection with the Work shall be at the direction and the responsibility of the Contractor. The Engineer shall have authority to and shall reject any and all Work whenever it is necessary to do so in order to insure the proper execution of the Work in accordance with the Contract Documents. The Engineer shall have no authority to approve or order changes in the Work that alter the terms or conditions of the Agreement. The Owner shall confirm by written Notice within fourteen (14) calendar Days any oral order, direction, requirement or determination.
- 17.2. In case of the termination of the employment of the Engineer, the Owner may appoint a capable and reputable Engineer as a replacement. The status under the Agreement of the Engineer shall be that of the former Engineer.
- 17.3. Approval by the Engineer of any materials, plans, equipment or drawings proposed by the Contractor, shall be construed only to constitute an approval of general design. Such approval shall not relieve the Contractor for any responsibility for the accurate and complete performance of the work in accordance with Contract Documents, or from any duty, obligation, performance guarantee or other liability imposed upon him by the provisions of the Agreement.
- 17.4 The Contractor may be required to accompany the Owner for an on-site review of the project after award, but prior to the pre-construction conference and issuance of the Notice to Proceed. The purpose of the on-site review will be to compile a property report that will list, according to the following categories, the properties affected by construction as determined mutually by the Contractor and the Owner, or his representative.
- A. Unrestrained access to and from residences and business locations. This includes but is not limited to, the following types of scheduled projects:
    - 1. Street repair (non-emergency) or improvement projects.
    - 2. Utilities repair (non-emergency) or improvement projects.
    - 3. Sidewalk repair (non-emergency) or improvement projects.
  - B. Right to enjoy one's residence or business free of disturbing and unusual environmental changes as a result of an Owner-authorized construction project. Examples of such changes are excessive noise, dust, light, as well as unusual working hours and odors. This includes, but is not limited to, projects such as:
    - 1. Drainage repair (non-emergency) or improvement projects.
    - 2. Sewage repair (non-emergency) or improvement projects.
  - C. The right to properly plan for the relocation of one's personal property which must be moved as a result of an Owner-authorized construction project. This includes, but is not limited to, the following:
    - 1. Trees, shrubs, plants and flowers.
    - 2. Play equipment.

3. Portable buildings.
4. Fences (above grade or underground electric pet containment).
5. Automobiles.

The property report is to remain on file with the Owner and the Contractor until project closeout.

**XVIII. NOTICE TO COMPLY ORDER**

*See page 105-15 18.*

**XIX. STOP WORK ORDER**

*See page 105-16 19.*

End of Section

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CITY/COUNTY OF \_\_\_\_\_

# NOTICE TO COMPLY

Department of \_\_\_\_\_

Pursuant to Section \_\_\_\_\_ of the Code of the City/County of \_\_\_\_\_, Virginia, as amended, a City Manager/County Administrator Designee inspected your site at \_\_\_\_\_ on \_\_\_\_\_, 20\_\_\_\_ at \_\_\_\_\_ a.m. / p.m.

The following conditions of noncompliance were noted:

- SILT FENCE DOWN
- DISTURBED AREAS NOT STABILIZED
- SEDIMENT TRAPPING DEVICES NOT INSTALLED PROPERLY
- TRACKING ON PUBLIC ROAD
- OTHER: \_\_\_\_\_  
\_\_\_\_\_

The following corrective measures are needed to bring you into compliance:

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

These measures are to be completed before \_\_\_\_\_, 20\_\_\_\_.

Notice ordered by \_\_\_\_\_, on \_\_\_\_\_, 20\_\_\_\_.  
(Designee of City Manager/County Administrator)

Hand Delivered \_\_\_\_\_ Certified Mail \_\_\_\_\_

If you have any questions, please call \_\_\_\_\_.  
(Telephone number)

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CITY/COUNTY OF \_\_\_\_\_

# STOP WORK ORDER

Permit Number \_\_\_\_\_

Date \_\_\_\_\_

Department of \_\_\_\_\_

Pursuant to Section \_\_\_\_\_ of the Code of the  
City/County of \_\_\_\_\_, Virginia, as amended, a substantial  
Code violation exists at \_\_\_\_\_. You are  
hereby notified that further work at this location must be

## IMMEDIATELY DISCONTINUED

Corrective Measures Required:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Ordered by: \_\_\_\_\_, on \_\_\_\_\_, 20\_\_\_\_\_.  
(Designee of City Manager/County Administrator)

Notice served to \_\_\_\_\_, on \_\_\_\_\_, 20\_\_\_\_.

Stop Work Order in Effect Until \_\_\_\_\_

\_\_\_\_\_  
(Signature of Enforcement Officer)

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## SECTION 106

### CONTROL OF MATERIAL

#### I. TESTS AND INSPECTIONS

- 1.1. All material and workmanship shall be subject to inspection, examination and test by the Owner at any time during manufacture and/or construction. The Owner shall have the right to reject defective material and workmanship or require their correction.
- 1.2. The Contractor shall provide at its expense the testing and inspection services required by the Contract Documents. The Owner will provide at his expense all inspection and testing services not required by the Contract Documents; provided, however, the Contractor will be responsible for the payment of all failing tests.
- 1.3. The Contractor shall furnish promptly without additional charge all reasonable facilities, labor, and materials, necessary and convenient for making such tests as may be designated in the Contract Documents. The Contractor shall work with the Owner and the Engineer in scheduling and coordinating Owner provided testing or inspection services.
- 1.4. If the Contract Documents, laws, ordinances, rules, regulations or orders of any public body having jurisdiction require any Work (or part thereto) specifically to be inspected, tested, or approved by someone other than the Owner, the Contractor shall assume full responsibility for arranging and obtaining such inspections, tests or approvals, pay all costs in connection therewith, and furnish the Owner the required certificates of inspection, or approval. The Contractor shall also be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for the Owner's acceptance of materials or equipment to be incorporated in the Work, or of materials, mix designs, or equipment submitted for approval prior to the Contractor's purchase thereof for incorporation in the Work.
- 1.5. Inspections, tests or approvals by the Owner shall not relieve the Contractor from its obligations to perform the Work in accordance with the requirements of the Contract Documents.
- 1.6. The failure of the Owner to reject or condemn materials and workmanship not conforming to the Contract Documents shall not prevent the Owner from rejecting materials and workmanship found not to be in accordance with the Contract Documents at any time prior to the acceptance of the completed Work, nor shall it be considered as a waiver of any nonconformance with the Contract Documents which may be discovered later, or as preventing the Owner at any time prior to the expiration of the guarantee period or of the expiration of any applicable statutory limitation period for legal actions for Contractor default from recovering damages for work not in accordance with the Contract Documents.

#### II. LABOR, MATERIALS AND EQUIPMENT

- 2.1. The Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. The Contractor shall at all times maintain good discipline and order at the site.

- 2.2. Unless otherwise specified, the Contractor shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all facilities and incidentals necessary for the furnishing, performance, testing, start-up, and completion of the Work.
- 2.3. All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by the Owner, the Contractor shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable Supplier except as otherwise provided in the Contract Documents.
- 2.4. It shall be the responsibility of the Contractor to legally dispose of all excess material at his expense unless otherwise indicated on the Drawings and/or noted in the Specifications.
- 2.5. No material that is not required for the Work on this Project may be stored on site or within the Project boundaries or on land designated for Project use, unless approved by the Owner in writing prior to placement.

### **III. WORK BY OWNER**

- 3.1. The Owner may perform other work related to the Project at the site by the Owner's own forces, have other work performed by utility owners, or let other direct contracts for Work at the site. If the fact that such other work is to be performed was not noted in the Contract Documents, Written Notice will be given to the Contractor prior to starting any such other work.

End of Section

## SECTION 107

### LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

#### I. PERMITS AND REGULATIONS

- 1.1. The Contractor shall procure all permits and licenses pay all charges, fees and taxes and give all notices necessary and incidental to the due and lawful prosecution of the Work except those provided by the Owner, and specified in the Special Provisions.
- 1.2. The Contractor shall be fully responsible for knowledge of and shall abide by each and every law, rule or regulation of all public bodies having political jurisdiction over the Project and in force at the time of the Contract; including, the safety of persons or property and the protection of persons and property from damage, injury or loss. The Contractor shall erect and maintain all necessary safeguards for such safety and protection and hold harmless the Owner and its agents, officers, or employees against any claim for liability arising from or based on any violation, whether by himself, his agents, his employees or subcontractors. If the Contractor observes that the Contract Documents are at variance with any such law, he shall promptly notify the Owner in writing. The Contractor shall execute and file the documents, statements, and affidavits required under any applicable federal or state law or regulation affecting his Bid or Agreement or prosecution of the Work thereunder. The Contractor shall permit examination of any records made subject to such examination by any federal or state law or by regulations promulgated thereunder by any state or federal agency charged with enforcement of such law. The Contractor shall not be entitled to claim any damages for delay occasioned by compliance with such laws. Where such laws are changed during the course of the Agreement, and where such changes create additional costs to the Agreement or affect the time of the Agreement, such changes shall be made effective through Change Orders prepared in accordance with the Contract Documents.
- 1.3. The Contractor shall comply fully with the U.S. Department of Labor Safety and Health Regulation promulgated under the Occupational Safety and Health Act of 1970, as amended, and under Section 107 of the Contract Work Hours and Safety Standards Act, as amended. The Contractor shall also comply fully with the Overhead High Voltage Act as set forth in Chapter 30, Title 59.1 of the Code of Virginia; Subpart P - "Elevations, Trenching and Shoring", of the Virginia Occupational Safety and Health Standards for Construction Industry; the Virginia Confined Space Standard 1910.146 of the Virginia Occupational Safety and Health Standards for General Industry; and the "Underground Utility Damage Prevention Act" as set forth in Chapter 10.3, Title 56 of the Code of Virginia, 1950, as amended. The above listing of safety laws and regulations is for informational purposes and in no way alters or limits Contractor's responsibility to comply with the safety laws of all public bodies having jurisdiction as set forth in Section 107-1.2 above.

#### II. LAND, EASEMENTS, AND RIGHTS-OF-WAY

- 2.1. Prior to issuance of Notice to Proceed, the Owner shall obtain all land, easements, and rights-of-way necessary for carrying out and for the completion of the work to be performed and pursuant to the Contract Documents, unless otherwise specified herein or otherwise mutually agreed. A land surveyor licensed in the Commonwealth of Virginia must perform the layout. Easements for temporary uses and detours requested by the Contractor and approved by the Owner in lieu of a

detour within the right of way or easement area shall be acquired by the Contractor without the Owner being a party to the Agreement.

- 2.2. The Owner shall provide to the Contractor information that delineates and describes the lands owned, rights-of-way, or easements acquired, and permits obtained.
- 2.3. The Contractor shall provide at its own expense and without liability to the Owner any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials. The Contractor shall not use private property in connection with the Work unless prior written permission is obtained from the property owner. A copy of the written permission indicating the name, address, and phone number of the property owner shall be furnished to the Owner. Upon completion of the use of the property, the Contractor shall also furnish the Owner a release signed by the property owner indicating that the property has been satisfactorily restored.
- 2.4. The Contractor shall acquire all necessary and appropriate Permit(s) from the locality, VDOT, or both, for entrance(s) to off-site storage or lay-down yard(s) and shall abide by all conditions required by the Permit. The Contractor shall be solely responsible for all costs incurred in acquiring the Permit and all costs associated with the efforts necessary to comply to Permit requirements.

The Contractor shall utilize the most direct means of access to the Work area and shall not access the Work area through adjacent neighborhoods, parking areas, etc. Any and all damages to adjacent areas resulting from the Contractor's activities shall be the sole responsibility of the contractor and shall be repaired at the Contractor's expense, to the complete satisfaction of the Owner, locality/VDOT, and the affected property owner(s).

### **III. PROTECTION OF WORK, PROPERTY & PERSONS**

- 3.1. The Contractor will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. The Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to all employees on the Work and other persons who may be affected thereby, all the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction. The Contractor shall provide and maintain all necessary watchmen, barricades, lights, and warning signs, and take all necessary precautions for the protection and safety of the public.
- 3.2. The Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. The Contractor shall erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection, and shall notify owners of adjacent utilities when prosecution of the Work may affect them. The Contractor shall remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by the Contractor, any Subcontractor, or anyone for whose acts any of them will be liable.
- 3.3. The Contractor shall designate a responsible member of its organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated in writing by the Contractor to the Owner.

- 3.4 In accordance with generally accepted construction practices, and the requirements of OSHA, the Contractor shall be solely and completely responsible for conditions of the Project site. This requirement shall apply continuously and not be limited to normal working hours. The Contractor shall comply with Federal and State safety regulations, at the site of the Work and provide such equipment and medical facilities as necessary to supply first aid service to anyone who may be injured. The Contractor shall promptly report in writing to the Owner all accidents whatsoever arising out of, or in connection with, the performance of the Work whether on, or adjacent to, the site and which caused death, personal injury or property damages, giving full details and statement of witnesses. In addition, if death or serious injuries or serious damages are caused, the accidents shall be reported immediately to both the Engineer and the Owner. If any claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts, in writing, to the Owner.
- 3.5 Until final acceptance of the Work by the Owner, the Contractor shall have charge and care thereof and shall take every precaution against damage to the Work or to any part thereof by action of the elements or from any other cause whether installed, in storage, or off-site. The Contractor shall rebuild, repair, restore, and make good damage to any portion of the Work occasioned by any of the foregoing causes before final acceptance and shall bear the expense thereof. The Owner may reimburse the Contractor for repair of damage to Work attributable to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor. In case of suspension of work, the Contractor shall be responsible for the Project and shall take such precautions as may be necessary to prevent damage to the Work, provide for erosion and environmental control and drainage control, and erect any necessary temporary structures, signs, or other facilities at his own expense. During the suspension of Work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established plantings, seedings, and soddings furnished under the Contract and shall take adequate precautions to protect new tree growth and other important vegetation against damage.
- 3.6 Emergency traffic such as police, fire and disaster units shall be provided reasonable access to the work area at all times. The Contractor shall coordinate partial or full street closures with all emergency services, such as police, fire and disaster units, and shall bear the responsibility of notification to same of all closures, blockages and re-openings.
- 3.7 The Contractor shall, during the progress of the Work and as directed by the Owner, remove from the Owner's property and from all public and private property and rights-of-way, at its own expense, all temporary structures, rubbish, debris, piles of earth, foreign matter, and waste materials resulting from his operations. The site of the Work shall be restored to the conditions existing before the Work was started, to the satisfaction of the Owner. Lawns, pavements, sidewalks, and other surfaces shall be preserved where practicable, but if damaged, shall be fully restored.
- 3.8 The Owner may take corrective action if the Contractor fails to perform cleanup and restoration in an orderly, continuous, and expeditious manner. The Owner may take corrective action three days after delivery of notice to do so to the Contractor and deduct the cost from any monies due the Contractor.
- 3.9 The Contractor shall preserve property and improvements along the lines of and adjacent to the Work unless their removal or destruction is called for by the Contract Documents. The Contractor shall use suitable precautions to prevent damage to such property.

- 3.10 When the Contractor finds it necessary to enter on private property, he shall secure from the property owner or lessee a written permit for such entry prior to moving thereon. An executed copy of this permit shall be furnished to the Owner.
- 3.11 The Contractor shall be responsible for damage or injury to property during the prosecution of the Work resulting from any act, omission, neglect, or misconduct in the method of executing the Work or attributable to defective Work or materials. This responsibility shall not be released until final acceptance of the Project.
- 3.12 When direct or indirect damage is done to property by or on account of any act, omission, neglect or misconduct in the method of executing the Work or in consequence of the non-execution thereof on the part of the Contractor, the Contractor shall restore such property to a condition substantially equal to that existing before such damage was done by repairing, rebuilding or restoring, as may be directed by the Owner, or making settlement with the property owner. The Contractor shall secure from the property owner a release from any claim against the Owner without additional compensation therefor. A copy of this release shall be furnished to the Owner.
- 3.13 All property boundary markers shown on the Drawings or discovered during the course of construction shall be protected. All property boundary markers disturbed due to construction activities shall be replaced by the Contractor at no expense to the Owner. Property boundary markers shall be restored by a surveyor licensed in the State of Virginia and all restored property boundary markers shall be shown on the Record Drawings.
- 3.14 The Contractor shall employ a licensed Plumbing Contractor, who shall obtain the necessary permits and shall do all Work on private property in accordance with the International Plumbing Code, latest edition. The Owner will obtain the permission of the property owner to work on private property. No payment will be made for work done on private property until all restoration work is complete to the satisfaction of the Owner and the homeowner.
- 3.15 The Contractor will notify the affected property owners, in writing **Two (2) Work Days** prior to commencement of Work. "Affected Property Owners" shall be those property owners whose properties are affected by construction on the Project in the following manner: (i) restrained access to and from residences and business locations; (ii) interference with the right to enjoy one's residence or business free of disturbing and unusual environmental changes as a result of the Project, such as excessive noise, dust, light, as well as unusual working hours and odors; and (iii) the relocation of personal property, such as trees, shrubs, plants and flowers, play equipment, portable buildings, fences and automobiles, which must be moved as a result of the Project. Such Notice shall be deemed properly given if mailed by first class, postage prepaid, to the address for the property owners shown in the local tax records.
- 3.16 It shall be the Contractor's paramount responsibility to additionally notify each residence and business that construction adjacent to their property is imminent. This notification will be given and noted no less than 48 hours prior to Work commencing adjacent to the affected property. The Notice from the Contractor shall be written and may be hand delivered to each affected residence and business. A separate Notice shall be delivered each time the entrance to each residence and business will be blocked or inaccessible.
- A. If this Notice is mailed, time is to be allowed such that receipt by the addressee is at least 48

hours prior to Work commencement. Such Notice shall be deemed properly given if mailed by first class, postage prepaid, to the address for the property owners shown in the local tax records. A duplicate copy of each mailed Notice is to be forwarded to the Owner.

- B. If this Notice is hand delivered, a duplicate copy of each Notice is to be forwarded to the Owner indicating the date of delivery and if personal contact was achieved.

#### **IV. ENVIRONMENTAL STIPULATIONS**

- 4.1. Any cost associated with violations of the law including, but not limited to, remediations, clean up cost, fines, administrative or civil penalties or charges, and third party claims imposed on the Owner by any regulatory agency or by any third party as a result of the Contractor's noncompliance with federal, state, or local environmental laws and regulations or nuisance statutes by the Contractor or by Subcontractors, consultants, sub-consultants, or any other persons, corporations or legal entities retained by the Contractor for this Agreement, shall be paid by the Contractor.

No separate payment will be made for the Work or precautions described herein except where provided for as a specific item in the Agreement or except where provision has been made for such payment in these specifications.

- 4.2. Pollution:

- A. Water

The Contractor shall exercise every reasonable precaution throughout the duration of the project to prevent pollution of rivers, streams, and impoundments. Pollutants such as chemicals, fuels, lubricants, bitumens, raw sewage, paints, sedimentation, and other harmful material shall not be discharged into or alongside rivers, streams, or impoundments or into channels leading to them.

Construction discharge water shall be filtered to remove deleterious materials prior to discharge into state waters. During specified spawning seasons, discharges and construction activities in spawning areas of state waters shall be restricted so as not to disturb or inhibit aquatic species that are indigenous to the waters. Neither water nor other effluence shall be discharged onto wetlands or breeding or nesting areas of migratory waterfowl. When used extensively in wetlands, heavy equipment shall be placed on mats. Temporary construction fills and mats in wetlands and flood plains shall be constructed of approved non-erodible materials and shall be removed by the Contractor to natural ground when the Owner so directs.

If the Contractor dumps, discharges, or spills any oil or chemical that reaches or has the potential to reach a waterway, he shall immediately notify all appropriate jurisdictional state and federal agencies and shall take immediate actions to contain, remove, and properly dispose of the oil or chemical.

Excavation material shall be disposed of in approved areas above the mean high water mark shown on the plans in a manner that will prevent the return of solid or suspended materials to state waters. If the mark is not shown on the plans, the mean high water mark shall be considered the elevation of the top of stream banks.

Construction operations in rivers, streams, or impoundments shall be restricted to those areas where channel changes are shown on the plans and to those that shall be entered for the construction of structures. Rivers, streams, and impoundments shall be cleared of false-work, piling, debris, or other obstructions placed therein or caused by construction operations.

The Contractor shall prevent stream constriction that would reduce stream flows below the minimum, as defined by the State Water Control Board, during construction operations. If it is necessary to relocate an existing stream or drainage facility temporarily to facilitate construction, the Contractor shall design and provide temporary channels or culverts of adequate size to carry the normal flow of the stream or drainage facility. The Contractor shall submit a temporary relocation design to the Owner for review and acceptance in sufficient time to allow for discussion and correction prior to beginning the work the design covers. Costs for the temporary relocation of the stream or drainage facility shall be included in the Contract Price for the related pipe or box culvert.

When a live watercourse must be crossed by construction vehicles more than twice in any six month period, a temporary vehicular stream crossing constructed of nonerodible material shall be provided.

Contractor shall comply with all provisions of the latest edition of the Virginia Erosion and Sedimentation Control Handbook.

**B. Air**

The Contractor shall comply with the provisions of the State Air Pollution Control Law and Rules of the State Air Pollution Control Board, including notifications required therein.

Burning shall be performed in accordance with applicable local laws and ordinances and under the constant surveillance of watchpersons. Care shall be taken so that the burning of materials does not destroy or damage property or cause excessive air pollution. The Contractor shall not burn rubber tires, asphalt, used crankcase oil, or other materials that produce dense smoke. Burning shall not be initiated when atmospheric conditions are such that smoke will create a hazard to the motoring public or airport operations. Provisions shall be made for flagging vehicular traffic if visibility is obstructed or impaired by smoke. At no time shall a fire be left unattended.

Asphalt mixing plants shall be designed, equipped, and operated so that the amount and quality of air pollutants emitted will conform to the Rules of the State Air Pollution Control Board.

Emission standards for asbestos incorporated in the EPA's National Emission Standards for Hazardous Air Pollutants apply to the demolition or renovation of any institutional, commercial, or industrial building, structure, facility, installation, or portion thereof that contains friable asbestos.

C. Noise

The Contractor's operations shall be performed so that exterior noise levels measured during a noise-sensitive operation shall not be more than 80 decibels within 100 feet from the point of origin or within ten (10) feet of a noise-sensitive facility. Noise-sensitive facility is any facility for which lowered noise levels are essential if the facility is to serve its intended purpose. Such facilities include, but are not limited to, those associated with residences, hospitals, nursing homes, churches, schools, libraries, parks and recreational areas.

The Owner may monitor construction-related noise. If construction noise levels exceed the specified limits, the Contractor shall take corrective action before proceeding with operations. The Contractor shall be responsible for costs associated with the abatement of construction noise and the delay of operations attributable to noncompliance with these requirements.

The Owner may prohibit or restrict to certain portions of the project any work that produces objectionable noise between 9 P.M. and 7 A.M. If other hours are established by local ordinance, the local ordinance shall govern.

Equipment shall in no way be altered so as to result in noise levels that are greater than those produced by the original equipment.

When feasible, the Contractor shall establish haul routes that direct his vehicles away from developed areas and ensure that noise from hauling operations is kept to a minimum.

These requirements are not applicable if the noise produced by sources other than the Contractor's operation at the point of reception is greater than the noise from the Contractor's operation at the same point.

D. Forest Fires

The Contractor shall take all reasonable precautions to prevent and suppress forest fires in any area involved in construction operations or occupied by him as a result of such operations. The Contractor shall cooperate with the proper authorities of the state and federal governments in reporting, preventing, and suppressing forest fires. Labor, tools, or equipment furnished by the Contractor upon the order of any forest official issued under authority granted the official by law shall not be considered a part of the Contract. For fires originating by no fault of the Contractor, the Contractor may negotiate with the proper forest official for compensation for such labor, tools, or equipment.

4.3. Archeological, Paleontological, and Rare Mineralogical Findings:

In the event of the discovery of prehistoric ruins, Indian or early settler sites, burial grounds, skeletal remains, relics, artifacts, fossils, stone tools, meteorites, or other articles of archeological, paleontological, or rare mineralogical interest during the prosecution of work, the Contractor shall act immediately to suspend work at the site of the discovery and notify the Owner. The Owner will immediately notify the proper state authority charged with the responsibility of investigating and evaluating such finds. The Contractor shall cooperate and, upon request by the Owner, assist in

protecting, mapping, and removing the findings. Findings shall become the property of the Owner unless they are located on federal lands, in which event they shall become the property of the U.S. government.

When such work delays the progress of the Work, the Owner will give consideration to adjustments in the Contract Time limit. However, no adjustment in Contract Price nor Time will be allowed for delays that do not exceed 2 working days from the time the Contractor is notified to stop work.

## **V. TEMPORARY FACILITIES**

- 5.1. The Contractor shall provide and maintain in a neat, sanitary condition such accommodations for the use of employees as may be necessary to comply with the requirements of any governing body and regulatory agency having jurisdiction.

The Contractor shall pay for and furnish temporary facilities (such as light, power, and water) complete with connecting piping, wiring, lamps, and similar equipment as necessary. The Contractor shall install, maintain, and remove temporary facilities upon completion of the Work. The Contractor shall obtain all permits and bear all costs in connection with temporary facilities at no expense to the Owner. The use of temporary facilities shall be in compliance with the requirements of the facility owner.

- 5.2. The Contractor shall provide at least one self-contained single-occupant toilet unit of the chemical, or aerated recirculation type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar non absorbent material. Unit shall be emptied and serviced regularly

## **VI. EMERGENCIES**

- 6.1 In emergencies affecting the safety of persons, or the Work, or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the Owner, shall act to prevent threatened damage, injury or loss. The Contractor shall give the Owner prompt Written Notice of any significant changes in the Work or deviations from the Contract Documents caused thereby. Any compensation, claimed by the Contractor on account of emergency work, shall be determined by agreement between the Owner and the Contractor, and a Change Order shall be issued to document the changes.

## **VII. WARRANTY AND GUARANTEE**

- 7.1. The Contractor shall warrant and guarantee to the Owner that all Work is in accordance with the Contract Documents and is not defective. Prompt notice of all defects shall be given to the Contractor. The Contractor shall promptly correct all defective Work performed and replace defective materials or items found deficient during the final inspection, in a manner satisfactory and at no additional cost to the Owner for a period of one (1) year following the date of Substantial Completion; provided, however, if the local ordinances or code regarding warranties and guarantees, or if any provision in the local ordinances or code regarding the timing of performance or defect bonds conflicts with such one (1) year period, the local ordinance or code shall control. This warranty and guarantee shall not operate as a waiver of any of the rights and remedies of the Owner for default under or breach of the Agreement which rights and remedies may be exercised at any time within the period of any applicable statute of limitations.

- 7.2. Where defective Work (and damage to other Work resulting therefrom) has been corrected, removed or replaced under this Article, the correction period hereunder with respect to such Work will be extended for an additional period of one (1) year after such corrections or removal and replacement has been satisfactorily completed. Repetitive malfunction of an equipment or product item shall be cause for replacement and an extension of the correction period to a date one (1) year following acceptable replacement. A repetitive malfunction shall be defined as the third failure of an equipment or product item following original acceptance.
- 7.3. If the Contractor does not promptly correct the defective Work or replace defective materials, the Owner may have the defective Work corrected or the rejected Work removed and replaced, and all costs of such removal and replacement shall be paid by the Contractor.
- 7.4. Certain equipment or items may be required in the Contract Documents to be warranted for periods longer than one year.
- 7.5. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Contract Documents or by Change Order.

#### **VIII. OPENING SECTIONS OF PROJECTS TO TRAFFIC**

- 8.1. When specified in the Contract or when directed by the Owner, certain sections of the Work may be opened to traffic.
- 8.2. On any section of the Work opened by order of the Owner where the Contract Documents do not provide for traffic to be carried through the Work and the Contractor has not been dilatory in prosecuting the Work, the Contractor will not be required to assume any expense entailed in maintaining the road for traffic. Such expense will be borne by the Owner or will be compensated for by Change Order. Repair of slides and repair of damage attributable to traffic will be compensated for by Change Order. The cost of all other repairs shall be borne by the Contractor.
- 8.3. On any section of the Work opened by the order of the Owner where the Contract Documents do not provide for traffic to be carried through the Work, any additional cost for the completion of other items of Work that are occasioned because of the changed working conditions will be compensated by Change Order.
- 8.4. If the Contractor is dilatory in completing the Work, he shall not be relieved of the responsibility for maintenance during the period the section is opened to traffic prior to final acceptance. Any expense resulting from the opening of such portions under these circumstances, except for slides, shall be borne by the Contractor. The Contractor shall conduct the remainder of the construction operations so as to cause the least obstruction to traffic.

#### **IX. NO WAIVER OF LEGAL RIGHTS**

- 9.1. The Owner shall not be precluded or estopped by any measurement, estimate, or certificate made either before or after final acceptance of the Work and payment therefor from showing (1) the true amount and character of the Work performed and materials furnished by the Contractor, (2) that any such measurement, estimate, or certificate is untrue or incorrectly made, or (3) that the Work or materials do not conform with the provisions of the Contract. The Owner shall not be precluded or

estopped, notwithstanding any such measurement, estimate, or certificate, and payment in accordance therewith, from recovering from the Contractor or his surety, or both, such damage as it may sustain by reason of his failure to comply with the terms of the Contract. Neither the acceptance by the Owner or any representative of the Owner, nor any payment for or acceptance of the whole or any part of the Work, nor any extension of time, nor any possession taken by the Owner shall operate as a waiver of any portion of the Contract or of any power herein reserved or of any right to damages. A waiver of any breach of the Contract shall not be held to be a waiver of any other or subsequent breach. The Owner reserves all rights, privileges, immunities and defenses available to it at law.

End of Section

## SECTION 108

### PROSECUTION AND PROGRESS OF WORK

#### I. PATENT FEES AND ROYALTIES

- 1.1. The Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of the Owner its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by the Owner in the Contract Documents.
- 1.2. To the fullest extent permitted by Laws and Regulations, the Contractor shall indemnify and hold harmless the Owner, the Engineer, the Engineer's Consultants and the officers, directors, employees, agents and other consultants of each and any of them from and against all claims, costs, losses and damages arising out of or resulting from any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product or device not specified in the Contract Documents.

#### II. TAXES

- 2.1. The Contractor shall pay all sales, consumer, use and other similar taxes required to be paid by the Contractor in accordance with the Laws and Regulations of the Project that are applicable during the performance of the Work. (The Contractor may apply to the Virginia Department of Environmental Quality for tax exempt status for certain wastewater products.)

#### III. NOTICE TO PROCEED

- 3.1. Written Notice to Proceed will be given after the Agreement has been executed and the required Bid Security and insurances have been filed with and approved by the Owner.
- 3.2. The Contractor shall notify the Owner and all other governing bodies having jurisdiction, of the time and location that work will begin at least 48 hours prior to beginning Work.

#### IV. PRE-CONSTRUCTION CONFERENCE

- 4.1. Within ten (10) Days of the Effective Date of the Agreement, a conference attended by the Contractor, the Owner, and others as appropriate will be held to discuss the Project, and to discuss procedures relating to Shop Drawings, submittals, Applications for Payment, and other Project issues, and to establish a working relationship among the parties as to the Work.

#### V. CONSTRUCTION PROGRESS SCHEDULE

- 5.1. Within ten (10) Days after the Effective Date of the Agreement, the Contractor shall submit a written schedule to the Owner showing the proposed order of Work and indicating the time required for completion of major items of Work. This schedule shall take into account the passage or handling of traffic with the least practicable interference and the orderly, timely and efficient prosecution of the

Work. The schedule will be used as an indication of the sequence of the major construction operations and as a check on the progress of the Work.

- 5.2. The Contractor shall update the progress schedule monthly to reflect any schedule changes required to complete the remaining Work in accordance with the requirements of the Contract Documents. The updated schedule shall be submitted to the Owner for acceptance with the monthly application for progress payment; no payment will be made if the updated schedule is not submitted. All proposed adjustments in the progress schedule shall generally conform to the progress schedule then in effect and will comply with any provisions of the general requirements applicable thereto.

## **VI. SUBCONTRACTS**

- 6.1. Except as otherwise noted, contract Work, the cost of which is at least fifty percent (50%) of the total Contract Price shall be performed by the Contractor's own organization.
- 6.2. No part of the Work shall be transferred or subcontracted without prior written consent of the Owner, and no such consent or approval shall release the Contractor from any obligations to the Owner or persons employed by the Subcontractors, or to those supplying materials to the Subcontractors.
- 6.3. The Contractor agrees that it is as fully responsible to the Owner for the acts and omissions of its Subcontractors and persons either directly or indirectly employed by the Subcontractors as it is for the acts or omissions of persons directly employed.
- 6.4. Nothing contained in the Agreement shall create any contractual relation between any Subcontractor and the Owner.

## **VII. COMMENCEMENT AND PROSECUTION OF WORK**

- 7.1. The Contractor shall commence Work within ten (10) Days of the date specified in the Notice to Proceed. Time being of the essence of this Project, the Contractor shall prosecute the Work diligently, using such means and methods of construction as will secure its full completion within the time period specified in the Agreement. No Work shall be done at the site prior to the date specified in the Notice to Proceed.
- 7.2. The Contractor shall proceed with the Work at such rate of progress to insure full completion within the Contract Time. It is expressly understood and agreed, by and between the Contractor and the Owner, that the Contract Time for the completion of the Work as specified in the Agreement is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the Project.
- 7.3. The Contract Time will commence on the date indicated in the Notice to Proceed.
- 7.4. Once the Contractor has commenced Work, it shall be prosecuted continuously and to the fullest extent possible except for interruptions caused by delays authorized or ordered by the Owner.
- 7.5. Gifts, gratuities, or favors shall not be given or offered by the Contractor to personnel of the Owner.
- 7.6. The Contractor shall not employ any personnel of the Owner or the Engineer for any services without the prior written consent of the Owner.

- 7.7. Workers shall have sufficient skill and experience to perform properly the Work assigned to them. Workers engaged in special or skilled work shall have sufficient experience in such work and in the operation of equipment required to perform it properly and satisfactorily. Any person employed by the Contractor or any subcontractor who, in the opinion of the Owner, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Owner, be removed forthwith by the Contractor or subcontractor employing the person and shall not be employed again on any portion of the work without the approval of the Owner.
- 7.8. Equipment shall be of sufficient size and in such mechanical condition as to meet the requirements of the Work and produce a satisfactory quality of work. Equipment and the Contractor's methods and means shall be such that no damage to the roadway, adjacent property, or other highways will result from its use. The Owner may order the removal and require replacement of unsatisfactory equipment.

### **VIII. SUSPENSION OF WORK**

- 8.1. The Owner may, at any time and without cause, suspend the Work or any portion thereof for a period of not more than 90 Days or such further time as agreed upon by the Contractor, by Written Notice to the Contractor. Such Notice shall specify the date on which Work shall be resumed and the Contractor shall resume the Work on the date so specified. The Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension if the Contractor makes a claim in accordance with the Contract Documents, except that no such increase or extension shall be allowed if the suspension was due to a failure by the Contractor to perform the Work in accordance with the Agreement.

- 8.2 The Owner may decline to approve or, because of subsequently discovered evidence, nullify the whole or part of any Certificate of Payment to such extent as may be necessary to protect the Owner from loss on account of:**

- a. Defective Work not remedied;**
- b. Claims filed or reasonable evidence indicating probable filing of claims against the Contractor;**
- c. Failure of the Contractor to make payments properly to subcontractors or for materials or labor;**
- d. A reasonable doubt that the Contract can be completed for the balance then unpaid;**
- e. Damage to the Owner by another Subcontractor;**
- f. Failure to maintain (each month) the record set of drawings and specifications, or a failure to provide the Owner record drawings and specifications within 30 calendar days from the date of the Certificate of Substantial Completion;**
- g. Failure to periodically remove and dispose of accumulated debris, rubbish, and discarded/damaged materials;**
- h. Persistent failure to carry out the Work in accordance with the Contract Documents;**
- i. A reasonable doubt that the Work will be completed within the Contract Time.**

- 8.3. When the above grounds are resolved to the satisfaction of the Owner, payment shall be made for amounts withheld therefore.**

## **IX. TERMINATION OF AGREEMENT**

### **9.1. Termination for the Convenience of the Owner**

The performance of Work under this Agreement may be terminated by the Owner in accordance with this section in whole, or in part(s), whenever the Owner shall determine that such termination is in the best interest of the Owner. Any such termination shall be effected by delivery to the Contractor of a notice of termination specifying the extent to which performance of Work under the Agreement is terminated, and the date upon which such termination becomes effective.

After receipt of a notice of termination, and except as otherwise directed by the Owner, the Contractor shall:

- A. Stop Work under the Agreement on the date and to the extent specified in the notice of termination.
- B. Place no further orders or subcontracts for materials, services, or facilities, except as may be necessary for completion of such portion of the Work under the Agreement that is not terminated.
- C. Terminate all orders and subcontracts to the extent that they relate to the performance of the Work terminated by the notice of termination.
- D. Assign to the Owner, and as directed by the Owner, all of the right, title and interest of the Contractor under the orders and subcontracts so terminated. The Owner shall have the right and discretion to settle or pay any and all claims arising out of the termination of such orders and subcontracts.
- E. Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts, with the approval or ratification of the Owner. This approval or ratification will be final for all purposes of this section.
- F. Transfer title and deliver to the Owner, as directed by the Owner, the fabricated or unfabricated parts, Work in process, completed Work, supplies, and other materials produced as a part of or acquired in connection with the performance of the Work terminated by the notice of termination, and the completed or partially completed plans, drawings, information and other property which, if the Agreement has been completed, would have been required to be furnished to the Owner.
- G. Use his best efforts to sell as directed or authorized by the Owner, property of the type referred to in Paragraph F above; provided, however, that the Contractor shall not be required to extend credit to any purchaser. The proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the Owner to the Contractor under this Agreement or shall otherwise be credited to the Contract price or cost of the Work covered by this Agreement or paid in such manner as directed by the Owner. The Contractor may acquire any such property under the conditions prescribed and at a price or prices approved by the Owner.
- H. Complete performance of that Work which was not terminated by the Owner.

- I. Take such action as may be necessary, or as the Owner may direct, for the protection and preservation of the property related to this Agreement which is in the possession of the Contractor and in which the Owner has, or may acquire, an interest.
- J. Within 30 Days after the receipt of the Notice of termination, the Contractor may submit a list to the Owner for approval, certified as to quantity and quality of any or all items of, inventory not previously disposed of, exclusive of items, the disposition of which has been directed or authorized by the Owner, and may request the Owner to remove such approved items or enter into a storage agreement covering the same. Not later than 15 Days thereafter, the Owner will accept title to such approved items and remove them or enter into a storage agreement covering same. The list submitted shall be subject to final verification by the Owner upon removal of the items, or if the items were stored within 45 Days from the date of submission of the list. Any necessary adjustment to correct the list as submitted shall be made prior to final settlement.
- K. Within 30 Days after receipt of the notice of termination, the Contractor shall submit to the Owner his termination claim. Such claim shall be submitted in writing. Upon failure of the Contractor to submit its termination claim within the time allowed, the Owner may, at its discretion, reject such termination claim. Such termination claim shall include the cost of the following:
  - 1. The cost of supplies accepted by the Owner and not previously paid for by the Owner, appropriately adjusted for any saving of freight or other charges.
  - 2. The cost incurred in the performance of the Work terminated, including Initial cost and preparatory expense allocable thereto, but exclusive of any cost attributable to supplies paid or to be paid for by the Owner.
  - 3. The cost of settling and paying claims arising out of the termination of Work under subcontracts or orders which are properly chargeable to the terminated portion of the Agreement, exclusive of amounts paid or payable on account of supplies or materials delivered or services furnished by subcontractors or vendors prior to the effective date of notice of termination and previously paid for by the Owner.
  - 4. A reasonable amount of profit or commission, which will be determined based on the Project's specific overhead and expense data at the rate computed in the original Contract Price or, at the discretion of the Owner, as determined by an audit. The cost of the audit will be borne by the Contractor.
  - 5. Cost of reasonable storage, transportation and other costs incurred in connection with the protection or disposition of property allocable to this termination portion of the Agreement.
  - 6. The total sum to be paid to the Contractor shall not exceed the Contract Price as reduced by the amount of payments previously made and its further reduced by the Contract Price of Work not terminated. Said total sum shall also be reduced by the reasonable value, as determined by the Owner, of property which is destroyed, lost, stolen, or damaged so as to become undeliverable to the Owner or to a buyer.

## 9.2. Termination with Cause/Default

In the event that the Contractor shall for any reason or through any cause be in default of the terms of this Agreement, the Owner may give the Contractor written Notice of such default by certified mail/return receipt requested at the address set forth herein.

Unless otherwise provided, Contractor shall have ten (10) Days from the date such notice is mailed in which to cure the default. Upon failure of the Contractor to cure the default, the Owner may immediately cancel and terminate this Agreement as of the mailing date of the default notice.

Upon termination, the Contractor shall withdraw its personnel and equipment, cease performance of any further Work under this Agreement, and turn over to the Owner any Work in process for which payment has been made.

In the event of violations of law, safety or health standards and regulations, this Agreement may be immediately canceled and terminated by the Owner and provisions herein with respect to opportunity to cure default shall not be applicable.

## 9.3. Contractor's Right to Terminate the Agreement

Should the Work be stopped for a period of 90 Days or more, through no fault of the Contractor, or should the Owner fail to pay the Contractor any payment within a reasonable length of time after said payment shall become due, the Contractor may, upon seven (7) Days written notice to the Owner, stop Work, or terminate the Agreement and recover from the Owner payment for all Work executed, plus any loss actually sustained, plus reasonable profit and damage; provided, however, the total recovery from Owner shall not exceed the Contract Price.

## X. LIQUIDATED DAMAGES

- 10.1. It is mutually understood and agreed by and between the Contractor and Owner that in the execution of the Work, time is an essential element of the Agreement, and it is important that the Work proceed vigorously to completion.
- 10.2. The Owner has the right to deduct *any* liquidated damages from any money in the Owner's hands, otherwise due, or to become due, to the Contractor, and to sue for and recover any additional compensation for damages for non-performance of the Work or failure to complete the Work within the Contract Time.
- 10.3. The assessment of liquidated damages for failure to complete the Work within the Contract Time shall not constitute a waiver of the Owner's right to collect any additional damages that the Owner may sustain by failure of the Contractor to carry out the terms of the Agreement.
- 10.4. In the event of delay in the completion of the Work as specified beyond the Completion Date as adjusted by Change Orders, it would be difficult to determine the exact amount of the loss or damages suffered by the Owner due to delays in completion of the Agreement. Therefore, for every - Day of delay past Completion Date of this Agreement as adjusted by Change Orders, the Contractor and the Contractor's Surety will be liable to the Owner, as liquidated damages for delay and not as a penalty, in the sum designated in Section 102, III. Bid Form, and in paragraph H of the Agreement between Contractor and Owner as set forth in Section 103, for each and every calendar Day the Contractor shall be in default, as follows:

- A. If Substantial Completion has not been achieved by the scheduled Substantial Completion date, the Substantial Completion liquidated damages shall accrue each day until Substantial Completion is achieved.
  - B. If neither Substantial Completion nor Final Completion has been achieved by the scheduled Final Completion date, only Substantial Completion liquidated damages shall occur each day until Substantial Completion is achieved and, thereafter, Final Completion liquidated damages shall accrue each day until Final Completion is achieved.
  - C. If Substantial Completion has been achieved but Final Completion has not been achieved by the Final Completion date, Final Completion liquidated damages shall accrue each day until Final Completion is achieved.
  - D. Substantial Completion liquidated damages and Final Completion liquidated damages shall not run concurrently.
  - E. The scheduled Final Completion date shall not be extended, in any case, solely because Substantial Completion was not achieved by the scheduled Substantial Completion date.
  - F. This paragraph will not apply to delays in completion of the Work due to acts of God, acts of the Public Enemy, acts of the Government (in either its sovereign or contractual capacity), fires, floods, strikes, or unusually severe weather, provided, that the Contractor shall, within five (5) days from the end of the month in which such delay occurred, notify the Owner in writing of the causes of delay and the facts relating thereto; and, provided that such delay occurs prior to the Substantial Completion date or, if Substantial Completion has been achieved, such delay occurs prior to the Final Completion date. Failure to provide such notice shall preclude the Contractor from claiming that delays resulted from the acts of God, acts of the Public Enemy, acts of the Government (in either its sovereign or contractual capacity), fires, floods, strikes, or unusually severe weather.
  - G. Nothing in the above clause shall be interpreted as limiting in any way, the Owner's right to proceed against the Contractor for additional damages or losses. Liquidated damages are for delay only and are in addition to any other rights available to the Owner by contract or law. To the fullest extent permitted by Laws and Regulations, the Contractor shall waive any defense as to the validity of such liquidated damages as set forth herein on the grounds that such liquidated damages are void as penalties or are not reasonably related to actual damages.
- 10.5. Weather shall be considered "unusually severe", only if a weather condition (or any combination of weather conditions) prevents the Contractor from working a number of workdays during a calendar month, which number exceeds the number of workdays listed below for that calendar month. Delays will only be allowed for the amount of lost work days in excess of the following:

January	6	July	4
February	4	August	3
March	4	September	3
April	3	October	3
May	4	November	3
June	4	December	5

- 10.6. The Contractor shall anticipate the potential loss of the number of workdays listed above for each calendar month due to weather, and shall schedule the Work accordingly. Any schedules submitted

shall include the above number of days each month as lost days. The Owner shall determine, upon examination of submitted evidence, whether or not weather prevented the Contractor from performing Work on the days claimed by the Contractor. The Owner's determination shall be final and binding upon the parties.

- 10.7. The Work shall be considered complete when the following criteria have been met; all items of the Work have been constructed, inspected and accepted by the Owner and further that all punch list items have been corrected and the Owner has issued a letter of acceptance.

## **XI. SEPARATE CONTRACTS BY OWNER**

- 11.1. The Owner reserves the right to award other contracts in connection with the Project, the work under which may proceed simultaneously with the execution of this Agreement. The Contractor shall afford other separate contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work, and the Contractor shall take all reasonable action to coordinate its Work with theirs. If the work performed by the separate contractor is defective or so performed as to prevent the Contractor from performing the Work, the Contractor shall immediately notify the Owner upon discovering such conditions. Upon receiving notification, the Owner shall take such appropriate steps as are necessary to allow the Contractor to perform Work under the Agreement, and appropriate extensions of time and change orders will be given to the Contractor, pursuant to the Agreement, to compensate for any delays and extra costs caused by separate contractor's performance.

## **XII. INDEMNIFICATION**

- 12.1. To the fullest extent permitted by Laws and Regulations, the Contractor shall indemnify and hold harmless the Owner, the Engineer, the Engineer's Consultants and officers, directors, employees, agents and other consultants of each and any of them from and against all claims, costs, losses and damages (including, but not limited to all fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs) caused by, arising out of or resulting from the performance of the Work, provided that any such claim, cost, loss or damage: (i) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, and (ii) is caused in whole or in part by any negligent act, errors, omissions, recklessness, or intentionally wrongful conduct of the Contractor, any Subcontractor, any supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of a person or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such person or entity.
- 12.2. In any and all claims against the Owner or any of the Owner's consultants, agents, officers, directors, or employees by any employee (or the survivor or personal representative of such employee) of the Contractor, any Subcontractor, any supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for the Contractor or any such Subcontractor, supplier or other person or organization under workers' compensation acts, disability benefit acts or other employee benefit acts.

- 12.3. The indemnification obligations of the Contractor shall not extend to the damages caused by the Owner and the Owner's consultants, officers, directors, employees or agents resulting from the negligent preparation or approval of, Drawings, or Specifications.

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## SECTION 109

### MEASUREMENT AND PAYMENT

#### I. MEASUREMENT AND PAYMENT PROCEDURES

##### 1.1. General

- A. Measurement will be made on the basis of completion of the Work in accordance with the Contract Documents and the appropriate specification section.
- B. Measurement of quantities will be made by the Contractor in the presence of the Owner. The methods of measurement and computations used in determination of quantities of materials furnished and installed shall be those generally recognized as conforming to good engineering practice.
- C. The term "Complete in Place" will mean that the item of Work shall be furnished and installed in accordance with the Contract Documents complete with all appurtenances necessary for the item to be used for its intended function. Testing and acceptable results shall be included.
- D. Linear foot and vertical foot measurements shall be measured along the horizontal plane of the ground or paved surface.
- E. Area computations shall be made on the surface. Pay measurements for area computations will not exceed plan dimensions as shown on the Drawings, unless otherwise approved by the Owner in writing.
- F. No payment will be made for length, width, or depth, in excess of that shown on the Drawings or specified in the Specifications for any construction, unless otherwise approved by the Owner in writing.
- G. The term "Each" when used as an item of payment will mean complete payment for the Work described in the Contract Documents.
- H. The word "Lump Sum" when used as an item of payment will mean complete payment for Work described in the item, including all materials, labor, and equipment necessary to complete the Work in accordance with the Contract Documents.
- I. Quantities will be measured and paid for in accordance with one of the following methods, and as specified on the Bid form

##### 1.2 Incidental Items

- A. There are numerous incidental items of work that are required to complete the Project. While these items may not be specifically mentioned or illustrated by the Contract Documents and there may be no specific pay items listed for them, the Contractor will be required to perform those incidental tasks that can be anticipated through inspection of the

Contract Documents, inspection of the construction area, and experience in this class of construction.

- B. Items considered incidental work shall not be measured for payment or paid for as such unless specified as unit price by items on the bid form. These items and their costs shall be included in the unit prices or lump sum bid for the pay items unless bid separately.

Incidental items include but are not limited to the following:

1. Allaying dust and mud
2. Daily cleanup
3. Excavation and dewatering
4. Furnishing, hauling, placing, manipulating, and compacting material
5. Location of existing utilities
6. Material royalties
7. Mobilization and demobilization
8. Offsite disposal of excess excavated, surplus and remnant excavated materials
9. Permits, unless provided by the Owner
10. Removal and replacement of existing signs, fences, mail boxes, and similar existing improvements
11. Site restoration and cleanup
12. Site security
13. Stakeout and surveying
14. Traffic control
15. Minor relocation of buried cables, gas lines, water lines, sewer lines, or similar utility lines 2 inches and smaller in diameter
16. Construction entrances
17. Pavement marking
18. Final Surface restoration
19. Top soil and seeding
20. Clearing and grubbing
21. Protection of existing utilities and other facilities.
22. **Shoulder tie-in to restored pavement**
23. **Connections to existing driveways**
24. **Connection to existing and newly constructed mains and force main**
25. **Drainage feature restoration including culvert end-walls, swales, and paved swales**
26. **Record Drawings**
27. **Operations and Maintenance Manuals**
28. **Administrative items of every nature**
29. **CCTV Inspection for post-installation inspection**

### 1.3 Schedule of Values for Lump Sum Bid Items

- A. Within fourteen (14) days after the Effective Date of the Agreement, the Contractor shall submit a schedule of values for all of the Work which shall include quantities and prices of items aggregating the Contract Price and shall subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices shall include an appropriate amount of overhead and profit applicable to each item of Work. The Owner shall review the schedule and shall respond in writing to the Contractor within

ten (10) Days either approving or disapproving the schedule. If the schedule of values is disapproved, the Contractor shall resubmit the schedule with revised value or additional substantiating data and the Owner shall either approve or disapprove the revised schedule within ten (10) Days. No payments shall be processed or approved until the schedule of values is approved by the Owner.

#### 1.4 Application for Progress Payment by Contractor

- A. Unless otherwise provided in this Section, the Owner shall make monthly progress payments to the Contractor on the basis of a duly certified and approved Application for Payment for Work performed during the preceding calendar month as approved by the Owner.
- B. At least ten (10) Days before each partial progress payment (but not more often than once a month), the Contractor shall submit to the Owner an Application for Payment filled out and signed by the Contractor for the Work completed during the period covered by the partial progress payment estimate and supported by such data as is required by the Contract Documents.
- C. The schedule of values for lump sum items established as provided in Section 109-1.2 shall serve as the basis for progress payments and shall be incorporated into a form of Application for Payment acceptable to the Owner.

#### 1.5 Payment for Material on Hand

If payment is requested on the basis of materials and equipment not incorporated in the Work, but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall be accompanied by a bill of sale, invoice or other instrument documenting that the materials and equipment are free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance, all of which will be satisfactory to the Owner. The Owner, at its sole discretion, may not pay for stored materials without prejudice and without cause.

#### 1.6 Review of Applications for Progress Payments

- A. The Owner shall, within ten (10) Days after receipt of each Application for Payment, make such investigations as deemed necessary to verify the accuracy of the Application for Payment and either accept the application as accurate and suitable for payment or return the Application to the Contractor indicating in writing the Owner's reasons for refusing payment. If payment is refused, the Contractor shall make the necessary corrections and resubmit the Application and the Owner shall have an additional ten (10) Days after receipt of the corrected Application for Payment from the Contractor to determine whether this Application is accurate and suitable for payment.
- B. The Owner shall, within 30 Days after acceptance of the Application for Payment, make payment to the Contractor. The Owner may refuse to make payment of the full amount because claims have been made against the Owner on account of the Contractor's performance or furnishing of the Work, or because Liens have been filed in connection with the Work, or because there are other claims entitling the Owner to a set-off against the

payment. The Owner shall give the Contractor immediate written Notice stating the reasons for its failure to make payment.

- C. The Owner may also refuse to make payment of the full amount because there are other items entitling the Owner to retain set-offs from the amount recommended, including but not limited to:
1. Owner compensation to the Engineer for actual costs for extra personnel hours for labor plus expenses because of the following Contractor caused events:
    - a. Witnessing re-testing of corrected or replaced defective work.
    - b. Return visits to manufacturing facilities to witness factory testing or re-testing.
    - c. Evaluation of proposed substitutes and in making changes to Contract Documents occasioned thereby.
    - d. Overtime worked by the Contractor necessitating the Engineer, Resident Project Representative (and support staff, if any), to work overtime.
  2. Liability for liquidated damages incurred by the Contractor as set forth in the Agreement.
  3. Loss to Owner caused by Contractor acts or omissions including, but not limited to:
    - a. Defective Work not remedied;
    - b. Claims filed or reasonable evidence indicating probable filing of claims against the Contractor;
    - c. Failure of the Contractor to make payments properly to subcontractors or for materials or labor;
    - d. A reasonable doubt that the Project can be completed for the balance then unpaid;
    - e. Failure to maintain (each month) the record set of Drawings and Specifications. Failure to provide the Owner with record Drawings and Specifications within thirty (30) calendar Days from the date of the Substantial Completion;
    - f. Failure to periodically remove and dispose of accumulated debris, rubbish, and discarded/damaged materials;
    - g. Persistent failure to carry out the Work in accordance with the Contract Documents;

- h. A reasonable doubt that the Work will be completed within the Contract Time.
- 4. Failure of the Contractor to submit an updated progress schedule or other required supporting documentation (if requested by the Owner) to the Owner with the monthly application for progress payment.

#### 1.7 Retained Funds

- 1. The Owner shall retain **five (5)** percent (%) of the total amount of each partial progress payment to assure faithful performance of the Agreement by the Contractor. The Owner will release all retainage upon Final Payment.
- 2. Pursuant to and in accordance with Section 2.2-4334 of the Code of Virginia, the Contractor may exercise the option to use the escrow account utilization procedure with respect to retained funds. The Contractor may do so by indicating its preference for this procedure in the appropriate space provided on the Bid Form.
- 3. Should this option be selected, the Contractor shall execute the Escrow Agreement and shall submit same to the Owner in the manner prescribed by law. If the Escrow Agreement form is not submitted as noted, the Contractor shall forfeit such rights to the use of the escrow account utilization procedure.
- 4. In order to have retained funds paid to an escrow account, the Escrow Agreement shall be executed by the Contractor, the escrow agent, and the surety, and shall be submitted by the Contractor to the Owner for approval by the Owner's attorney. The Contractor's escrow agent shall be a trust company, bank or savings institution with its principal office located in the Commonwealth of Virginia. The Escrow Agreement shall contain the complete address of the escrow agent and surety, and the executed Escrow Agreement will be authority for the Owner to make payment of retained funds to the Escrow Agent. After approving the Escrow Agreement, the Owner shall pay to the escrow agent the funds retained as provided herein except that funds retained for lack of progress or other deficiencies on the part of the Contractor shall not be paid to the Escrow Agent. The Escrow Agent may, in accordance with the terms of the Escrow Agreement, invest the funds paid into the escrow account and pay earnings on such investments to the Contractor or release the funds to the Contractor provided that such funds are fully secured by approved securities.
- 5. Retained funds invested and securities held as collateral for retainage may be released only as and when directed by the Owner. When the Final Payment is paid, the Owner shall direct to the Contractor monies due as determined by the Owner. The Owner reserves the right to recall retained funds and to release retained funds to the surety upon receipt of written request from the Contractor or in the event of default.
- 6. The escrow account procedure shall apply to any contract for the sum of Two Hundred Thousand Dollars (\$200,000), or more, for construction of highways,

roads, streets, bridges, parking lots, demolition, clearing, grading, excavating, paving, pile driving, miscellaneous drainage structures, and the installation of water, gas, sewer lines, and pumping stations.

1.8 Conditions of Payment to Contractor

- A. All material and Work covered by partial progress payments shall thereupon become the sole property of the Owner, but this provision shall not be construed as relieving the Contractor from the sole responsibility for the safety and protection of all materials and Work upon which payments have been made or the restoration or replacement of any damaged or stolen Work or property or as a waiver of the right of the Owner to require the fulfillment of all the terms of the Agreement
- B. Prior to Substantial Completion, the Owner, with the concurrence of the Contractor, may use any completed or substantially completed portions of the Work. Such use shall not constitute an acceptance of such portions of the Work.
- C. The Owner shall have the right to enter the premises for the purpose of doing work not covered by the Contract Documents. This provision shall not be construed as relieving the Contractor of the sole responsibility for the care and protection of the Work, or the restoration of any damaged Work except such as may be caused by agents or employees of the Owner.
- D. The Contractor shall indemnify and save the Owner or the Owner's agents harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, material men, and furnishers of machinery and parts thereof, equipment, tools and all supplies, incurred in the furtherance of the performance of the Work. The Contractor shall, at the Owner's request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived. If the Contractor fails to do so the Owner may, after having notified the Contractor, either pay unpaid bills or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed, in accordance with the terms of the Contract Documents but in no event shall the provisions of this Section be construed to impose any obligations upon the Owner to either Contractor, the Surety, or any third party. In paying any unpaid bills of the Contractor, any payment so made by the Owner shall be considered as a payment made under the Contract Documents by the Owner to the Contractor and the Owner shall not be liable to the Contractor for any such payments made in good faith.
- E. The Contractor shall take one of the two following actions within seven (7) days after receipt of amounts paid to the Contractor by the Owner for Work performed by the Subcontractor under the Agreement:
  - 1. Pay to the Subcontractor the proportionate share of the total payment received attributable to the Work performed by the Subcontractor under the Agreement; or
  - 2. Notify the Owner and Subcontractor, in writing, of his intention to withhold all or a part of the Subcontractor's payment with the reason for nonpayment.

- F. All contracts awarded by the Contractor to a Subcontractor for any portion of the Work shall include:
1. An interest clause that obligates the Contractor to pay interest to the Subcontractor on all amounts owed by the Contractor that remain unpaid after seven (7) days following receipt by the Contractor of payment from the Owner for Work performed by the Subcontractor under that contract, except for amounts withheld as allowed.
  2. An interest rate clause stating, "Unless otherwise provided under the terms of this contract, interest shall accrue at the rate of one percent per month."
  3. A payment clause that requires (i) individual contractors to provide their social security numbers and (ii) proprietorships, partnerships, limited liability companies and corporations to provide their federal employer identification numbers.
- G. The Contractor shall include in each of its subcontracts a provision requiring each Subcontractor to include or otherwise be subject to the same payment and interest requirements as specified in Section 1.7 above, with respect to each lower-tier Subcontractor.
- H. A Contractor's obligation to pay an interest charge to a Subcontractor pursuant to the payment clause in this section may not be construed to be an obligation of the Owner. A contract modification may not be made for the purpose of providing reimbursement for such interest charge. A cost reimbursement claim may not include any amount for reimbursement for such interest charge.

#### 1.9 Final Payment

After the Contractor has completed all corrective Work as determined by a final inspection to the satisfaction of the Owner and has delivered all maintenance and operations manuals, schedules, guarantees, bonds, certificates of inspection, and other documents as required by the Contract Documents, the Contractor may make application for final payment following the procedure for partial progress payments. Within thirty (30) days after approval, the Owner shall pay to the Contractor the amount stated, less all prior payments and advances to or for the account of the Contractor. All prior estimates and payments including those relating to extra Work shall be subject to correction by this payment, which is called the Final Payment. The Contractor's obligation to perform the Work and complete the Project in accordance with the Contract Documents shall be absolute. Neither approval of any progress or Final Payment by the Owner nor the issuance of a Certificate of Substantial Completion, nor any payment by Owner to Contractor under the Contract Documents, nor any use or occupancy of the Project or any part thereof by Owner, nor any act of acceptance by Owner nor any failure to do so, nor any correction of defective Work by Owner shall constitute an acceptance of Work not in accordance with the Contract Documents.

#### 1.10 Acceptance of Final Payment Constitutes Release

The acceptance by the Contractor of the Final Payment shall be and operate as a release to the Owner of all claims and of all liability to the Contractor for all things done or furnished in

connection with this Work excepting the Contractor's claims for interest upon Final Payment, should this payment be improperly delayed. No payment, final or otherwise, or partial or entire use or occupancy of the Work by the Owner, shall constitute an acceptance of any Work or materials not in accordance with the Contract Documents, nor shall the same relieve the Contractor of responsibility for faulty materials or workmanship or operate to release the Contractor or his Surety from any obligation under the Contract, the Performance Bond and Payment Bond.

#### 1.11 Assignments

Neither party to the Agreement shall sell, transfer, assign or otherwise dispose of the whole or any parts of the Agreement or of the right, title or interest therein without the prior written consent of the other, nor shall the Contractor assign any monies due or to become due hereunder, without the previous written consent of the Owner.

#### 1.12 Payment Affidavit

The Owner, before making any payment, including the final payment, if it is deemed that such procedure necessary to protect his interests, may require the Contractor to furnish an affidavit from all subcontractors and material suppliers used in conjunction with this Contract that each has been paid in full, or in the alternative, an affidavit that so far as he has knowledge or information, all payments have been made and that there is no basis under which a claim against the payment bond could be filed. However, the Owner may make payments in part or in full to the Contractor without requiring the affidavits, and the payments so made shall not impair the obligations of any Surety or Sureties on any bond or bonds furnished under this Contract.

## II. CHANGE ORDERS AND FIELD ORDERS

- 2.1. The Owner may at any time, as the need arises, order changes within the scope of the Work without invalidating the Agreement. If such changes increase or decrease the amount due under the Contract Documents, or in the time required for performance of the Work, an equitable adjustment shall be authorized by Change Order.
- 2.2. The Contract Price and Contract Time may be changed only by a Change Order, approved by the Owner prior to the performance of the Work by the Contractor or granted by the Owner upon written Notice by Contractor submitted in accordance with Section 104-5.2 and 5.3 or Section 105-16.2. The value of any Work covered by a Change Order or of any claim for increase or decrease in the Contract Price or Contract Time shall be established in accordance with the following methods in the order of precedence listed below:
  - A. established contract unit prices;
  - B. an agreed lump sum or unit price established by direct negotiation between the Contractor and the Owner; or,
  - C. In the event that any changes in the Work are not settled under A. and B. above, the Contract Price shall be adjusted in accordance with the following:
    1. In any case such change involves extra Work which is performed by the Contractor, the Contract Price shall be increased by (a) the direct cost of such Work, as mutually

agreed upon or otherwise as determined in accordance with the Contract Documents, and (b) ten percent (10%) of the amount of (a) to cover Contractor's additional job (field and home office) overhead, and (c) five percent (5%) of the sum of (a) and (b) to cover Contractor's additional job profit.

2. In any case such change involves extra Work which is performed by a Subcontractor, the Contract Price shall be increased by (a) the amount paid by the Contractor to the Subcontractor for such extra Work, and (b) seven and one-half percent (7-1/2%) of the amount paid to the Subcontractor to cover the Contractor's additional job (field and home office) overhead and (c) five percent (5%) of the sum of (a) and (b) to cover Contractor's additional job profit. On Work performed by the Subcontractor, the Subcontractor shall be allowed overhead and profit in accordance with paragraph C (1) above.
  3. In the case of either subparagraph 1 or 2 above, the Contract Price shall also be increased by the corresponding increase in the cost of the Contractor's performance bond.
- 2.3. It is the Contractor's responsibility to notify his Surety of any change affecting the general scope of the Work or change in the Contract Price and/or Contract Time so that the amount of the applicable Bonds shall be adjusted accordingly. The Contractor shall furnish proof of such adjustment to the Owner.
  - 2.4. Whenever changes, alterations, additions, omissions, or revisions are called for by the Owner for which the necessary Drawings and details have been completed and submitted to the Contractor, or when changes, alterations, additions or omissions are clearly given in writing to the Contractor, the Contractor is to submit an itemized statement of quantities and prices incidental to such revisions, changes, additions and omissions.
  - 2.5. The Owner may at any time order minor changes within the scope of Work by issuing a Field Order. The Contractor shall proceed with the performance of any changes in the Work so ordered by the Owner unless the Contractor believes that such Field Order entitles the Contractor to a change in Contract Price or Time or both, in which event the Contractor shall give the Owner written Notice thereof within seven (7) Days after the receipt of the ordered change. The Contractor shall not execute such changes pending the receipt of an executed Change Order or further instruction from the Owner. The Owner shall respond to such written Notice from Contractor within twenty-one (21) Days after receipt.
  - 2.6. If any item in the Agreement is determined to be unnecessary for the proper completion of the Work contracted, the Owner may, upon written Notice to the Contractor, eliminate such item from the Agreement. Payment will not be made for such item except that the Contractor shall be compensated for the actual cost of any Work performed for the installation of such item and the net cost of materials purchased, including freight and tax costs, as evidenced by invoice. No additional compensation will be made for overhead or anticipated profit.
  - 2.7. The Contractor shall not be entitled to any adjustment in the Contract Price or Contract Time due to any condition or alleged condition if:

- A. The Contractor knew of the existence of such conditions at the time the Contractor made a final commitment to the Owner in respect of Contract Price and Contract Time by the submission of a Bid; or
- B. The existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test or study of the site and contiguous areas required by the Contract Documents to be conducted by or for the Contractor prior to the Contractor making such final commitment; or
- C. The Contractor failed to give the written Notice within the time and as required by Section 104-5.2 and 5.3 or Section 105-16.2.

**III. CHANGE ORDER**

No. \_\_\_\_\_

DATE OF ISSUANCE \_\_\_\_\_ EFFECTIVE DATE \_\_\_\_\_

OWNER \_\_\_\_\_  
 CONTRACTOR \_\_\_\_\_  
 Contract \_\_\_\_\_  
 Project \_\_\_\_\_  
 OWNER'S Contract No. \_\_\_\_\_ ENGINEER'S Contract No. \_\_\_\_\_  
 ENGINEER \_\_\_\_\_

You are directed to make the following changes in the Contract Documents:

Description:

Reason for Change Order:

Attachments: (List documents supporting change)

CHANGE IN CONTRACT PRICE:
Original Contract Price \$ _____
Net Increase (Decrease) from previous Change Orders No. _____ to _____: \$ _____
Contract Price prior to this Change Order: \$ _____
Net increase (decrease) of this Change Order: \$ _____
Contract Price with all approved Change Orders: \$ _____

CHANGE IN CONTRACT TIMES:
Original Contract Times: Final Completion: _____ (days or dates)
Net change from previous Change Orders No. _____ to No. _____: Final Completion: _____ (days)
Contract Times prior to this Change Order: Final Completion: _____ (days or dates)
Net increase (decrease) of this Change Order: Final Completion: _____ (days)
Contract Times with all approved Change Orders: Final Completion: _____ (days or dates)

RECOMMENDED:

APPROVED:

ACCEPTED:

By: \_\_\_\_\_  
ENGINEER(Authorized Signature)

By: \_\_\_\_\_  
OWNER(Authorized Signature)

By: \_\_\_\_\_  
CONTRACTOR(Authorized Signature)

Date: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_



**IV. APPLICATION FOR PAYMENT**

PROJECT SUMMARY

Date: \_\_\_\_\_ Contractor's Name: \_\_\_\_\_

Project Name: \_\_\_\_\_ Project Number: \_\_\_\_\_

Original Contract Amount: \$ \_\_\_\_\_  
 Original Contract Time: \_\_\_\_\_ days  
 Adjusted Contract Amount (by approved Change Orders): \$ \_\_\_\_\_  
 Adjusted Contract Time (by approved Change Orders): \_\_\_\_\_ days  
 Adjusted Contract Completion Date: \_\_\_\_\_

STATUS OF WORK PERFORMED

Total Value of Original Work Performed to Date: \$ \_\_\_\_\_  
 Total Value of Change Order Work Performed to Date (with attachment): \$ \_\_\_\_\_  
 Total Value of All Work Performed to Date: \$ \_\_\_\_\_  
 Value of Materials Stored (Attach Statement): \$ \_\_\_\_\_  
 Less \_\_\_\_\_ % Retained by Owner: \$ \_\_\_\_\_  
 Net Amount Earned on Contract to Date: \$ \_\_\_\_\_  
 Fewer Amounts of Previous Payments Approved:  
 \$ \_\_\_\_\_

**BALANCE DUE THIS PAYMENT:** \$ \_\_\_\_\_

Value of Work Remaining to be Completed: \$ \_\_\_\_\_  
 Percentage Complete to Date (Value/Time): \_\_\_\_\_ % \_\_\_\_\_ %

CERTIFICATION OF CONTRACTOR

I certify to the best of my knowledge and belief that all items and amounts on the face of the attached estimate and invoice and this Application for Payment are correct; that all Work has been performed and/or material supplied in full accordance with the terms and conditions of the Contract Documents, including all duly authorized deviations, substitutions, alterations, additions and/or deletions; that the foregoing is a true and correct statement of the Contract Price up to and including the last day of the period covered by this estimate and Application for Payment; that no part of the "BALANCE DUE THIS PAYMENT" has been received; that all previous Progress Payments received on this Agreement have been applied by the undersigned to discharge in full all obligations of the undersigned incurred in connection with the Work covered by prior applications for payment under this Agreement; and that all materials and equipment incorporated in said payment or otherwise listed in or covered by this Application for Payment are free and clear of all liens, claims, security interest and encumbrances.

APPROVALS

This Application for Payment has been checked, verified and approved for payment by:

_____ Contractor	By	_____ Title	_____ Date
_____ Resident Project Rep.	By	_____ Title	_____ Date
_____ Engineer	By	_____ Title	_____ Date
_____ Owner	By	_____ Title	_____ Date



## V. ESCROW AGREEMENT

THIS ESCROW AGREEMENT, made and entered into this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, by, between and among the \_\_\_\_\_ (Owner) and \_\_\_\_\_ (Contractor), and \_\_\_\_\_ (Bank), a trust company, bank, or savings and loan institution with its principal office located in the Commonwealth of Virginia and \_\_\_\_\_ (Surety), provides:

5.1. The Owner and the Contractor have entered into an Agreement dated (*month, date, year*), with respect to a Project titled \_\_\_\_\_ (the Agreement). This Escrow Agreement is pursuant to, but in no way amends or modifies the Agreement. Payments made hereunder or the release of funds from escrow shall not be deemed approval or acceptance of performance by the Contractor.

5.2. In order to assure full and satisfactory performance by the Contractor of its obligations under the Agreement, the Owner is entitled to retain certain amounts otherwise due the Contractor, known as retainage. The Contractor has, with the approval of the Owner, elected to have such retainage held in escrow by the Bank. This document sets forth the terms of the escrow. The Bank shall not be deemed a party to, bound by, or required to inquire into the terms of the Agreement or any other instrument or agreement between the Owner and the Contractor.

5.3. The Owner shall from time to time pursuant to its Agreement pay to the Bank amounts retained by it under the Agreement. Except as to amounts actually withdrawn from escrow by the Owner, the Contractor shall look solely to the Bank for the payment of funds retained under the Agreement and paid by the Owner to the Bank.

The risk of loss by diminution of the principal of any funds invested under the terms of this Escrow Agreement shall be solely upon the Contractor.

5.4. Funds and securities held by the Bank pursuant to this Escrow Agreement shall not be subject to levy, garnishment, attachment, lien or other process whatsoever. The Contractor agrees not to assign, pledge, discount, sell or otherwise transfer or dispose of its interest in the escrow account or any part thereof, except to the Surety.

5.5. The following securities, and none other, are approved securities for all purposes of this Escrow Agreement:

- A. United States Treasury Bonds, United States Treasury Notes, United States Treasury Certificates of Indebtedness or United States Treasury Bills;
- B. Bonds, notes and other evidences of indebtedness unconditionally guaranteed as to the payment of principal and interest by the United States.
- C. Bonds or notes of the Commonwealth of Virginia;
- D. Bonds of any political subdivision of the Commonwealth of Virginia, if such bonds carried, at the time of purchase by the Bank or deposit by the Contractor, a Standard and Poor's or Moody's Investors Service rating of at least "A"; and,

- E. Certificates of deposit issued by commercial banks located within the Commonwealth, including, but not limited to, those insured by the Bank and its affiliates.
- F. Any bonds, notes, or other evidences of indebtedness listed in Paragraphs A through C may be purchased pursuant to a repurchase agreement with a bank, within or without the Commonwealth of Virginia having a combined capital, surplus and undivided profit of not less than \$25,000,000, provided the obligation of the Bank to repurchase is within the time limitations established for investments as set forth herein. The repurchase agreement shall be considered a purchase of such securities even if title, and/or possession of such securities is not transferred to the Escrow Agent, so long as the repurchase obligation of the bank is collateralized by the securities themselves, and the securities have on the date of the repurchase agreement a fair market value equal to at least 100% of the amount of the repurchase obligation of the Bank and the securities are held by a third party, and segregated from other securities owned by the Bank.

No security is approved hereunder which matures more than five years after the date of its purchase by the Bank or deposit by the Contractor.

- 5.6. The Contractor may from time to time withdraw the whole or any portion of the escrowed funds by depositing with the Bank securities approved, in writing, by the Owner in an amount equal to, or in excess of, the amount so withdrawn. Any securities so deposited or withdrawn shall be valued at such time of deposit or withdrawal at the lower par or market value, the latter as determined by the Bank. Any securities so deposited shall thereupon become a part of the escrowed fund.

Upon receipt of a direction signed by the chief administrative and financial official of the Owner, the Bank shall pay the principal of the fund, or any specified amount thereof, to the Owner. Such payment shall be made as soon as is practicable after receipt of the direction.

Upon receipt of a direction signed by either the chief administrative or the chief financial official on behalf of the Owner, the Bank shall pay and deliver the principal of the fund, or any specified portion thereof, to the Contractor, in cash or in kind, as may be specified by the Contractor. Such payment and delivery shall be made as soon as is practicable after receipt of the direction.

- 5.7. For its services hereunder the Bank shall be entitled to a reasonable fee in accordance with its published schedule of fees or as may be agreed upon by the Bank and the Contractor. Such fee and any other costs of administration of this Escrow Agreement shall be paid from the income earned upon the escrow fund and, if such income is not sufficient to pay the same, by the Contractor.

Under no circumstances shall the Owner be responsible to the Bank for any fee or costs of administering this Escrow Agreement, account, or escrow fund.

- 5.8. The net income earned and received upon the principal of the escrow fund shall be paid over to the Contractor in quarterly or more frequent installments. Until so paid or applied to pay the Bank's fee or any other costs of administration such income shall be deemed a part of the principal of the fund. All income earned shall be reported by the Bank to the Internal Revenue Service and other taxing authorities on the Contractor's Tax. I.D. Number, except for interest withdrawn by the Owner pursuant to paragraph IV.

5.9. The Surety undertakes no obligation hereby but joins in the escrow Agreement for the sole purpose of acknowledging that its obligations as surety for the Contractor's performance of the Agreement are not affected hereby.

WITNESS the following signatures, all as of the day and year first above written.

OWNER:

\_\_\_\_\_  
Name of Owner

By: \_\_\_\_\_  
Name

\_\_\_\_\_  
Title

CONTRACTOR:

\_\_\_\_\_  
Name of Contractor

\_\_\_\_\_  
Contractor's Tax I.D. Number

By: \_\_\_\_\_  
Officer, Partner, or Owner

BANK:

\_\_\_\_\_  
Name of Bank

\_\_\_\_\_  
Mailing Address for Payments

\_\_\_\_\_  
Account Number

By: \_\_\_\_\_  
President/Vice-President

SURETY:

\_\_\_\_\_  
Name of Surety

By \_\_\_\_\_  
Attorney-in-Fact

**VI. AFFIDAVIT OF PAYMENT OF CLAIMS**

BY: \_\_\_\_\_ (Contractor)  
\_\_\_\_\_  
\_\_\_\_\_

THIS DAY \_\_\_\_\_ personally appeared before me, \_\_\_\_\_, a Notary Public in and for the City/County/State of Virginia, and being by me first duly sworn states that all Subcontractors and suppliers of labor and materials have been paid all sums due them to date for work performed or materials furnished in the performance of the Agreement between:

\_\_\_\_\_ (Owner)

and \_\_\_\_\_ (Contractor)

dated \_\_\_\_\_, 20 \_\_, for the construction of \_\_\_\_\_

\_\_\_\_\_ or arrangements have been made by the Contractor satisfactory to such Subcontractors and suppliers with respect to the payments of such sums as may be due them by the Contractor.

\_\_\_\_\_  
CONTRACTOR

BY: \_\_\_\_\_

TITLE: \_\_\_\_\_

DATE: \_\_\_\_\_

\_\_\_\_\_  
SEAL OF CONTRACTOR

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20 \_\_.

My commission expires on the \_\_\_\_\_ day of \_\_\_\_\_, 20 \_\_.

\_\_\_\_\_  
NOTARY PUBLIC

\_\_\_\_\_  
NOTARY SEAL



**VII. CERTIFICATE OF SUBSTANTIAL COMPLETION**

Project Description: \_\_\_\_\_ Project No \_\_\_\_\_  
 \_\_\_\_\_ Other: \_\_\_\_\_  
 Location: \_\_\_\_\_ Completion Date: \_\_\_\_\_  
 \_\_\_\_\_ Contract Date: \_\_\_\_\_  
 Contract For: \_\_\_\_\_ Contractor: \_\_\_\_\_  
 Owner: \_\_\_\_\_

This Certificate of Substantial Completion applies to all Work under the Contract Documents or to the following specified parts thereof:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

TO WIT: The Owner and Contractor are hereby advised that the work to which this certificate applies has been inspected by authorized representatives of the Owner, Contractor, and Engineer, and that all Work is hereby declared to be substantially complete in accordance with the Contract Documents on:

\_\_\_\_\_  
 Date of Substantial Completion

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive and the failure to include an item in it does not alter the responsibility of the CONTRACTOR to complete all items of the Work in accordance with the Contract Documents. When this certificate applies to a specified part of the Work, the items in this tentative list shall be completed or corrected by the CONTRACTOR within \_\_\_\_\_ days of the above date of substantial completion. The date of substantial completion is the date which all guarantees and warranties begin, except as follows:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

This certificate is issued, accepted, and acknowledged by:

_____ Engineer	By	_____ Title	_____ Date
_____ Contractor	By	_____ Title	_____ Date
_____ Owner	By	_____ Title	_____ Date



**VIII. STATEMENT OF SURETY COMPANY**

IN ACCORDANCE with the provisions of the AGREEMENT dated \_\_\_\_\_, 20\_\_,

BETWEEN \_\_\_\_\_  
(OWNER)

AND \_\_\_\_\_  
(CONTRACTOR)

THE \_\_\_\_\_  
(SURETY)

SURETY on the Material and Labor Payment BOND of:

\_\_\_\_\_  
(CONTRACTOR)

after a careful examination of the books and records of said CONTRACTOR or after receipt of an affidavit from CONTRACTOR, which examination of a affidavit satisfies SURETY that all claims for labor and materials have been satisfactorily settled, hereby approves of the final payment to the said \_\_\_\_\_, CONTRACTOR, and by these presents witnesseth that payment to the CONTRACTOR of the final estimates shall not relieve SURETY of any of its obligations to

\_\_\_\_\_  
(OWNER)

as set forth in the said SURETY COMPANY'S BOND.

IN WITNESS WHEREOF, said SURETY has hereunto set its hand and seal this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

ATTEST:

(SEAL) \_\_\_\_\_ BY \_\_\_\_\_  
PRESIDENT

NOTE: This statement, if executed by any person other than the President or Vice President of the Company, shall be accompanied by a certificate of even date showing authority conferred upon the person so signing to execute such instruments on behalf of the Company represented.



**IX. CONTRACTOR'S RELEASE**

KNOW ALL MEN BY THESE PRESENTS THAT:

\_\_\_\_\_ (Contractor) of \_\_\_\_\_ County/City and State of \_\_\_\_\_ does hereby acknowledge that he has received this day from the \_\_\_\_\_ (Owner) the sum of One Dollar (\$1.00) and other valuable consideration in full satisfaction and payment of all sums of money owing, payable and belonging to \_\_\_\_\_ (Contractor) Dated \_\_\_\_\_, 20\_\_.

NOW, THEREFORE, the said \_\_\_\_\_ (Contractor) \_\_\_\_\_ (for myself, my heirs, executors and administrators; for itself, its successors and assigns) do by these presents remise, release, quitclaim and forever discharge the said \_\_\_\_\_, Owner, its successors and assigns, of and from all claims and demands arising from or in connection with the said Agreement dated \_\_\_\_\_, 20\_\_, and of and from all, and all manner of action and actions, cause and causes of action and actions, suits, debts, dues, duties, sum and sums of money accounts, reckonings, bonds, bills, specialties, covenants, contracts, agreements, promises, variances, damages, judgements, extents, executions, claims and demand, whatsoever in law or equity, or otherwise which against the said \_\_\_\_\_, Owner, its successors and assigns ever had, now have, or which (I, my heirs, executors, or administrators; it, its successors and assigns) hereafter can, shall or may have, for upon or by reason for any matter, cause or thing whatsoever, from the beginning of the world to the date of these presents.

IN WITNESS WHEREOF \_\_\_\_\_ (Contractor) has caused these presents to be duly executed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

Signed, Sealed and Delivered  
in the Presence of:

\_\_\_\_\_ CONTRACTOR \_\_\_\_\_  
(SEAL)

BY: \_\_\_\_\_  
\_\_\_\_\_ Title

\_\_\_\_\_  
ATTEST:  
\_\_\_\_\_  
SECRETARY







Date Applied	Manhole/ Structure Number	Actual Substrate Conditions			Ambient Air Conditions		Min/Max Recoat (Hrs/Hrs)	Dry Film Thickness	
		CSP Rating	Temp. (°F)	Moisture (Yes/No)	Temp. (°F)	Humidity (%)		(Avg)	(Min)

## XI. STANDARD BID ITEMS AND UNITS

Section	Bid Item	Category	Unit
301	Clearing and grubbing	Clearing and Grubbing	ACRE or LS
301	Tree protection fencing	Clearing and Grubbing	LF or EA
302	Storm sewer pipe (diameter and type)	Drainage Structures	LF
302	Pipe culverts (waterway opening)	Drainage Structures	LF
302	Pipe reducers (larger diameter)	Drainage Structures	LF
302	Jacked pipe (diameter and type)	Drainage Structures	LF
302	Reinstalled pipe (diameter)	Drainage Structures	LF
302	End sections (standard and size)	Drainage Structures	EA
302	End walls	Drainage Structures	EA
302	Box culverts (waterway opening)	Drainage Structures	LF
302	Pipe grate	Drainage Structures	LF or EA
302	Drop / yard inlets, catch basins, and intake boxes	Drainage Structures	EA
302	Base section (drop inlets and manholes)	Drainage Structures	LF
302	Manhole (0-6' depth) (4 or 5 foot diameter)	Drainage Structures	EA
302	Manhole (>6' depth) (4 or 5 foot diameter)	Drainage Structures	VF
302	Conflict manhole	Drainage Structures	EA
302	Concrete spring boxes	Drainage Structures	EA
302	Junction boxes	Drainage Structures	EA
302	Reconstructed manholes	Drainage Structures	EA
302	Precast Arches	Drainage Structures	LF
303	Regular excavation	Earthwork	CY
303	Pavement demolition (type and depth of pavement) [in proposed pavement]	Earthwork	SY
303	Pavement demolition (type and depth of pavement) [outside proposed pavement]	Earthwork	SY
303	Curb & gutter demolition	Earthwork	LF
303	Existing structure demolition	Earthwork	EA
303	Existing pipe demolition	Earthwork	LF
303	Existing Sidewalk Demolition	Earthwork	SY
303	Existing Driveway Demolition	Earthwork	SY
303	Undercut Excavation (regular)	Earthwork	CY
303	Select Material (min. CBR)	Earthwork	CY
303	Select Bedding (regular)	Earthwork	CY or TON
303	Suitable Fill (regular)	Earthwork	CY or TON

<b>Section</b>	<b>Bid Item</b>	<b>Category</b>	<b>Unit</b>
303	Backfill of Undercut Excavation (regular)	Earthwork	CY or TON
303	Surcharge placement and removal	Earthwork	CY
303	Settlement plate	Earthwork	EA
303	Geotextile fabric for Base Preparation	Earthwork	SY
303	Select Bedding/Backfill of Undercut Excavation (trenching)	Earthwork	CY or TON
303	Undercut Excavation (trenching)	Earthwork	CY
303	Sheeting, bracing, and shoring left in place (trenching)	Earthwork	LS
303	Rip-Rap for erosion control	Earthwork	TON or SY
303	Check dam (log or rock)	Earthwork	EA
303	Baled straw check dam	Earthwork	EA
303	Temporary silt fence	Earthwork	LF
303	Geotextile fabric for Erosion Control	Earthwork	SY
303	Temporary filter barrier	Earthwork	LF
303	Sediment basin excavation	Earthwork	CY
303	Slope drain	Earthwork	EA
303	Siltation control excavation for Sedimentation Traps and Basins	Earthwork	CY
303	Inlet Protection ( type of device)	Earthwork	EA
303	Construction entrance	Earthwork	EA
305	Select material - Type I	Subgrade and Shoulders	TON
305	Select material - Types II or III	Subgrade and Shoulders	CY
305	Gravel Driveway Replacement	Subgrade and Shoulders	EA
309	Aggregate material (base course)	Aggregate Base Course	CY or TON
309	Aggregate base material (base course for curb and gutter)	Aggregate Base Course	CY or TON
310	Tack coat	Tack and Prime Coat	GALLON
310	Prime coat	Tack and Prime Coat	GALLON or SY
313	Asphalt surface treatment	Asphalt Surface Treatment	SY
315/ 315A	Asphalt concrete (type and class)	Asphalt Concrete Pavement	TON or SY
315/ 315A	Bituminous Leveling Course	Asphalt Concrete Pavement	TON
315/ 315A	Edge clipping of shoulders	Asphalt Concrete Pavement	LF
315/ 315A	Asphalt Driveways (Thickness)	Asphalt Concrete Pavement	SY or EA
317	Pavement Patch	Pavement Patching	LF or SY
406	Reinforcing steel or welded wire mesh	Reinforcing Steel	POUND
406	Epoxy-coated reinforcing steel	Reinforcing Steel	POUND
414	Dry riprap (class and depth)	Riprap	SY or TON
414	Mortared riprap	Riprap	SY
414	Grouted riprap	Riprap	SY or TON

<b>Section</b>	<b>Bid Item</b>	<b>Category</b>	<b>Unit</b>
414	Dumped riprap	Riprap	SY or TON
414	Concrete riprap in bags	Riprap	CY
414	Erosion control rip rap	Riprap	SY or TON
501	Underdrain and combination underdrain	Underdrains	LF
501	Geotextile Fabric	Underdrains	LF
502	Curb, combination curb and gutter (detail designation)	Concrete Items	LF
502	Gutter, standard, radial and entrance	Concrete Items	SY or LF
502	Paved ditch	Concrete Items	SY or LF
502	Paved flume	Concrete Items	SY or LF
502	Street Connection pavement	Concrete Items	SY or LF
502	Energy Dissipators	Concrete Items	EA
502	Sign island	Concrete Items	EA or SY
502	Median barriers (including delineators)	Concrete Items	LF
502	Median Strips	Concrete Items	LF or SY
502	Directional island curb	Concrete Items	LF
502	Hydraulic cement concrete sidewalks (thickness)	Concrete Items	SY
502	Concrete steps (concrete)/Reinforcing Steel	Concrete Items	CY /LBS
502	Handrails	Concrete Items	LF
502	Geotextile drainage fabric	Concrete Items	SY
502	Curb Cut Ramps	Concrete Items	SY
502	Composite Detectable Warning Panels	Concrete Items	SF
502	Concrete Driveway Replacement (Pipe Installation)	Concrete Items	EA
502	Concrete Driveway	Concrete Items	SY
505	Guardrail (Standard)	Guardrail and Steel Median Barriers	LF
505	Radial guardrail (Standard)	Guardrail and Steel Median Barriers	LF
505	Reuse guardrail (Standard)	Guardrail and Steel Median Barriers	LF
505	Median barrier (Standard)	Guardrail and Steel Median Barriers	LF
505	Intermediate anchorage assembly	Guardrail and Steel Median Barriers	EA
505	Terminal Guardrail Treatment (Back of ditch)	Guardrail and Steel Median Barriers	LF
505	Terminal Guardrail (Roadway side)	Guardrail and Steel Median Barriers	EA
505	Reuse guardrail terminal (Standard and type)	Guardrail and Steel Median Barriers	LF or EA
505	Fixed object attachment (Standard)	Guardrail and Steel Median Barriers	EA
505	Special design guardrail bridge attachment (B or Str. No.)	Guardrail and Steel Median Barriers	LS
505	Cable barricade (Standard)	Guardrail and Steel Median Barriers	EA
505	Guardrail terminal site preparation (Standard)	Guardrail and Steel Median Barriers	EA
505	Bull nose barrier	Guardrail and Steel Median Barriers	EA
505	Guardrail terminal (Standard and type)	Guardrail and Steel Median Barriers	LF or EA

<b>Section</b>	<b>Bid Item</b>	<b>Category</b>	<b>Unit</b>
507	Fences (Standard and Height)	Fences	LF
507	Gate (Standard and Length)	Fences	EA
510	Remove, reset, relay, adjust, install, modify, reconstruct relocate, existing (Item or standard)	Relocating or Modifying Existing Miscellaneous Items	EA, LF, SY, CY or LS
510	Adjust structure heights	Relocating or Modifying Existing Miscellaneous Items	EA
511	Allaying dust	Allaying Dust	HR
512	Flagger Service (Certified)	Maintaining Traffic	HR
512	Flagger Service (Police-assisted))	Maintaining Traffic	HR
512	Pilot vehicle	Maintaining Traffic	HR
512	Electronic Arrow	Maintaining Traffic	HR
512	Warning Light	Maintaining Traffic	DAY
512	Group 2 Channelizing Devices	Maintaining Traffic	DAY,
512	Traffic barrier service (per location) (Type and/or standard)	Maintaining Traffic	LF
512	Traffic barrier service guardrail termination (standard)	Maintaining Traffic	EA or LF
512	Impact attenuator service (Type)	Maintaining Traffic	EA
512	Temporary signalization	Maintaining Traffic	LS
512	Construction pavement marking (type and message)	Maintaining Traffic	LF
512	Construction pavement message marking (type and width)	Maintaining Traffic	EA
512	Temporary Pavement marker ([ ]-way)	Maintaining Traffic	EA
512	Eradication of existing pavement marking (per 6-inch width)	Maintaining Traffic	LF
512	Temporary Detour (standard and type)	Maintaining Traffic	LF
512	Crusher run aggregate (No. 25 or 21A)	Maintaining Traffic	TON
512	Type III Barricades	Maintaining Traffic	EA
512	Construction Signs	Maintaining Traffic	SF
512	Truck Mounted Attenuator	Maintaining Traffic	HR
512	Portable Traffic Control Signal	Maintaining Traffic	LS
512	Portable Changeable Message Sign	Maintaining Traffic	HR
512	Maintenance of Traffic	Maintaining Traffic	LS
513	Mobilization (3 payments)	Mobilization & Demobilization	LS
515	Milling Pavement	Milling Pavement	SY
521	Pavers	Pavers	SF
530	Abandon Pipe, (diameter/flowable fill) < larger than 2-inch>	Abandonment of Existing Pipelines and Structures	LF or CY
530	Abandon Meter Boxes	Abandonment of Existing Pipelines and Structures	EA
530	Abandon Laterals and Cleanouts (on Active Mains)	Abandonment of Existing Pipelines and Structures	LF or EA
530	Abandon Drainage Structures	Abandonment of Existing Pipelines and Structures	EA

<b>Section</b>	<b>Bid Item</b>	<b>Category</b>	<b>Unit</b>
530	Abandon Metallic Structures	Abandonment of Existing Pipelines and Structures	EA
530	Abandon Manholes	Abandonment of Existing Pipelines	EA
530	Abandon Meter/Valve Vaults/Boxes	Abandonment of Existing Pipelines and Structures	EA
602	Topsoil (4-or 6-inch depth)	Topsoil	ACRE or SY
603	Lime, fertilizer, seed and mulch	Seeding	ACRE or SY
604	Sod, fertilizer and lime	Sodding	SY
605	Plants (Type and size)	Planting	EA
605	Mulching and remulching	Planting	100 SF
608	Mowing	Mowing	HR or LS
700	Concrete foundation (Standard, type and, size)	Traffic Control Devices	EA
700	Electrical service (Standard and type)	Traffic Control Devices	EA
700	Luminaire arm (Length)	Traffic Control Devices	EA
700	Lighting pole (Standard luminaire mounting height, and length of luminaire arm)	Traffic Control Devices	EA
700	Signal pole (Standard, length, number, and length of arms)	Traffic Control Devices	EA
700	Overhead sign structure	Traffic Control Devices	EA
700	Bridge-mounted sign structure (Location)	Traffic Control Devices	EA
700	Pedestal pole (Standard and length)	Traffic Control Devices	EA
700	Wood pole (Class and length)	Traffic Control Devices	EA
700	Conductor Cable (Size/number)	Traffic Control Devices	LF
700	Conduit (Type and size)	Traffic Control Devices	LF
700	Trench Excavation (Standard)	Traffic Control Devices	LF
700	Junction box (Standard)	Traffic Control Devices	EA
700	Sign Posts	Traffic Control Devices	EA
700	Test Bores	Traffic Control Devices	EA
700	Electrical service grounding electrode (per 10 foot)	Traffic Control Devices	EA
700	Bored Conduit	Traffic Control Devices	LF
704	Pavement line marking (Type and/or class and width)	Traffic Control Devices	LF
704	Pavement message marking (Message)	Traffic Control Devices	EA
704	Pavement marker (Type, [ ]-way, and/or type pavement)	Traffic Control Devices	EA
801	Water main (Type & diameter)	Water Distribution Systems	LF
801	Fire hydrant assembly (Type I, II or III)	Water Distribution Systems	EA
801	Water sampling stations	Water Distribution Systems	EA
801	Gate valves (size and diameter)	Water Distribution Systems	EA
801	Butterfly Valves (diameter)	Water Distribution Systems	EA
801	Water Meter Box	Water Distribution Systems	EA

<b>Section</b>	<b>Bid Item</b>	<b>Category</b>	<b>Unit</b>
801	Tapping sleeve/valve (diameter)	Water Distribution Systems	EA
801	Blowoff Assembly	Water Distribution Systems	EA
801	Manual air vent assembly	Water Distribution Systems	EA
801	Type K copper service lines (jack and pull) (single or dual)	Water Distribution Systems	LF or EA
801	Type K copper service lines (open cut) (single or dual)	Water Distribution Systems	LF or EA
801	Private Service Relocations	Water Distribution Systems	EA
801	Polyethylene encasement	Water Distribution Systems	LF
801	Connections to existing water mains	Water Distribution Systems	EA
801	Plugging Existing 2" Water Main	Water Distribution Systems	EA
801	Offset of Existing Water Main	Water Distribution Systems	LF
801	Cut in Tees	Water Distribution Systems	EA
801	Cut in Crosses	Water Distribution Systems	EA
801	Cut in Valves	Water Distribution Systems	EA
802	Gravity sewer pipe (diameter, type and depth 0-6, 6-8, 8-10, 10-12,12-14,14-16,16-18,18-20, >20')	Sanitary Gravity Sewer Systems	LF
802	Sewer laterals (type and diameter)	Sanitary Gravity Sewer Systems	LF or EA
802	Manhole, 0' to 6' in depth (4-or 5-foot dia.)	Sanitary Gravity Sewer Systems	EA
802	Manhole extra depth (4-or 5-foot dia.)	Sanitary Gravity Sewer Systems	VF
802	Drop Manhole (inside or outside)	Sanitary Gravity Sewer Systems	EA
802	Standard manhole frame and cover	Sanitary Gravity Sewer Systems	EA
802	Watertight manhole frame and cover	Sanitary Gravity Sewer Systems	EA
802	Clean-out assemblies (mainline and service lateral)	Sanitary Gravity Sewer Systems	EA
802	Remote Camera/TV Inspection	Sanitary Gravity Sewer Systems	LF
802	Connections to existing manholes	Sanitary Gravity Sewer Systems	EA
802	Connections from existing manholes	Sanitary Gravity Sewer Systems	EA
802	Manhole and Mainline Cleanout adjustment rings	Sanitary Gravity Sewer Systems	EA
802	Manhole/Structure Coatings (Type A or B, 4- or 5-foot manhole diameter)	Sanitary Gravity Sewer Systems	VF or EA
803	Force main (type and diameter)	Sanitary Force Main Systems	LF
803	Manual air vent assembly	Sanitary Force Main Systems	EA
803	Gate valves (size and diameter)	Sanitary Force Main Systems	EA
803	Tapping sleeve/valve (size and diameter)	Sanitary Force Main Systems	EA
803	Connections to existing force mains or manholes	Sanitary Force Main Systems	EA
803	Interior Pipe Corrosion Lining (Diameter)	Sanitary Force Main Systems	LF
803	Offset of Existing Force Main	Sanitary Force Main Systems	LF
803	Cut in Tees	Sanitary Force Main Systems	EA
803	Cut in Crosses	Sanitary Force Main Systems	EA
803	Cut in Valves	Sanitary Force Main Systems	EA

<b>Section</b>	<b>Bid Item</b>	<b>Category</b>	<b>Unit</b>
804	Bore and jack casing (diameter)	Boring and Jacking	LF
806	Horizontal Directional Drill	Horizontal Directional Drilling	LS
<b>Sanitary Sewer Rehabilitation</b>		<b>(Sections 810-822)</b>	
810	Light Cleaning (diameter)	Sewer Line Cleaning	LF
810	Heavy Cleaning (diameter and number of passes greater than 3)	Sewer Line Cleaning	LF
810	Manhole Cleaning	Sewer Line Cleaning	EA
811	Television Inspection (CCTV Only)	Television Inspection	LF
812	Bypass Pumping / Flow ~ ____ MGD (Flow > 2 MGD)	Bypass Pumping	LS
813	CIPP Method/Wall Thickness= ____ mm (Diameter)	Pipe Rehabilitation By Cured-In-Place Method	LF
813	Removal of Intruding Service Lateral Connections (Ferrous or Non-Ferrous)	Pipe Rehabilitation By Cured-In-Place Method	EA
814	Fold and Form Method / Wall Thickness = SDR ____ (diameter)	Pipe Rehabilitation By Fold and Form Pipe Method	LF
814	Removal of Intruding Service Lateral Connections (Ferrous or Non-Ferrous)	Pipe Rehabilitation By Fold and Form Pipe Method	EA
815	Pipe Bursting	Pipe Bursting	LF
815	Sealing and Benching Manholes	Pipe Bursting	EA
816	Sewer Joint Testing (diameter)	Sewer Joint Testing	EA
817	Chemical Joint Sealing / Grouting Sewer Point Repair	Chemical Grouting	GAL
818	(diameter, material, and depth 0-6, 6-8, 8-10, 10-12, 12-14, 14-16, 16-18, 18-20, >20')	Point Repair By Excavation	LF
819	Insitu Structural Point Repair / Wall Thickness = ____ mm (diameter)	Insitu Structural Point Repair	LF
820	Insitu Point Repair by Sectional Lining / Wall Thickness = ____ mm (diameter)	Insitu Point Repair By Sectional Lining	LF
821	Service Laterals (diameter and material)	Sanitary Sewer Service Reconnection	LF
822	Manhole Cementitious Coating (4- or 5-ft diameter)	Manhole Rehabilitation	VF
822	Manhole Frame Seals	Manhole Rehabilitation	EA

End of Section

SECTION 110

SPECIAL PROVISIONS

**I. CONSTRUCTION DRAWINGS:**

Plans are the property of the Owner and shall not be used for any purposes other than those specified in these Contract Documents.

**II. HAMPTON ROADS PLANNING DISTRICT COMMISSION REGIONAL CONSTRUCTION STANDARDS MODIFICATIONS:**

Prior to Construction, the Contractor is required to obtain a copy of the Hampton Roads Planning District Commission *Regional Construction Standards* (Fifth Edition), from the Hampton Roads Planning District Commission located in Chesapeake, Virginia.

The York County modifications, additions, or deletions to the HRPDC *Regional Construction Standards* (**attached as Appendix A**) are hereby incorporated into the contract documents

**III. SUPPLEMENTAL INFORMATION**

**A. Generator Installation Instruction Submittal:** Time is of the essence in the execution of this project, and it is expected that the generator equipment will require a long lead-time. In order to facilitate the schedule, the contractor shall submit a preliminary copy of the generator shop drawing submittal at the Preconstruction Conference. This submittal shall include detailed installation instructions with specific language indicating that the proposed generator, if installed in accordance with the Bid Documents, will adhere to applicable NEC and NFPA requirements and clearances. This preliminary shop drawing will be reviewed under a compressed schedule so that the final shop drawings will be released as quickly as possible.

**B. APPENDICES**

<b>APPENDIX A</b>	<b>YORK COUNTY MODIFICATIONS TO THE REGIONAL CONSTRUCTION STANDARDS</b>
<b>APPENDIX B</b>	<b>YORK COUNTY STANDARD DETAILS</b>
<b>APPENDIX C</b>	<b>SUPPLEMENTAL TECHNICAL SPECIFICATIONS</b>
<b>APPENDIX D</b>	<b>GEOTECHNICAL REPORT</b>

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# APPENDIX



## Appendix A

# YORK COUNTY MODIFICATIONS TO THE REGIONAL CONSTRUCTION STANDARDS



**YORK COUNTY MODIFICATIONS TO HRPDC REGIONAL CONSTRUCTION STANDARDS**

<b>Section</b>	<b>Title</b>	<b>Page</b>	<b>Subsection</b>	<b>Modification</b>
Details	EW01			Replace detail with pipe bedding details shown on Contract Documents
Details	EW03			Replace detail with trench width details shown on Contract Documents
Details	SS01			Add Note #7:  The minimum thickness of factory applied corrosion resistant coating shall be 40 mils and the minimum coating thickness for all field applied coatings shall be 40 mils.
Details	WS03			Replace detail with York County manual air relief valve assembly detail S2001.
200	Products and Materials	49	V 5.10 A.8	<p>Add the following:</p> <p><b>B. Corrosion Resistant Lining for Ductile Iron Pipe</b></p> <p>a. Corrosion Resistant Lining for Ductile Iron Pipe shall be provided where called for on the Drawings. For ductile iron pipe and fittings, the three products described below have been approved and shall be specified as acceptable alternatives.</p> <p>1. Polyurethane – Polyurethane lining shall be Corropipe II Wasteliner by Madison Chemical Industries.</p> <p>Polyurethane lining shall be shop applied in strict accordance with the manufacturer’s recommendations to cover the inner surface of the ductile iron pipe and iron pipe fittings. The lining shall extend from the spigot end through the socket. This lining shall be 40 mils nominal thickness and 35 mils minimum. The lining shall extend around the exterior of the spigot end along the area that is normally within the bell of the adjoining pipe. The polyurethane material on the outside of the spigot end shall have a maximum thickness of 10 mils unless it can be demonstrated that a thicker section will not hamper joint assembly.</p> <p>The lining in each joint of pipe and fitting shall pass volt wet sponge spark test. All holidays shall be repaired in accordance with</p>



**YORK COUNTY MODIFICATIONS TO HRPDC REGIONAL CONSTRUCTION STANDARDS**

Section	Title	Page	Subsection	Modification
				<p>manufacturer's instructions and tested again. The finished polyurethane lining shall be generally smooth and free of sharp protuberances.</p> <p>Field cutting and tapping of polyurethane lined pipe and fittings will not be permitted. Short lengths of pipe required to accommodate the force main geometry shall be furnished factory lined.</p> <p>2. Ceramic Epoxy Lining – The lining material for pipe and fitting shall be Protecto 401 ceramic epoxy.</p> <p>The lining shall be shop applied in strict accordance with the manufacturer's recommendations to cover the inner surface of the ductile iron pipe and fittings. The lining shall be 40 mils nominal thickness, 35 mils minimum. The gasket area and spigot end up to 6 inches back from the end of the spigot on the outside of the pipe shall be coated with 6 mils nominal, 10 mils maximum, of Protecto Joint Compound. The joint compound shall be applied by brush to ensure coverage. Care must be taken that the joint compound is smooth without excess buildup in the gasket seat or on the spigot ends. Coating of the gasket seat and spigot ends shall be done after the application of the lining. The lining in each joint of pipe and fitting shall pass a 2,500 volt pin hole/holiday test.</p> <p>Field cutting and tapping of lined pipe and fittings will not be permitted. Short lengths of pipe required to accommodate the force main geometry shall be furnished factory lined.</p>
200	Products and Materials	87	5.21. H. 6.	<p>Delete in its entirety and replace with the following:</p> <p>Other Materials: A polyurethane coating as supplied by Sprayroq Protective Lining</p>



**YORK COUNTY MODIFICATIONS TO HRPDC REGIONAL CONSTRUCTION STANDARDS**

<b>Section</b>	<b>Title</b>	<b>Page</b>	<b>Subsection</b>	<b>Modification</b>
				Systems may be used for manhole coating in accordance with recommendations by the manufacturer and minimum requirements in the contract documents.
303	Earthwork	11	II.2.2 E.4	Delete in its entirety and replace with the following:  4. The entire depth of backfill material shall be placed in six inch loose measure lifts and compacted as required to achieve the compaction requirements specified in Paragraph E.7 below. The maximum size stone in the first foot of backfill above the pipe bedding shall not exceed one-inch in diameter and the maximum size stone in the remainder of the backfill shall not exceed two inches in diameter.
303	Earthwork	11	II.2.2.E.5	Delete in its entirety and replace with the following:  5. Unused.
303	Earthwork	11	II 2.2 E.7.d and e	Delete 7.d and 7.e in their entirety and replace with the following:  d. The Contractor shall conduct compaction testing in accordance with the testing frequency established under paragraph E.7.e and the VDOT 1994 Road and Bridge Specifications, recompact and/or replace any backfill not achieving the specified percentage of maximum density, and submit compaction testing results to the Owner in accordance with Sections 105 and 200. The Owner reserves the right to conduct its own independent compaction testing and to require recompaction or replacement of any backfill not achieving the required percentage of maximum density as determined by the Contractor's or Owner's testing results.  e. For Work being performed within the pavement section (percent density requirements are specified elsewhere), compaction testing shall be as required by the Virginia Department of Transportation, but in no case shall the frequency of compaction testing be less than as follows:  <u>For trench widths less than 4-feet,</u>



**YORK COUNTY MODIFICATIONS TO HRPDC REGIONAL CONSTRUCTION STANDARDS**

Section	Title	Page	Subsection	Modification
				<ol style="list-style-type: none"> <li>1. once on each side of the pipe on the initial lift of backfill at intervals not to exceed 100-feet.</li> <li>2. for lifts less than 12-inches, loose measure, one test every 300-feet, every other lift.</li> <li>3. for lifts exceeding 12-inch thickness, loose measure, one test for every 300-feet for each lift.</li> </ol> <p><u>For trench widths exceeding 4-feet but less than 7-feet,</u></p> <ol style="list-style-type: none"> <li>1. once on each side of the pipe on the initial lift of backfill at intervals not to exceed 100-feet.</li> <li>2. for lifts less than 12-inches, loose measure, two tests every 300-feet, every other lift; space test locations at 1/3 points of the trench width.</li> <li>3. for lifts exceeding 12-inch thickness, loose measure, two tests for every 300-feet for each lift; space test locations at 1/3 points of the trench width.</li> </ol> <p><u>For trench widths exceeding 7-feet,</u></p> <ol style="list-style-type: none"> <li>1. twice on each side of the pipe on the initial lift of backfill at intervals not to exceed 100-feet.</li> <li>2. for lifts less than 12-inches, loose measure, three tests every 300-feet, every other lift; space test locations at 1/4 points of the trench width.</li> <li>3. for lifts exceeding 12-inch thickness, loose measure, three tests for every 300-feet for each lift; space test locations at 1/4 points</li> </ol>



**YORK COUNTY MODIFICATIONS TO HRPDC REGIONAL CONSTRUCTION STANDARDS**

<b>Section</b>	<b>Title</b>	<b>Page</b>	<b>Subsection</b>	<b>Modification</b>
				<p align="center">of the trench width.</p> <p>The Owner reserves the right to require additional testing, at no additional cost, should the Contractor fail to achieve the required densities.</p> <p>To prevent disturbing compacted materials, compaction testing shall not be performed until sheeting/shoring has been sufficiently raised/removed.</p>
802	Sanitary Sewer Gravity Sewer Systems	1	I 1.2 A	<p>Delete in its entirety and replace with the following:</p> <p>A. Provide a construction schedule for approval that includes the sequence of installation of the casings, pipelines, laterals and manholes. The construction schedule shall reflect the sequence of construction requirements established on the Construction Drawings.</p>
802	Sanitary Sewer Gravity Sewer Systems	12	II 2.4 B.1.d	Delete in its entirety.
803	Sanitary Force Main Systems	4	II 2.3 F	<p>Add the following:</p> <p>F. All buried hardware shall be 304 stainless steel.</p>
803	Sanitary Force Main Systems	5	II 2.5 D	<p>Add the following:</p> <p>D. All buried hardware shall be 304 stainless steel.</p>
811	Television Inspection	5	III.D.	Delete in its entirety.
822	Manhole Rehabilitation	2	1.2.B.3	<p>Add the following:</p> <p>3. Products approved for York County Type A Manhole Coatings:</p> <p>A. Tnemec</p>



**YORK COUNTY MODIFICATIONS TO HRPDC REGIONAL CONSTRUCTION STANDARDS**

Section	Title	Page	Subsection	Modification
				<ul style="list-style-type: none"> <li>1. New Manhole                             <ul style="list-style-type: none"> <li>a. Fill voids and bug holes with Series 218 MortarClad</li> <li>b. Series 435 Perma-Glaze @ 40 mil.</li> </ul> </li> <li>2. Existing Manhole                             <ul style="list-style-type: none"> <li>a. Series 218 MortarClad @ 1/16-inch skim coat</li> <li>b. Series 435 Perma-Glaze @ 40 mil.</li> </ul> </li> </ul> <p>B. Sauereisen</p> <ul style="list-style-type: none"> <li>1. New Manhole                             <ul style="list-style-type: none"> <li>a. Fill voids and bug holes with Epoxy Filler Compound no. 209</li> <li>b. Sewergard Glaze No. 210G – 40 mil.</li> </ul> </li> <li>2. Existing Manhole                             <ul style="list-style-type: none"> <li>a. Leaks: InstaPlug No. F-180</li> <li>b. Surfacing: Underlayment No. F-120 or Resurfacer No. F-121</li> <li>c. Coating: Sewergard Glaze No. 120G – 40 mil.</li> </ul> </li> </ul> <p>C. Raven</p> <ul style="list-style-type: none"> <li>1. New Manhole                             <ul style="list-style-type: none"> <li>a. Raven 405 Blue Epoxy Resin (80 mils)</li> </ul> </li> <li>2. Existing Manhole                             <ul style="list-style-type: none"> <li>a. Mortar: Quadex Hyperform or Strong-Seal Profile Plus mix</li> <li>b. Coating: Raven 405 Blue Epoxy Resin (80 mil)</li> </ul> </li> </ul> <p>D. Sprayroc</p> <ul style="list-style-type: none"> <li>1. New Manhole                             <ul style="list-style-type: none"> <li>a. One coat Spraywall polyurethane coating (100 mils)</li> </ul> </li> <li>2. Existing Manhole                             <ul style="list-style-type: none"> <li>a. Mortar: Strong-Seal Profile Plus mix – min. ½ inch (fill voids and defects)</li> <li>b. Coating: Spraywall polyurethane coating (100 mils)</li> </ul> </li> </ul> <p>E. Permacast 10,000 with Dinjer SG Mastic</p> <ul style="list-style-type: none"> <li>1. New Manhole</li> </ul>



**YORK COUNTY MODIFICATIONS TO HRPDC REGIONAL CONSTRUCTION STANDARDS**

Section	Title	Page	Subsection	Modification
				<ul style="list-style-type: none"> <li>a. One coat Dinjer SG Mastic coating (65 mils)</li> <li>2. Existing Manhole                             <ul style="list-style-type: none"> <li>a. Mortar: Permacast 10,000 – min. ½ inch (fill voids and defects)</li> <li>b. Coating: Dinjer SG Mastic coating (65 mils)</li> </ul> </li> </ul>
822	Manhole Rehabilitation	2	1.2.B.4	<p>Add the following:</p> <ul style="list-style-type: none"> <li>4. Products approved for York County Type B Manhole Coatings:                             <ul style="list-style-type: none"> <li>A. Tnemec                                     <ul style="list-style-type: none"> <li>1. New Manholes   <ul style="list-style-type: none"> <li>a. Lining: Permashield H2S Series 434 (125 mil)</li> <li>b. Topcoat/Gelcoat: Perma-Glaze Series 435 (15 mil) (Backrolling when applied over Series 434)</li> </ul> </li> <li>2. Existing Manhole   <ul style="list-style-type: none"> <li>a. Surfaces: Mortarclad Series 218</li> <li>b. Mortar: Mortarcast Series 219</li> <li>c. Lining: Permashield H2S Series 434 (125 mil)</li> <li>d. Topcoat/Gelcoat: Perma-Glaze Series 435 (15 mil) (Backrolling when applied over Series 434)</li> </ul> </li> </ul> </li> <li>B. Sauereisen                                     <ul style="list-style-type: none"> <li>1. New Manholes   <ul style="list-style-type: none"> <li>a. Lining: Sewergard No. 210T or 210RS (100 - 120 mils)</li> <li>b. Topcoat: Sewergard Glaze No. 210G (15 - 20 mils, 115 – 140 mils total)</li> </ul> </li> <li>2. Existing Manhole   <ul style="list-style-type: none"> <li>a. Leaks: InstaPlug No. F-180</li> <li>b. Surfacing: Underlayment No. F-120 or No. F-121 Resurfacer</li> <li>c. Lining: Sewergard No. 210T or 210RS (100 – 120 mils)</li> <li>d. Topcoat: Sewergard Glaze No. 210G (15 – 20 mils, total 115 – 140 mils)</li> </ul> </li> </ul> </li> <li>C. Raven                                     <ul style="list-style-type: none"> <li>1. New Manhole</li> </ul> </li> </ul> </li> </ul>



**YORK COUNTY MODIFICATIONS TO HRPDC REGIONAL CONSTRUCTION STANDARDS**

<b>Section</b>	<b>Title</b>	<b>Page</b>	<b>Subsection</b>	<b>Modification</b>
				<ul style="list-style-type: none"> <li>a. Coating: Raven 405 Blue Epoxy Resin (2 coats/100 mil total)</li> <li>2. Existing Manhole                             <ul style="list-style-type: none"> <li>a. AquaPoxy HB-1 (fill voids and defects)</li> <li>b. Mortar: Quadex Hyperform or Strong-Seal Profile Plus mix</li> <li>c. Coating: Raven 405 Blue Epoxy Resin (2 coats/100 mil total)</li> </ul> </li> <li>D. Sprayroc                             <ul style="list-style-type: none"> <li>1. New Manhole                                     <ul style="list-style-type: none"> <li>a. One coat Spraywall polyurethane coating (100 mils)</li> </ul> </li> <li>2. Existing Manhole                                     <ul style="list-style-type: none"> <li>a. Mortar: Strong-Seal Profile Plus mix – min. ½ inch (fill voids and defects)</li> <li>b. Coating: Spraywall polyurethane coating (200 mils)</li> </ul> </li> </ul> </li> <li>E. Permacast 10,000 with Dinjer SG Mastic                             <ul style="list-style-type: none"> <li>1. New Manhole                                     <ul style="list-style-type: none"> <li>a. One coat Dinjer SG Mastic coating (80 mils)</li> </ul> </li> <li>2. Existing Manhole                                     <ul style="list-style-type: none"> <li>b. Mortar: Permacast 10,000 – min. ½ inch (fill voids and defects)</li> <li>c. Coating: Dinjer SG Mastic coating (100 mils)</li> </ul> </li> </ul> </li> </ul>
822	Manhole Rehabilitation	7	II. 2.6	<p>Delete in its entirety and replace with the following:</p> <p>The manhole frame and the chimney above the cone shall be sealed in accordance with manufacturer’s recommendation. The seal between the frame and manhole chimney/cone shall be addressed as a minor leak as stated in the previous subsection 2.2 C.</p>
822	Manhole Rehabilitation	8	III. A.	Item 6: delete “Removal of steps” and replace with “Flow control and bypass pumping”
822	Manhole Rehabilitation	8	III C.	<p>Add the following:</p> <p>Measurement and payment shall be made for each manhole step removed and each invert bench (channel) rebuilt. Measurement and payment for pressure grouting to stop leaks shall be made per gallon of grout injected.</p>



## Appendix B

# YORK COUNTY STANDARD DETAILS



## SANITARY SEWER DETAILS

<b>Plate No.</b>	<b>DESCRIPTION</b>
S1001	STANDARD MANHOLE FRAME AND COVER
S1002	WATERTIGHT MANHOLE FRAME AND COVER
S1003	STANDARD PRECAST CONCRETE MANHOLE WITH EXTENDED MONOLITHIC BASE
S1005	INTERIOR DROP MANHOLE
S1006	PRECAST CONCRETE SHALLOW MANHOLE
S1007	SANITARY SEWER STRADDLE MANHOLE
S1008	MANHOLE INVERT SHAPING DETAIL
S1010	TYPICAL SEWER SERVICE CONNECTION
S1011	DUAL SEWER SERVICE CONNECTION
S1012	SANITARY CLEANOUT FRAME AND COVER
S1013	HEAVY DUTY CLEANOUT FRAME AND COVER
S1014	STEEL CASING DETAIL
S1015	PILE BENT SUPPORT DETAIL
S1016	WATER-SEWER CROSSING SEPARATION DETAIL
S1017	WATER-SEWER MAIN SEPARATION DETAIL
S1018	TYPICAL GREASE TRAP/OIL-WATER SEPARATOR
S1019	TYPICAL ACCESS ROAD GATE
S1020	TYPICAL STREAM CROSSING
S1022	LOW PRESSURE GRINDER PUMP FORCE MAIN CONNECTION TO GRAVITY SEWER SERVICE LATERAL
S1021	STANDARD FLEXIBLE BOOT CONNECTION
S2001	TYPICAL MANUAL AIR RELIEF VALVE
S2003	GRINDER FORCE MAIN CLEANOUT AND VALVE VAULT
S2004	TYPICAL VALVE SETTING DETAIL
S2005	STANDARD VALVE BOX FRAME AND COVER
S2006	EMERGENCY PUMP CONNECTION
S2007	TYPICAL TRACER WIRE BOX INSTALLATION
S2008	FORCE MAIN TO MANHOLE CONNECTION
S2009	TYPICAL GATE/CHECK VALVE VAULT
S2010	ALARM/DISCONNECT PANEL MOUNTING
S2026	GRINDER PUMP CLEANOUT DETAIL
S2027	GRINDER PUMP ELECTRICAL CONNECTION DIAGRAM
S2028	LOW PRESSURE FORCE MAIN ROAD CROSSING DETAIL
S2030	ENVIRONMENT ONE GRINDER PUMP DETAIL
S2031	TYPICAL TRENCH DETAIL
S2032	TYPICAL GRAVEL DRIVEWAY RESTORATION
S2033	LOW PRESSURE GRINDER PUMP CONNECTION TO LOW PRESSURE FORCE MAIN
S2034	ENVIRONMENT ONE MODEL 2014 GRINDER PUMP DETAIL
S2035	LOW PRESSURE GRINDER PUMP CONNECTION TO GRAVITY SEWER MAIN
S3001	PIPE BEDDING DETAIL
SV2011	TYPICAL VACUUM SERVICE CONNECTION - VALVE POT BELOW VACUUM MAIN
SV2012	TYPICAL VACUUM SERVICE CONNECTION - VACUUM MAIN ABOVE DITCH BOTTOM
SV2013	FIBERGLASS ANTI-FLOATATION COLLAR AND BEDDING DETAIL FOR VACUUM VALVE POTS
SV2014	VACUUM VALVE POT AND SUMP DETAIL
SV2015	DIVISION VALVE AND GAUGE TAP ASSEMBLY FOR VACUUM SEWER USING STANDARD MANHOLE FRAME AND COVER

SV2016 VACUUM LINE RESTRAINED JOINT DETAIL  
SV2017 DITCH CROSSING DETAIL  
SV2018 DUAL SERVICE GRAVITY LATERAL FOR VACUUM SEWER  
SV2019 END-OF-LINE IDENTIFICATION MARKER  
SV2020 TYPICAL VERTICAL LIFT DETAIL FOR VACUUM SEWER  
SV2021 TYPICAL CROSSOVER CONNECTION TO VACUUM MAIN  
SV2023 3" SERVICE CONNECTION DETAIL FOR VACUUM SEWER  
SV2024 TYPICAL VACUUM SEWER LATERAL AND CLEANOUT DETAIL  
SV2025 STANDARD VACUUM SEWER MANHOLE FRAME AND COVER  
SV2026 5' AND 6'-6" ONE PIECE VACUUM VALVE POT AND SUMP DETAIL

Appendix C

**SUPPLEMENTAL TECHNICAL  
SPECIFICATIONS**



## SECTION 01 22 00

### MEASUREMENT AND PAYMENT

#### PART 1 – GENERAL

##### 1.01 MEASUREMENT OF QUANTITIES

- A. Measurement of quantities will be made by the Contractor in the presence of the Owner. The methods of measurement and computations used in determination of quantities of materials furnished and installed shall be those generally recognized as good engineering practice. Final payment request shall include all totals and approved change orders.
- B. Area measurements shall be measured on a horizontal plane on the ground surface. Pay quantities will not exceed plan dimensions except as approved by the Owner or his representative.
- C. Structure measurements shall be in accordance with the Contract Documents except as approved by the Owner or his representative.
- D. Linear foot measurements shall be measured along the horizontal plane of the ground or paved surface. Vertical foot measurements shall be measured along the vertical plane, perpendicular to the ground or paved surface. Pay quantities will not exceed plan dimensions except as approved by the Owner or his representative.
- E. Volume computations of excavation or fill shall use the average-end-area method.
- F. Weight measurement shall be made based on Owner approved supplier delivery tickets submitted documenting the amount of material delivered in each truckload and the specific location by recorded plan station utilized. Pay measurement for delivery weights shall not exceed plan dimensions and shall be based on the average bulk density of the material as established in the Contract Documents.
- G. The term "Each" when used as an item of payment will mean complete payment for the unit of the work described.
- H. The word "Lump Sum" when used as an item of payment will mean complete payment for work described in the item including all materials, labor, and equipment necessary to complete the work in accordance with the Contract Documents.
- I. The term "complete and in place" will mean that the item of work shall be furnished and installed in accordance with the Contract Documents complete with all appurtenances necessary for the item to be used for its intended function, including all materials, labor and equipment.
- J. All measurement and payment items within this section replace individual measurement and pay item descriptions found in applicable sections of the Hampton Roads Planning District Commission (HRPDC) Regional Construction Standards.

## 1.02 SCOPE OF PAYMENT

- A. The Contractor will receive and accept compensation provided for in the Contract as full payment for furnishing all materials, labor, tools, and equipment and for performing all Work under the Contract in a complete and acceptable manner and for all risk, loss, damage, or expense of whatever character arising out of the nature of the Work or the prosecution thereof, subject to the provisions of the Contract Documents.
- B. If any unit price in the Bid Schedule requires that the said unit price cover and be considered compensation for certain work or material essential to the item, this same work or material will not also be measured or paid for under any other pay item identified on the Bid Form.

## 1.03 PAYMENT ITEMS

- A. Bid Item No. 1 – Mobilization (up to 5% of all other bid items): Mobilization will be measured on the basis of completion of the Work in accordance with the Contract Documents and this Section. Mobilization will be paid for at the contract lump sum price up to 5% of all other applicable bid items as indicated on the Bid Form. No additional payment will be made for demobilization and remobilization because of shutdowns, suspensions of work, or other mobilization activities. An initial payment of 50% of the mobilization bid item, less retainage, will be made as an initial progress payment once the Work commences on-site, as determined by the Owner. The final 50%, less retainage, will be made upon satisfactory demobilization as determined by the Owner.
- B. Bid Item No. 2 – Undercut Excavation with Bedding Backfill: As directed by the Owner, when directed and authorized by the Owner, replacement of unsuitable bearing material will be measured and paid for based on the cubic yards of undercut actually excavated. Measurement shall be based on the following details as shown in the Contract Documents and per Section 303 2.2.D of the Regional Construction Standards. Volumes shall be calculated as described above, payment height shall be the vertical distance measured between the plan elevation of excavation to the bottom of undercut, measured horizontally at 25' maximum intervals; or both ends of the undercut, whichever is less:
  - 1. Trench width details for payment of contingent items; and
  - 2. Select material, backfill pay quantities.

No payment will be made for material excavated and replaced as a result of native material becoming unsuitable due to acts of the Contractor. Payment will include, but is not limited to the cost of the following:

- 1. Excavation.
  - 2. Disposal of unsuitable material.
  - 3. Furnish and install bedding in accordance with the Contract Documents.
  - 4. Backfill, compaction, and compaction testing.
- C. Bid Item Nos. 3 and 4 – Select Material Sand and Stone: As directed by the Owner, when directed and authorized by the Owner in accordance with Section 303 2.2.E.3 of the Regional Construction Standards, replacement of unsuitable backfill material with select

material will be paid for at the unit price bid per ton of backfill satisfactorily installed. Select material will be measured based on the following details and as otherwise specified in the Contract Documents.

1. Trench width details for payment of contingent items; and
2. Select material, backfill pay quantities.

No payment will be made for material excavated and replaced as a result of native material becoming unsuitable due to acts of the Contractor. Payment will include, but is not limited to the cost of the following:

1. Disposal of unsuitable material
2. Furnish and install select material, (backfill #21B stone or backfill sand) in accordance with the Contract Documents.

Prior to delivery of materials, contractor shall submit a certification of scales calibration from the materials provider(s). Certification shall be considered valid only if the date of calibration is within 180 days of the Bid opening.

- D. Bid Item No. 5 – Miscellaneous Unclassified Excavation: As directed by the Owner, when directed and authorized by the Owner to excavate beyond plan dimensions, in a manner not measured or paid for as a separate Bid Item, miscellaneous unclassified excavation will be measured and paid for based on the cubic yards of excavation. Measurement shall be based on the details listed below and as required in the Contract Documents. Volumes shall be calculated as described above, payment height shall be the vertical distance measured between the plan elevation of the excavation bottom measured horizontally at 25' maximum intervals for trenches to the agreed upon extents of the excavation, or other measurement method as agreed to by the Owner.

1. Trench width details for payment of contingent items; and
2. Select material, backfill pay quantities.

No payment will be made for additional excavation and replacement material placed as a result of native material becoming unsuitable or excavation necessary due to acts of the Contractor. Payment shall include excavation, shoring, backfill, compaction, grading, non-roadway surface restoration, disposal of materials and incidental work.

- E. Bid Item Nos. 6, 7, 8 and 9 - Erosion and Sediment Control Measures: Installed, complete in place, erosion and sediment control measures will be measured and paid for based on the unit and unit price indicated on the Bid Form for each measure. The cost of each unit shall include all materials, equipment, and labor required to furnish, install, maintain and remove the erosion and sediment control measures, disposal of any and all accumulated silt and debris, as well as the removal and disposal of erosion and siltation control measures themselves. Surface restoration resulting from erosion and sediment control shall be considered incidental to erosion and sediment control.

- F. Bid Item No. 10 – Tree Protection: Tree protection will be selective to protect sensitive and ornamental plantings. The Drawings generally show areas where tree protection is to be provided. Actual placement shall be as approved by the Owner. Payment will be

made at the unit price bid per linear foot of temporary tree protection installed and will include all materials, equipment and labor required to furnish, install, maintain and remove the tree protection fencing, routinely dispose of any and all siltation and debris that may accumulate, disposal of the tree protection fencing itself, and surface restoration, all in accordance with the Contract Documents.

- G. Bid Item No. 11 - Clearing and Grubbing: Complete, measurement shall be the lump sum for all clearing and grubbing as required for successful completion of the work shown on the Contract Drawings. Work shall include, but not be limited to all labor equipment and materials necessary for clearing, grubbing, removing and disposing of vegetation, debris, and other objects. Payment for the work of Lump Sum items will be made at the Contractor's lump sum price stated in the Bid and appropriate to all items included under this section. No payment will be made under this section for work paid for under another section, or for work performed by the Contractor to replace defective work, or for work which is not shown or ordered, or for work which is outside the limits shown or ordered.
- H. Bid Item No. 12 – Temporary Fence - Complete and In Place, installation and removal of temporary fencing, posts, gates, fabric, supports, braces and all other appurtenances for operable fencing system. Measurement shall be made in linear feet of fencing as shown on the plans or as directed by the Owner. Payment shall be made at the Contractor's unit price stated in the Bid, include all materials, equipment and labor required to install and remove the fencing, including final site restoration.
- I. Bid Item No. 13 – Aggregate Base Material: Complete in Place, aggregate base material shall be measured and paid for based upon the ton of aggregate base satisfactorily installed. Measurement for aggregate base material will be based on the presentation of delivery tickets to the Owner. Each ticket will be serial numbered, shall list the name of the company supplying the material, truck identification number, date of delivery, size of load, and project location where delivered. Payment shall include all materials, equipment and labor required to furnish, haul, place, manipulate, and compact the aggregate base material in accordance with these specifications and the Contract Documents.
- Prior to delivery of materials, contractor shall submit a certification of scales calibration from the materials provider(s). Certification shall be considered valid only if the date of calibration is within 180 days of the Bid opening.
- J. Bid Item No. 14 – Asphalt Concrete Pavement Overlay: Complete in Place, measurement will be made at the unit price bid per square yard of asphalt concrete pavement overlay suitably placed in accordance with the Contract Documents per plan dimension of the existing roadway unless otherwise directed by the Owner. Payment at the unit price bid shall include all work incidental to asphalt pavement overlay including furnishing, hauling, placing, manipulating and compacting the asphalt pavement material, testing, saw cutting of existing pavement, removal and disposal of existing and temporary materials, asphalt tack coat, tie in to existing pavement, pavement markings, shoulder restoration, drainage restoration, aggregate tie in of new pavement with existing shoulder and tie ins with all existing driveways regardless of type.

- K. Bid Item No. 15 – Milled Asphalt Payment: Complete, measurement will be made at the unit price bid per square yard of milled pavement and disposal in accordance with the Contract Documents, based on plan dimensions of the existing roadway unless otherwise directed by the Owner. Payment at the unit price bid shall include all incidental work to milling, including labor equipment, hauling, testing, milling, edge clipping, asphalt prime coat, pavement markings, shoulder restoration, drainage restoration and tie ins with all existing driveways regardless of type.
- L. Bid Item No. 16 – Grass Lined Drainage Swale, Complete & In-Place: Installed, drainage swale will be measured and paid for based on the PER LINEAR FOOT as indicated on the Bid Form. The cost of each unit shall include all materials, equipment, and labor required for all excavation and final grading operations, temporary and permanent seeding establishment, all additional erosion and sediment control measures not covered under other pay items, disposal of any and all silt and debris, as well as surface restoration.
- M. Bid Item Nos. 17 – 8-inch Gravity Sewer Main: Installed Complete in Place, gravity sewer mains will be measured along the centerline of the pipeline based on linear footage of each pipe type installed in accordance with the Contract Documents and satisfactorily tested, regardless of depth. Pipe will be measured to the centerline of the manholes. Payment for gravity sewer main will be at the unit price bid and will include all pipe up to the wall of the wetwell and also include, but not limited to the cost of the following:
1. Saw cutting pavement and pavement removal for trench excavation.
  2. Backfilling, compacting, and compaction testing.
  3. Bedding as detailed on the plans.
  4. Sheeting, shoring and bracing.
  5. Dewatering.
  6. Disposal of surplus material.
  7. Excavation.
  8. Flushing.
  9. Gravity sewer pipe, fittings and appurtenances.
  10. Main line fittings including wye fittings for lateral connections.
  11. Connections to exiting pipes and appurtenances.
  12. Temporary and final restoration in the right-of-way and easements of shoulders and grade surface features including drainage ditches, culverts, curb, gutter, topsoil, seeding and plantings.
  13. Stripping and stockpiling topsoil.
  14. Temporary seeding and stabilization.
  15. Testing.
  16. Maintenance, restoration and replacement of utility facilities disturbed or otherwise displaced during construction.
  17. Marking tape.
  18. Clearing and grubbing.
  19. Cleanup.
- N. Bid Item No. 18– 8-inch Gravity Sewer Tie-In to Existing Manhole: Measurement of gravity sewer tie-in will be made for each tie-in, regardless of pipe diameter, installed in

accordance with the Contract Documents and satisfactorily tested regardless of depth. Payment for each tie-in will be at the unit price bid and will include, but not limited to the cost of bypass pumping or pump and haul operations, concrete core drilling, saw cutting pavement and pavement removal for excavation, select material backfill, backfilling, compacting, and compaction testing, stone bedding as detailed on the plans, shoring and bracing, dewatering, disposal of surplus material, excavation, flushing, pipe openings and seals, appurtenances for connection and support, temporary and final restoration in the right-of-way and easements of shoulders and grade surface features including drainage ditches, culverts, curb and gutter, topsoil, seeding and plantings, testing and cleanup.

O. Bid Item No. 19- Gravity Service Laterals – Installed Complete in Place, gravity sewer laterals will be measured along the centerline of the pipeline based on linear footage of each pipe type installed in accordance with the Contract Documents and satisfactorily tested regardless of depth. Pipe will be measured to the centerline of the mainline manholes, pipelines, and cleanouts. Payment for gravity sewer laterals will be at the unit price bid and will include, but not limited to the cost of the following:

1. Saw cutting pavement and pavement removal for trench excavation.
2. Backfilling, compacting, and compaction testing.
3. Bedding as detailed on the plans.
4. Sheeting, shoring and bracing.
5. Dewatering.
6. Disposal of surplus material.
7. Excavation.
8. Flushing.
9. Gravity sewer pipe, fittings, and appurtenances.
10. Connections to exiting pipes and appurtenances.
11. Temporary and final restoration in the right-of-way and easements of shoulders and grade surface features including drainage ditches, culverts, curb, gutter, topsoil, seeding and plantings.
12. Stripping and stockpiling topsoil.
13. Temporary seeding and stabilization.
14. Testing.
15. Maintenance, restoration and replacement of utility facilities disturbed or otherwise displaced during construction.
16. Clearing and grubbing.
17. Cleanup
18. Marking tape.
19. Tracer Wire

P. Bid Item No. 20 - PVC Gravity Sewer Service Cleanout- Installed Complete in Place, lateral cleanouts will be measured based upon each installed in accordance with the Contract Documents and satisfactorily tested. Cleanouts will be paid for at the unit price bid and will include, but not limited to the cost of the following:

1. Excavation outside trench limits.
2. Backfilling, compacting, and compaction testing.
3. Bedding as detailed on the plans.

4. Sheeting, shoring and bracing.
5. Dewatering.
6. Disposal of surplus material.
7. All fittings, caps, pipe and necessary appurtenances.
8. Cleanout box, frame, and cover with bedding stone.
9. Maintenance, restoration and replacement of utility facilities disturbed or otherwise displaced during construction.
10. Temporary and final restoration in the right-of-way and easements of shoulders and grade surface features including drainage ditches, culverts, curb, gutter, topsoil, seeding and plantings.
11. Testing
12. Marking tape.
13. Tracer Wire

Q. Bid Item No. 21 – 4-inch D.I. Force Main: Installed Complete in Place, force main will be measured based upon the linear footage, installed in the horizontal plane installed in accordance with the Contract Documents and satisfactorily tested. Pipe in place will be paid for at the unit price bid and will include all pipe up to the wall of the valve vault, and also include but is not limited to the cost of the following:

1. Saw cutting pavement and pavement removal for trench excavation.
2. Excavation.
3. Sheeting, shoring and bracing.
4. Backfilling, compacting, and compaction testing.
5. Dewatering.
6. Flushing.
7. Force main, including fittings and appurtenances excluding valves and air release assemblies.
8. Interior and exterior coatings.
9. Polyethelene encasement.
10. Thrust restraint.
11. Testing.
12. Water for testing.
13. Tracer wire, tracer wire boxes every 1000 feet, and subsurface marking tape.
14. Restoration in right-of-way and easements (not including curb and gutter restoration or pavement restoration, unless otherwise noted).
15. Shoulder restoration.
16. Temporary seeding and stabilization.
17. Maintenance, restoration and replacement of utility facilities disturbed or otherwise displaced during construction.
18. Clearing and grubbing.
19. Cleanup.

R. Bid Item No. 22 – 4-inch Force Main Isolation Valve: Measured based upon EACH isolation valve installed in accordance with the Contract Documents and satisfactorily tested. Paid for at the unit price bid and will include, but not limited to the cost of the following:

1. Saw cutting pavement and pavement removal for excavation.
  2. Excavation outside trench limits.
  3. Backfilling, compacting, and compaction testing.
  4. Bedding as detailed on the plans.
  5. Sheeting, shoring and bracing.
  6. Dewatering.
  7. Disposal of surplus material.
  8. All fittings, caps, pipe, jointing materials and necessary appurtenances.
  9. Valve box, frame, and cover, with bedding stone.
  10. Concrete collars.
- S. Bid Item No. 23 – Air Relief Valve Assembly: Installed Complete in Place, measured based upon each installed in accordance with the Contract Documents and satisfactorily tested. Paid for at the unit price bid and will include, but not limited to the cost of the following:
1. Saw cutting pavement and pavement removal for excavation.
  2. Excavation outside trench limits.
  3. Backfilling, compacting, and compaction testing.
  4. Bedding as detailed on the plans.
  5. Sheeting, shoring and bracing.
  6. Dewatering.
  7. Disposal of surplus material.
  8. All fittings, caps, pipe, jointing materials and necessary appurtenances.
  9. Valve box, frame, and cover, with bedding stone.
  10. Concrete collars.
- T. Bid Item No. 24– Force Main Tie-in to Existing Force Main: Measurement of force main tie-in will be made for each tie-in, regardless of force main diameter, installed in accordance with the Contract Documents and satisfactorily tested regardless of depth. Payment for each tie-in will be at the unit price bid and will include, but not limited to the cost of bypass pumping or pump and haul operations, saw cutting pavement and pavement removal for excavation, select material backfill, backfilling, compacting, and compaction testing, stone bedding as detailed on the plans, shoring and bracing, dewatering, disposal of surplus material, excavation, flushing, pipe openings and seals, appurtenances for force main connection and support, temporary and final restoration in the right-of-way and easements of shoulders and grade surface features including drainage ditches, culverts, curb and gutter, topsoil, seeding and plantings, testing and cleanup.
- U. Bid Item No. 25 – Emergency Pump Connection: Complete and in place. Under this section the Contractor shall furnish all materials and install the assembly, including isolation valve and all appurtenances as shown in County Detail S 2006. Payment for this item shall be for each emergency pump connection, from the side outlet of the main-line tee, regardless of distance.
- V. Bid Item No. 26 – Old Wormley Creek Road Lift Station, Complete and In Place: Complete and In Place, under this section, the Contractor shall furnish all materials and construct the lift station and appurtenant facilities; shall furnish, install, test, place into satisfactory operation and maintain until final acceptance the equipment, piping and

systems pertinent thereto; and shall fully complete the work as shown, specified, scheduled and directed. The principal items of work scheduled herein are included under this section. The work of this section also includes all accessories, appurtenances and other work required to complete this Contract. Payment for the work of Lump Sum items will be made at the Contractor's lump sum price stated in the Bid and appropriate to all items included under this section. No payment will be made under this section for work paid for under another section, or for work performed by the Contractor to replace defective work, or for work which is not shown or ordered, or for work which is outside the limits shown or ordered.

- W. Bid Item No. 27 – Bio-Retention BMP: Payment for this item will be LUMP SUM for the installation of the BMP complete as shown, specified, scheduled and directed. Included in this pay item are excavation, disposal of soil, the soil mixture, plants, grading, erosion control, mulch and all other appurtenances as required. Payment shall be made at the Contractor's lump sum price stated in the Bid, include all materials, equipment and labor required to complete the BMP, including final site restoration.

#### 1.04 PAYMENT

- A. Measurement of the several Bid Items listed on the Bid Form will be in the units indicated. No measurement will be made until the item has been installed and accepted as complete by the Owner and the Owner's Representative.
- B. When requested, gravity sewer pipe and force main payments will be made at 90% of the unit price bid per linear foot for each size and type of pipe installed complete in place, prior to satisfactory testing. The remaining 10% shall be paid following successful completion of the Work including restoration, and Owner acceptance of the testing. All payments shall be subject to applicable retainage in accordance with Section 109.
- C. Payment at the unit price bid shall constitute full compensation for furnishing all labor, material, and equipment required for provision of the item in accordance with the Contract Documents.

### **PART 2 – PRODUCTS**

NOT APPLICABLE TO WORK IN THIS SECTION

### **PART 3 – EXECUTION**

NOT APPLICABLE TO WORK IN THIS SECTION

End of Section

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## SECTION 03 30 00

### CAST-IN-PLACE CONCRETE

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, waterstops, mixture design, placement procedures, and finishes, for the following:
  - 1. Footings.
  - 2. Slabs-on-grade.
  - 3. Water Retaining Structures.
  - 4. Equipment Pads

##### 1.02 REFERENCES

- A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications (Contractor shall provide copies of all documents on-site), except where more stringent requirements are specified herein:
  - 1. American Concrete Institute (ACI)
    - a. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
    - b. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
    - c. ACI 301 – Specification for Structural Concrete.
    - d. ACI 302 – Guide for Concrete Floor and Slab Construction.
    - e. ACI 304 – Guide for Measuring, Mixing, Transporting and Placing Concrete.
    - f. ACI 305R - Hot Weather Concreting.
    - g. ACI 306R - Cold Weather Concreting.
    - h. ACI 308 - Standard Practice for Curing Concrete.
    - i. ACI 318 - Building Code Requirements for Structural Concrete.
    - j. ACI 350 – Environmental Engineering Concrete Structures.
    - k. ACI 350.1 and 350.1R – Tightness Testing of Environmental Engineering Concrete Structures and Commentary.
    - l. ACI 350.3R – Seismic Design of Liquid Containing Concrete Structures and Commentary.
  - 2. American National Standards Institute (ANSI)
    - a. ANSI/ASTM A185 – Welded Steel Wire Fabric for Concrete Reinforcement.
  - 3. American Society for Testing and Materials (ASTM)
    - a. ASTM A615 - Deformed and Plain Billet Steel for Concrete Reinforcement.
    - b. ASTM C33 - Concrete Aggregates.
    - c. ASTM C94 - Ready-Mixed Concrete.
    - d. ASTM C150 - Portland Cement.
    - e. ASTM C260 - Air Entraining Admixtures for Concrete.
    - f. ASTM C494 - Chemical Admixtures for Concrete.

4. Concrete Reinforcing Steel Institute (CRSI)
  - a. Manual of Standard Practice.
  - b. Design Handbook.

#### 1.03 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

#### 1.04 SUBMITTALS

- A. Submit the following in accordance with the General Conditions.
- B. Scheduling: Submit concrete placement schedule before start of placement operations. Include locations of all joints including construction joints.
- C. Product data for each type of manufactured material and product indicated, including reinforcement and forming accessories, admixtures, patching compounds, joint systems, dry-shake finish materials, fiber reinforcement, curing materials, floor and slab treatments, bonding agents and others, if requested by Owner's Representative.
- D. Written mix design shall be based on field experience or trial mixture. Submit documentation in accordance with ACI 301, Section 3.9.
  1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- E. Shop drawings for detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, bent bar diagrams, arrangement, and support of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

#### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
  1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
  2. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

- C. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management And Coordination."
  - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Cast-in-place concrete subcontractor.
  - 2. Review concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction joints, forms and form-removal limitations, reinforcement accessory installation, concrete repair procedures, and protection of cast-in-place concrete.

#### 1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

### PART 2 - PRODUCTS

#### 2.01 FORM-FACING MATERIALS

- A. General: Comply with Division 03 Section "Cast-In-Place Concrete" for formwork and other form-facing material requirements.
- B. Form-Facing Panels for As-Cast Finishes: Steel, glass-fiber-reinforced plastic, or exterior-grade, medium-density overlay, Class 1, or better, mill-applied release agent and edge sealed plywood panels other approved nonabsorptive panel materials that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- C. Rustication Strips: Metal, rigid plastic or dressed wood with sides beveled and back kerfed; nonstaining; in longest practicable lengths.
- D. Chamfer Strips: Metal, rigid plastic, elastomeric rubber, or dressed wood, 3/4 by 3/4 inch (19 by 19 mm), minimum; nonstaining; in longest practicable lengths.
- E. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA 800, "Specification 810.1, Expanded Cellular Glazing Tape"; minimum 1/4 inch (6 mm) thick.

- F. Form Joint Sealant: Elastomeric sealant complying with ASTM C 920, Type M or S, Grade NS that adheres to form joint substrates.
- G. Sealer: Penetrating, clear, polyurethane wood form sealer formulated to reduce absorption of bleed water and prevent migration of set-retarding chemicals from wood.
- H. Form-Release Agent: Commercially formulated colorless form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of those surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- I. Form Ties: Factory-fabricated, internally disconnecting ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish ties with tapered tie cone spreaders that, when removed, will leave holes 1 inch (25 mm) in diameter on concrete surface.
  - 2. Furnish internally disconnecting ties that will leave no metal closer than 2 inches (38 mm) from the concrete surface.
  - 3. Furnish glass-fiber-reinforced plastic ties, not less than 1/2 inch (13 mm) in diameter.
  - 4. Furnish ties with integral water-barrier plates to walls of water retaining structures.

## 2.02 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  - 1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:
    - a. Fly Ash: ASTM C 618, Class F.
    - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
    - c. Silica Fume: ASTM C 1240, amorphous silica.
- B. Normal-Weight Aggregates: ASTM C 33, Class 5S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
  - 1. Maximum Coarse Aggregate Size: 1 inch (25 mm).
  - 2. Gradation: Uniformly graded.
- C. Normal-Weight Fine Aggregate: ASTM C 33, manufactured or natural sand, from same source for entire Project.
- D. Water: Potable, complying with ASTM C 94/C 94M except free of wash water from mixer washout operations.

## 2.03 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

#### 2.04 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.
  1. For concrete indicated to be sealed, curing compound shall be compatible with sealer.

#### 2.05 REPAIR MATERIALS

- A. Bonding Agent: ASTM C 1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements.
  1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

#### 2.06 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of cast-in-place concrete proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  1. Use a qualified independent testing agency for preparing and reporting proposed design mixtures based on laboratory trial mixtures.
- B. Proportion concrete mixtures as follows:
  1. Compressive Strength (28 Days):
    - a. Liquid Retaining Structures: 4500 psi (31 MPa).
    - b. All other structures: 4000 psi (27.6 MPa).
  2. Maximum Water-Cementitious Materials Ratio:
    - a. Liquid Retaining Structures: 0.42
    - b. All other structures: 0.45
  3. Exposure Categories and Classes:
    - a. Freezing and Thawing:
      - 1) Liquid Retaining Structures: F2
      - 2) All other Structures: F1

4. Slump Limit: 3 inches (75 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
  5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.
- C. Cementitious Materials: For cast-in-place concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301, 318 and 350 requirements. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Admixtures: Use admixtures according to manufacturer's written instructions.

## 2.07 CONCRETE MIXING

- A. Ready-Mixed or Site-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and furnish batch ticket information.
1. Clean equipment used to mix and deliver cast-in-place concrete to prevent contamination from other concrete.
  2. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

## 2.08 STEEL REINFORCEMENT AND ACCESSORIES

- A. Reinforcing bars shall be ASTM A615, Grade 60, deformed. Reinforcing bars to be welded shall be ASTM A706.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufacture according to CRSI's "Manual of Standard Practice."
1. Where legs of wire bar supports contact forms, use gray, all-plastic or CRSI Class 2, stainless-steel bar supports.

## 2.09 WATERSTOPS

- A. Standard waterstops shall be ribbed polyvinyl chloride (PVC) waterstops by the Paul Murphy Plastics Co., Vinylex Corporation, Greenstreak Co. or equal, at construction joints and control joints as indicated. Waterstops at expansion joints in new construction shall be ribbed, center-bulb type PVC. Waterstops for connection to future construction shall be ribbed or split-ribbed PVC. Thickness shall be 3/8-inch. Width shall be as indicated on the Contract Drawings. PVC waterstops shall meet Corps of Engineers CRD C572. Use in strict accordance with manufacturer's instructions. PVC waterstops shall be provided with integral hog rings to facilitate tie-off to reinforcing bars.

## PART 3 - EXECUTION

### 3.01 FORMWORK

- A. Limit deflection of form-facing panels to not exceed ACI 347 requirements.
- B. In addition to ACI 347 limits on form-facing panel deflection, limit cast-in-place concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
  - 1. Class B, 1/4 inch (6 mm).
- C. Fabricate forms to result in cast-in-place concrete that complies with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-in-place surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood rustications, keyways, reglets, recesses, and the like, for easy removal.
  - 1. Seal form joints and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.
  - 2. Do not use rust-stained steel form-facing material.
- E. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- F. Chamfer exterior corners and edges of cast-in-place concrete.
- G. Coat contact surfaces of wood rustications and chamfer strips with sealer before placing reinforcement, anchoring devices, and embedded items.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.
- L. Coat contact surfaces of forms with surface retarder, according to manufacturer's written instructions, before placing reinforcement.

### 3.02 REINFORCEMENT AND INSERTS

- A. Securely fasten steel reinforcement and wire ties against shifting during concrete placement.
- B. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

### 3.03 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
  - 1. Cut off and grind glass-fiber-reinforced plastic form ties flush with surface of concrete.
- B. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 75 percent of 28-day design compressive strength. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- C. Clean and repair surfaces of forms to be reused in the Work. Do not use split, frayed, delaminated, or otherwise damaged form-facing material. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for cast-in-place concrete surfaces.

### 3.04 JOINTS

- A. Construction Joints: Install construction joints true to line with faces perpendicular to surface plane of cast-in-place concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Owner..
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
  - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete. Align construction joint within rustications attached to form-facing material.
  - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  - 6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

- B. Contraction Joints: Form weakened-plane contraction joints true to line with faces perpendicular to surface plane of cast-in-place concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Owner.

### 3.05 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, form-release agent, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Owner.
- C. Before test sampling and placing concrete, water may be added at Project site, up to the limits of the specified water-cement ratio and slump, subject to limitations of ACI 301. This presumes that not all mixing water is added at the batching plant.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously between construction joints. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. Do not permit vibrators to contact forms.
- E. Cold-Weather Placement: Comply with ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
  - 4. Do not use chemical accelerators unless otherwise specified and approved in design mixtures.
- F. Hot-Weather Placement: Comply with ACI 305 and as follows:
  - 1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

### 3.06 QUALITY CONTROL DURING CONSTRUCTION

- A. The Contractor shall employ a testing agency, approved by the Owner, to perform tests and to submit test reports. Field testing to be performed by an ACI certified concrete field testing technician grade I.
- B. Sampling and testing for quality control during concrete placement may include the following, as directed by Owner.
  1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.
    - a. Slump testing shall be in accordance with ASTM C143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
    - b. Air content testing shall be in accordance with ASTM C173, volumetric method for lightweight or normal weight concrete; ASTM C231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.
    - c. Testing of concrete temperature shall be in accordance with ASTM C1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
    - d. Molding of cylinders for compression testing shall be in accordance with ASTM C31; one set of either four standard 6-inch dia. Cylinders or six 4-inch dia. cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
    - e. Compressive-strength testing shall be in accordance with ASTM C 39; one set for each 100 cu. yd. or fraction thereof, of each concrete mix placed in any one day; one specimen tested at 7 days (6 inch cylinders) or two specimens tested at 7 days (4 inch cylinders), two specimens (6 inch cylinders) tested at 28 days or three specimens (4 inch) tested at 28 days, and one specimen retained in reserve for later testing if required.
  2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
  3. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
  4. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

- C. Test results will be reported in writing to Owner, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
- D. Nondestructive testing shall consist of impact hammer, sonoscope, or other nondestructive device but shall not be used as the sole basis for acceptance or rejection.
- E. The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Owner. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed.

### 3.07 REMOVING FORMS

- A. Formwork not supporting the weight of concrete, such as sides of walls, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, concrete is able to support its own weight and provided curing and protection operations are maintained.
- B. Formwork supporting the weight of concrete, such as slabs and other structural elements, may be removed in less than 14 days but in no case until concrete has attained at least 75 percent of design minimum compressive strength at 28 days, unless otherwise noted. Determine representative compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

### 3.08 REUSING FORMS

- A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Owner's Representative.

### 3.09 CONCRETE SURFACE REPAIRS

- A. Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Owner's Representative.

- B. Mix dry-pack mortar, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.
1. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.
  2. For surfaces exposed to view, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- C. Remove and replace formed concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner's Representative. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
1. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.
- D. Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
1. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
  2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
  3. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Owner's Representative.
  4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- E. Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and

finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

- F. Perform structural repairs with prior acceptance by Owner's Representative for method and procedure, using specified epoxy adhesive and mortar.
- G. Repair methods not specified above may be used, subject to acceptance of Owner's Representative.

### 3.10 FINISHES, GENERAL

- A. Concrete Finish: Match Owner's design reference sample, identified and described as indicated, to satisfaction of Owner.
- B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.
  - 1. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.
- C. Maintain uniformity of special finishes over construction joints, unless otherwise indicated.

### 3.11 AS-CAST FORMED FINISHES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections exceeding specified limits on formed-surface irregularities.
- B. Smooth-Formed Finish (exposed to view): As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Remove fins and other projections exceeding specified limits on formed-surface irregularities. Repair and patch tie holes and defects.

### 3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306 for cold-weather protection and with ACI 305 for hot-weather protection during curing.
- B. Begin curing cast-in-place concrete immediately after applying as-cast formed finishes to concrete. Cure according to ACI 308.1, by one or a combination of the following methods that will not mottle, discolor, or stain concrete:
  - 1. Moisture Curing: Keep exposed surfaces of cast-in-place concrete continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period; use cover material and waterproof tape.
3. Curing Compound: Mist concrete surfaces with water. Apply curing compound uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

### 3.13 LEAKAGE TESTING

- A. All manholes shall be vacuum tested by the Contractor prior to acceptance.
  1. Vacuum Test:
    - a. The vacuum test shall be in accordance with ASTM C 1244.
    - b. All pipe entries into the manhole shall be plugged. The compression bank of the manhole vacuum testing equipment shall be inflated to effect a seal between the vacuum equipment base and the top of the manhole.
    - c. If the Contractor backfills around the manhole prior to testing, ten (10) inches of mercury shall be applied to the manhole and the time measured for the vacuum to drop from 10 inches to 9 inches shall be recorded. The test duration for a 48-inch diameter manhole is 60 seconds; the test duration for a 60-inch diameter manhole is 75 seconds.
  2. If the vacuum drop is greater than 1-inch of mercury during the test period, necessary repairs shall be made and the vacuum test and repairs shall be repeated until the manhole passes the test.

End of Section

SECTION 04 20 00

UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
  - 1. Concrete masonry units (CMUs).
  - 2. Face brick.
  - 3. Mortar and grout.
  - 4. Reinforcing steel.
  - 5. Masonry joint reinforcement.
  - 6. Ties and anchors.
  - 7. Miscellaneous masonry accessories.
- B. Related Sections include the following:
  - 1. Division 7 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.

1.03 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
  - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
  - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

- C. Samples for Initial Selection: For the following:
1. Decorative concrete masonry units, in the form of small-scale units.
  2. Face brick, in the form of straps of five or more bricks.
  3. Colored mortar.
- D. Samples for Verification: For each type and color of the following:
1. Face brick.
  2. Accessories embedded in masonry.
- E. Qualification Data: For testing agency.
- F. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
1. Masonry units.
    - a. Include material test reports substantiating compliance with requirements.
    - b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
    - c. For exposed brick, include material test report for efflorescence according to ASTM C 67.
    - d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
  2. Cementitious materials. Include brand, type, and name of manufacturer.
  3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
  4. Grout mixes. Include description of type and proportions of ingredients.
  5. Reinforcing bars.
  6. Joint reinforcement.
  7. Anchors, ties, and metal accessories.
- G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports, per ASTM C 780, for mortar mixes required to comply with property specification.
  2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- H. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

## 1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

## 1.07 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24 inches (600 mm) down both sides and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
  - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  - 2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

## PART 2 - PRODUCTS

### 2.01 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

### 2.02 CONCRETE MASONRY UNITS (CMUs)

- A. Shapes: Provide shapes indicated and as follows:
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  2. Provide square-edged units for outside corners, unless otherwise indicated.
- B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.
1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.

C. Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi (13.1 MPa).
2. Weight Classification: Normal weight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.03 BRICK

A. General: Provide shapes indicated and as follows:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. On Drawings, show details of special conditions and special shapes required. Revise three subparagraphs below to suit Project.
3. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
4. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
5. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: ASTM C 216, Grade MW or SW, Type FBX.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi (20.7 MPa).
2. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
4. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet (3 m).
5. Size (Actual Dimensions): 3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm) long].
6. Application: Use where brick is exposed, unless otherwise indicated.
7. Color and Texture: As selected by Owner.

2.04 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled

with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

## 2.05 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color approved by Owner.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.
- D. Masonry Cement: ASTM C 91.
- E. Mortar Cement: ASTM C 1329.
- F. Aggregate for Mortar: ASTM C 144.
  - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
  - 2. For joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
- G. Aggregate for Grout: ASTM C 404.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
- J. Water: Potable.

## 2.06 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Masonry Joint Reinforcement, General: ASTM A 951.
  - 1. Interior Walls: Hot-dip galvanized, carbon steel.
  - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
  - 3. Wire Size for Side Rods: W2.8 or 0.188-inch (4.8-mm) diameter.

4. Wire Size for Cross Rods: W2.8 or 0.188-inch (4.8-mm) diameter.
  5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
  6. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

## 2.07 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with eight subparagraphs below, unless otherwise indicated.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.

## 2.08 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Headed steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- B. Postinstalled Anchors: Provide chemical anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
1. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

## 2.09 MISCELLANEOUS MASONRY ACCESSORIES

- A. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch (3.6-mm) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.

## 2.10 PENETRATING WATER REPELLANTS

- A. Apply clear penetrating water repellent to all exterior masonry surfaces upon completion of masonry work. Apply a Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blend with 600 g/L or less of VOCs. Penetrating water repellent to be compatible with integral water repellent specified in Section 2.2.B above. Apply repellent per manufacturer's recommendations.

## 2.11 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

## 2.12 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
  - 1. Do not use calcium chloride in mortar or grout.
  - 2. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
  - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270 and BIA Technical Notes 8A, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
  - 1. For masonry below grade or in contact with earth, use Type M.
  - 2. For reinforced masonry, use Type S.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
  - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

2. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
  1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
  2. Verify that foundations are within tolerances specified.
  3. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
  1. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

- G. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
  2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
  3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
  4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
  5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
  6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.
  7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

### 3.03 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches (100-mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- H. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

### 3.04 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units as follows:
  - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
  - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
  - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
  - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

### 3.05 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
  - 1. Space reinforcement not more than 16 inches (406 mm) o.c.
  - 2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
  - 3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings.
    - a. Reinforcement above is in addition to continuous reinforcement.

- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

### 3.06 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows:
  - 1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.

### 3.07 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

### 3.08 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. Flexible Flashing: Use the following unless otherwise indicated:
  - 1. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch (1.0 mm) thick.
- B. Application: Unless otherwise indicated, use the following:
  - 1. Where flashing is indicated to receive counterflashing, use metal flashing.
  - 2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
  - 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing or flexible flashing with a metal drip edge.
  - 4. Where flashing is fully concealed, use metal flashing or flexible flashing.

- C. Solder and Sealants for Sheet Metal Flashings:
  - 1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- E. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

### 3.09 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
  - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ ASCE 6/ TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
  - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  - 2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

### 3.10 FIELD QUALITY CONTROL

- A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
  - 1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

- B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
  - 1. Payment for these services will be made by Owner.
  - 2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- C. Testing Frequency: One set of tests for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof.
- D. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C 140.
- E. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for mortar air content and compressive strength.
- F. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

### 3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Owner's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
  - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
  - 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

### 3.12 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: All unused full masonry units shall be provided to Owner at the end of the masonry work. Any other excess masonry materials are Contractor's property and are to be removed from the Project site at the completion of the unit masonry work.

End of Section

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SECTION 05 12 00  
STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data Shop Drawings and mill test reports.
- B. Comply with AISC's "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design," RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts," and AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.01 STRUCTURAL STEEL

- A. W-Shapes: ASTM A 992, Grade 50, high-strength, low-alloy, columbium-vanadium steel.
- B. Channels, Angles, S-Shapes: ASTM A 36, high-strength, low-alloy, columbium-vanadium steel.
- C. Plate and Bar: ASTM A 36 high-strength, low-alloy, columbium-vanadium steel.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

2.02 ACCESSORIES

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
- B. Anchor Rods: ASTM F 1554, Grade 36.
  - 1. Nuts: ASTM A 563 heavy hex carbon steel.
  - 2. Plate Washers: ASTM A 36 carbon steel.
  - 3. Washers: ASTM F 436 hardened carbon steel.
- C. Primer: MPI 27
- D. Grout: ASTM C 1107, nonmetallic, shrinkage resistant, factory packaged.

## 2.03 FABRICATION

- A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and its "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design."

## PART 3 - EXECUTION

### 3.01 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and its "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design."
- B. Base and Bearing Plates: Clean bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts.
  - 2. Weld plate washers to top of base plate.
  - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Cut off protruding wedges or shims flush with edge of plate before packing with grout.
  - 4. Promptly pack grout solidly between bearing surfaces so no voids remain. Neatly finish exposed surfaces; protect grout and allow it to cure.
- C. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- D. Do not use thermal cutting during erection unless approved by Owner. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- E. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Pretensioned
- F. Weld Connections: Comply with AWS D1.1/D1.1M for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

End of Section

SECTION 06 10 00  
ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Model code evaluation reports for metal framing anchors.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

- A. Lumber: Provide dressed lumber, S4S, marked with grade stamp of inspection agency.
- B. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

2.02 TREATED MATERIALS

- A. Preservative-Treated Materials: AWWPA C2, except that lumber not in ground contact.
1. Use treatment containing no arsenic or chromium.
  2. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
  3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- B. Provide preservative-treated materials for items indicated on Drawings, and the following:
1. Wood members in connection with roofing, flashing, vapor barriers, and waterproofing.
  2. Concealed members in contact with masonry or concrete.
  3. Wood framing members that are less than 18 inches above the ground.
  4. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 LUMBER

- A. Dimension Lumber:
1. Maximum Moisture Content for all lumbers.
  2. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would

impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

- B. Exposed Boards: Mixed southern pine, No. 1, SPIB or No. 1-15 percent maximum moisture content.

#### 2.04 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: Plywood, Exposure 1, C-D Plugged, fire-retardant treated, not less than 1/2 inch thick.

#### 2.05 MISCELLANEOUS PRODUCTS

- A. Fasteners: Size and type indicated. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153.
  - 1. Power-Driven Fasteners: CABO NER-272.
  - 2. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- B. Metal Framing Anchors: Structural capacity, type, and size indicated.
  - 1. Use anchors made from hot-dip galvanized steel complying with ASTM A 653/A 653M, G60 coating designation for interior locations where stainless steel is not indicated.
  - 2. Use anchors made from stainless steel complying with ASTM A 666, Type 304 for exterior locations and where indicated.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Securely attach rough carpentry to substrates, complying with the following:
  - 1. CABO NER-272 for power-driven fasteners.
  - 2. Published requirements of metal framing anchor manufacturer.
  - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings

End of Section

## SECTION 06 17 36

### METAL-PLATE-CONNECTED WOOD TRUSSES

#### PART 1 - GENERAL

##### 1.01 SECTION REQUIREMENTS

- A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads indicated without exceeding TPI 1 deflection limits.
- B. Submittals: Product Data, Shop Drawings, and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Owner and authorities having jurisdiction.
- D. Comply with applicable requirements and recommendations of the following publications:
  - 1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
  - 2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
  - 3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
- E. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

- A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review, any species, graded visually or mechanically.
  - 1. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Connector Plates: TPI 1, fabricated from hot-dip galvanized steel sheet complying with ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A

(HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.

- C. Fasteners: Where trusses are exposed to weather or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- D. Metal Framing Anchors: Provide framing anchors made from hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

## 2.02 FABRICATION

- A. Assemble trusses using jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted. Fabricate wood trusses within manufacturing tolerances in TPI 1.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install and brace trusses according to TPI recommendations and as indicated. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- B. Anchor trusses securely at bearing points; use metal framing anchors. Install fasteners through fastener hole in metal framing anchor as specified on Drawings.
- C. Securely connect each truss ply required for forming built-up girder trusses. Anchor trusses to girder trusses.
- D. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
  - 1. Install bracing to comply with Division 6 Section "Rough Carpentry."
  - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- E. Install wood trusses within installation tolerances in TPI 1.
- F. Do not cut or remove truss members.
- G. Remove wood trusses that are damaged or do not meet requirements and replace with trusses that do meet requirements.

End of Section

SECTION 07 31 13

ASPHALT SHINGLES

PART 1 - GENERAL

1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data and Samples.
- B. Identify each bundle of shingles with appropriate markings of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A.
  - 2. Wind-Resistance-Test Characteristics: ASTM D 3161 or UL 997, passed.
- C. Warranties: Provide standard manufacturer's written warranty, signed by manufacturer agreeing to promptly repair or replace asphalt shingles that fail in materials or workmanship within 25 years from date of Substantial Completion, prorated, with first 5 years nonprorated.

PART 2 - PRODUCTS

2.01 ASPHALT SHINGLES

- A. Fiberglass Shingles: ASTM D 3462 and as follows:
  - 1. Laminated-Strip Asphalt Shingles: Laminated, multi-ply overlay construction, mineral-granule surfaced, and self-sealing. Notched cut butt edge.
  - 2. Multitab-Strip Asphalt Shingles: Mineral-granule surfaced and self-sealing. Three tabs, regularly spaced with Straight butt edge.
  - 3. No-Cutout-Strip Asphalt Shingles: Mineral-granule surfaced, self-sealing, square, and single tab. Stagger cut, Straight butt edge.

2.02 ACCESSORIES

- A. Felts: ASTM D 226, Type I, asphalt-saturated organic felts.
- B. Self-Adhering Sheet Underlayment: ASTM D 1970, SBS-modified asphalt; mineral-granule or slip-resisting-polyethylene surfaced; with release paper backing; cold applied.
- C. Ridge Vent: Rigid UV-stabilized plastic ridge vent with nonwoven geotextile filter strips and with external deflector baffles; for use under ridge shingles.

- D. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- E. Roofing Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel shingle nails, minimum 0.120-inch (3-mm) diameter, of sufficient length to penetrate 3/4 inch (19 mm) into solid wood decking or extend at least 1/8 inch (3 mm) through OSB or plywood sheathing.
- F. Sheet Metal Flashing and Trim: Comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."
  - 1. Sheet Metal: Stainless steel.
  - 2. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual."
  - 3. Drip Edge: Formed sheet metal with at least a 2-inch roof deck flange and a 1-1/2-inch fascia flange with a 3/8-inch drip at lower edge.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Comply with recommendations in ARMA's "Residential Asphalt Roofing Manual" and with asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- B. Apply self-adhering sheet underlayment at eaves and rakes from edges of roof to at least 24 inches inside exterior wall line.
- C. Apply self-adhering sheet underlayment at valleys extending 18 inches (450 mm) on each side.
- D. Install metal flashings and other sheet metal to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim," recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."
- E. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

End of Section

## SECTION 07 46 00

### SIDING

#### PART 1 - GENERAL

##### 1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data and Samples.
  - 1. Submit product data, along with installation instructions and maintenance guide.
  - 2. Submit two (2) material samples in the selected color.
- B. Warranties: Provide manufacturer's product warranty with a 30-year non-prorated period. Provide finish warranty with a 15-year warranty covering paint and labor. Furnish copy of warranty information along with material shop drawings.

#### PART 2 - PRODUCTS

##### 2.01 SIDING

- A. Siding shall be fiber cement siding engineered product, similar to HardiePlank Lap Siding, manufactured by James Hardie Building Products, Inc., resistant to high UV environments.
- B. Style shall be Select Cedarmill (not Smooth) as manufactured by James Hardie Building Products, Inc.
- C. Color shall be similar to Monterey Taupe, similar to James Hardie ColorPlus Palette, North Regions. Color system shall be a factory applied baked-on finish.

#### PART 3 - EXECUTION

##### 3.01 INSTALLATION

- A. Install Hardie siding as recommended by manufacturer.
- B. Install as recommended by manufacturer including mounting and fixture hardware. Complete installation with caulking and touch-up coating according to manufacturer's installation requirements and with compatible materials.

End of Section

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## SECTION 07 62 00

### SHEET METAL FLASHING AND TRIM

#### PART 1 - GENERAL

##### 1.01 SECTION REQUIREMENTS

- A. Submittals: Product Data, Shop Drawings, and Samples.
- B. Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- C. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

#### PART 2 - PRODUCTS

##### 2.01 SHEET METAL

- A. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, with No. 2D finish; not less than 0.016 inch (0.4 mm) thick.

##### 2.02 FLASHING AND TRIM

- A. Refer to SMACNA's "Architectural Sheet Metal Manual" and NRCA's "The NRCA Roofing and Waterproofing Manual" for recommendations for profiles, thicknesses, fastenings, and installation of flashing.
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.

##### 2.03 ACCESSORIES

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- C. Butyl Sealant: ASTM C 1311, solvent-release type, for expansion joints with limited movement.

- D. Asphalt Mastic: SSPC-Paint 12, asbestos free, solvent type.
- E. Roofing Cement: ASTM D 4586, Type I, asbestos free, asphalt based.
- F. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Comply with SMACNA's "Architectural Sheet Metal Manual." Allow for thermal expansion; set true to line and level. Install Work with laps, joints, and seams permanently watertight and weatherproof; conceal fasteners where possible.
  - 1. Roof-Edge Flashings: Secure metal flashings at roof edges according to FMG Loss Prevention Data Sheet 1-49 for specified wind zone.
- B. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- C. Fabricate nonmoving seams in sheet metal with flat-lock seams. For metals other than aluminum, tin edges to be seamed, form seams, and solder
  - 1. Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), unless pretinned surface would show in finished Work.
- D. Separation: Separate noncompatible metals or corrosive substrates with a coating of asphalt mastic or other permanent separation.

END OF SECTION

## SECTION 07 92 00

### JOINT SEALANTS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. This Section includes sealants for precast concrete substrate.
  - 1. Polysulfide joint sealants.

##### 1.02 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide joint sealants for exterior applications that have been produced and installed to establish and maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.
- B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.
- C. Product Data: For each joint-sealant product indicated.
- D. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- E. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
- F. Qualification Data: For qualified Installer.
- G. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- H. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

##### 1.03 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

#### 1.04 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

#### 1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Handle materials and components according to manufacturer's written instructions. Use factory-installed lifting provisions.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
  - 1. Architectural Sealants: 250 g/L.
  - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
  - 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
  - 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated. For sealants used in water retaining structures, NSF-61 approval is required.

#### 2.02 POLYSULFIDE JOINT SEALANTS

- A. Immersible, Multicomponent Nonsag, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T and Use I.

1. Products: Available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Pecora Corporation; Synthacalk GC-2+.
  - b. BASF Sonolastic® Polysulfide Sealant
  - c. Other

#### 2.03 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), as approved in writing by joint-sealant manufacturer for joint application indicated], and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

#### 2.04 SYSTEM DESCRIPTION

- A. Masking tape shall be nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

#### 2.05 MISCELLANEOUS MATERIALS

- A. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- B. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Masonry.
  - 3. Remove laitance and form-release agents from concrete.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
  2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  3. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.

### 3.04 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Inspect tested joints and report on the following:
    - a. Whether sealants filled joint cavities and are free of voids.
    - b. Whether sealant dimensions and configurations comply with specified requirements.
    - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
  2. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
  3. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### 3.05 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.06 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or

deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

End of Section

## SECTION 08 31 13

### ACCESS DOORS AND FRAMES

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. This Section includes the following:
  - 1. Floor access doors and frames.

##### 1.02 SUBMITTALS

- B. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- C. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

##### 1.03 QUALITY ASSURANCE

- D. Source Limitations: Obtain access door(s) and frame(s) through one source from a single manufacturer.

#### PART 2 - PRODUCTS

##### 2.01 ALUMINUM MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
  - 1. Mill finish, AA-M10 (Mechanical Finish: as fabricated, unspecified).
- B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
  - 1. Mill finish, AA-M10 (Mechanical Finish: as fabricated, unspecified).
- C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15; with minimum sheet thickness indicated representing specified thickness according to ANSI H35.2 (ANSI H35.2(M)).
  - 1. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

##### 2.02 FLOOR ACCESS DOORS AND FRAMES

- 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:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Acudor Products, Inc. (aluminum only).
  - 2. Babcock-Davis, A Cierra Products Co.
  - 3. Bilco Company (The).
  - 4. Cendrex Inc.
  - 5. Dur-Red Products.
  - 6. Halliday Products (aluminum only).
  - 7. J. L. Industries, Inc.
  - 8. Karp Associates, Inc.
  - 9. Milcor Inc.
  - 10. Nystrom, Inc.
  - 11. U.S.F. Fabrication.
  
- C. Floor Doors, General: Equip each door with adjustable counterbalancing springs, heavy-duty hold-open arm that automatically locks door open at 90 degrees, release handle with red vinyl grip that allows for one-handed closure, and recessed lift handle.
  
- D. Watertight Aluminum Floor Door: Single or double-leaf opening (see drawings). Extruded-aluminum gutter frame with NPS 1-1/2 (DN 40) drainage coupling and 1/4-inch- (6.4-mm-) thick, diamond-pattern, aluminum tread plate door; watertight; loading capacity to support 150-lbf/sq. ft. pedestrian live load.
  
- E. Hardware: Provide the following:
  - 1. Hinges: Heavy-duty, aluminum butt hinges with stainless-steel pins.
  - 2. Latch: Stainless-steel slam latch.
  - 3. Lock: Jumbo lock box
  - 4. Hardware Material: Stainless steel, including latch and lifting mechanism assemblies, hold-open arms, and all brackets, hinges, pins, and fasteners.

## 2.03 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
  
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
  
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
  - 1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
  
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
  - 1. For cylinder lock, furnish two keys per lock and key all locks alike.
  - 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

- E. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

#### 3.02 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

End of Section

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## SECTION 09 90 00

### PAINTING

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION OF WORK

- A. The work includes all labor, materials, tools, equipment, supplies, services; and related work for the construction of painting, provided complete and ready for operations.
- B. Related work specified elsewhere includes:
  - 1. Section 03 30 00 – Cast-In-Place Structural Concrete
  - 2. Section 04 20 00 – Masonry
  - 3. Section 06 10 00 – Rough Carpentry
  - 4. Section 07 31 13 – Asphalt Shingles
  - 5. Section 08 31 13 – Access Doors and Frames

##### 1.02 REFERENCES

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

- A. AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)
  - 1. ACGIH-02 - (1996) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices
- B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
  - 1. ASTM D 4258 - (1988; R 1992) Surface Cleaning Concrete for Coating
- C. SOCIETY FOR PROTECTIVE COATINGS (SSPC)
  - 1. SSPC SP 1 - (1982) Solvent Cleaning
  - 2. SSPC SP 2 - (1995) Hand Tool Cleaning
  - 3. SSPC SP 3 - (1995) Power Tool Cleaning
  - 4. SSPC SP 7 - (1994) Brush-Off Blast Cleaning
  - 5. SSPC (PM1) - SSPC Painting Manual, Vol. 1, Good Painting Practice
  - 6. SSPC (PM2) - SSPC Painting Manual, Vol. 2, Systems and Specifications

##### 1.03 SUBMITTALS

Submit the following in accordance with Section 105 CONTROL OF WORK.

- A. Data
- Paint.

The names, quantity represented, and intended use for the proprietary brands of materials

substituted for the specified materials. The contractor will indicate any cost impact. Provide documentation that the substitution will be equal in quality to the specified product.

B. Instructions

Application.

Manufacturer's current printed product description, material safety data sheets (MSDS) and technical data sheets for each coating system. Detailed mixing, thinning and application instructions, minimum and maximum application temperature, and curing and drying times between coats for epoxy, moisture-curing polyurethane, and liquid glaze coatings.

C. Certificates

Lead.  
Mildewcide and Insecticide.  
Volatile Organic Compound (VOC) Content.

Certificate stating that paints for interior use contain no mercurial mildewcide or insecticide. Certificate stating that paints proposed for use contain not more than 0.06 percent lead by weight of the total nonvolatile. Certificate stating that paints proposed for use meet Federal VOC regulations.

1.04 PACKAGING, LABELING, AND STORING

Paints shall be in sealed containers that legibly show the designated name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons. Paints and thinner shall be stored in accordance with the manufacturer's written directions and as a minimum stored off the ground, closed, under cover, with sufficient ventilation to prevent the buildup of flammable vapors and at temperatures between 40 and 95 degrees F. Paints shall be stored on the project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for testing.

1.05 APPROVAL OF MATERIALS

When samples are tested, approval of materials will be based on tests of the samples; otherwise, materials will be approved based on test reports furnished with them. If materials are approved based on test reports furnished, samples will be retained by the Owner for testing should the materials appear defective during or after application. In addition to any other remedies under the contract the cost of retesting defective materials will be at the Contractor's expense.

1.06 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the paint manufacturer, the ambient temperature shall be between 45 and 95 degrees F when applying coatings other than water-thinned, epoxy, and moisture-curing polyurethane coatings. Water-thinned coatings shall be applied only when ambient temperature is between 50 and 90 degrees F. Epoxy, and moisture-curing polyurethane coatings shall be applied only within the minimum and maximum temperatures recommended by the coating manufacturer. Moisture-curing polyurethane shall not be applied when the relative humidity is below 30 percent.

## 1.07 SAFETY AND HEALTH

Work shall comply with applicable Federal, State, and local laws and regulations.

### A. Worker Exposures

Exposure of workers to hazardous chemical substances shall not exceed limits established by ACGIH-02, or as required by a more stringent applicable regulation.

### B. Toxic Compounds

Toxic products having ineffective physiological warning properties, such as no or low odor or irritation levels, shall not be used unless approved by the Owner.

### C. Training

Workers having access to an affected work area shall be informed of the contents of the applicable material safety data sheets (MSDS) and shall be informed of potential health and safety hazard and protective controls associated with materials used on the project. An affected work area is one which may receive mists and odors from the painting operations. Workers involved in preparation, painting and clean-up shall be trained in the safe handling and application, and the exposure limit, for each material which the worker will use in the project. Personnel having a need to use respirators and masks shall be instructed in the use and maintenance of such equipment.

### D. Coordination

Work shall be coordinated to minimize exposure of building occupants and components, other Contractor personnel and their equipment, and visitors to mists and odors from preparation, painting and clean-up operations.

## PART 2 - PRODUCTS

### 2.01 PAINT

The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, cement-emulsion filler, and other coatings, whether used as prime, intermediate, or finish coat. Paint shall conform to the requirements listed in the painting schedules at the end of this section, except when the required amount of a material of a particular batch is 50 gallons or less, an approved first-line proprietary paint material with similar intended formulation, usage and color to

that specified may be used. Paint provided shall be as manufactured by TNEMEC, MAB, DURON or approved equal. Additional requirements are as follows:

A. Colors and Tints

Colors shall be as selected from manufacturer's standard colors, as indicated. Manufacturer's standard color is for identification of color only. Tinting of epoxy and urethane paints shall be done by the manufacturer. The color of the undercoats shall vary slightly from the color of the next coat. Colors shall be as approved by the Owner.

B. Mildewcide and Insecticide

Mercurial mildewcide shall not be used in interior paint. Insecticides shall not be used in paint.

C. Lead

Paints containing lead in excess of 0.06 percent by weight of the total nonvolatile content (calculated as lead metal) shall not be used.

D. Chromium

Paints containing zinc chromate or strontium chromate pigments shall not be used.

E. Volatile Organic Compound (VOC) Content

Paints shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards.

### PART 3 - EXECUTION

#### 3.01 PROTECTION OF AREAS NOT TO BE PAINTED

Items not to be painted which are in contact with or adjacent to painted surfaces shall be removed or protected prior to surface preparation and painting operations. Items removed prior to painting shall be replaced to original condition when painting is completed. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

#### 3.02 SURFACE PREPARATION

Surfaces to be painted shall be clean and free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

A. Concrete, Stucco and Masonry Surfaces

Concrete, stucco and masonry surfaces shall be allowed to dry at least 30 days before painting, except concrete slab on grade which shall be allowed to cure 90 days before painting. Surfaces shall be cleaned in accordance with ASTM D 4258. Glaze, efflorescence, laitance, dirt, grease, oil, asphalt, surface deposits of free iron and other foreign matter shall be removed prior to painting. Surfaces to receive polyurethane or epoxy coatings shall be acid-etched or mechanically abraded as specified by the coating manufacturer, rinsed with water, allowed to dry, and treated with the manufacturer's recommended conditioner prior to application of the first coat.

B. Ferrous Surfaces

Ferrous surfaces including those that have been shop-coated, shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be cleaned mechanically with hand tools according to SSPC SP 2, power tools according to SSPC SP 3 or by sandblasting according to SSPC SP 7. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection and preparation.

C. Nonferrous Metallic Surfaces

Galvanized, aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1.

D. Mastic-Type Surfaces

Mastic-type surfaces shall be prepared by removing foreign material.

E. Wood Surfaces

Wood surfaces shall be cleaned of foreign matter. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter, unless otherwise authorized. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints. Small, dry seasoned knots shall be scraped, cleaned, and given a thin coat of commercial knot sealer before application of the priming coat. Pitch on large, open, unseasoned knots and all other beads or streaks of pitch shall be scraped off, or, if it is still soft, removed with mineral spirits or turpentine, and the resinous area shall be thinly coated with knot sealer. Finishing nails shall be set and all holes and surface imperfections shall be primed. After priming, holes and imperfections in finish surfaces shall be filled with putty or plastic wood filler, colored to match the finish coat if natural finish is required, allowed to dry, and sanded smooth. Putty or wood filler shall be compatible with subsequent coatings. All surfaces of trim and finish lumber shall be primed on all surfaces.

### 3.03 MIXING AND THINNING

When thinning is approved as necessary to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions. When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, and required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

A. Cement-Emulsion Filler Coat

Cement and aggregate shall be dry-mixed so that uniform distribution and intermixing are obtained. Mixing liquid and one-half of the total amount of water shall be premixed and added gradually to the white portland cement and aggregate with constant stirring until a thick, smooth material is obtained. Emulsion paint shall then be added to the mixture and stirred until uniformity is obtained. The blend shall have a thick, creamy consistency. The remainder of the water shall be added if necessary to obtain a material with adequate application properties. Blending resin emulsion or emulsion paint with any other component shall be done with caution; too rapid an agitation will cause air entrapment and foaming.

B. Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

### 3.04 APPLICATION

Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application. Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

A. Ventilation

Affected areas shall be ventilated during paint application so that workers exposure to chemical substances shall not exceed limits as established by ACGIH-02, or as required by a more stringent applicable regulation. Interior work zones having a volume of 10,000 cubic feet or less shall be ventilated at a minimum of 2 air exchanges per hour. Ventilation in larger work zones shall be maintained by means of mechanical exhaust. Solvent vapors shall be exhausted outdoors, away from air intakes and workers. Return

air inlets in the work zone shall be temporarily sealed before start of work until the coatings have dried.

B. Respirators

Operators and personnel in the vicinity of operating paint sprayers shall wear respirators.

C. First Coat

The first coat shall include repeated touching up of suction spots or overall application of primer or sealer to produce uniform color and gloss. Excess sealer shall be wiped off after each application.

D. Timing

Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practical after such pretreatment has been completed, but prior to any deterioration of the prepared surface. Sufficient time shall elapse between successive coats to permit proper drying. This period shall be modified as necessary to suit weather conditions. Oil-based or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause the undercoat to lift or lose adhesion. Manufacturer's instructions for application, curing and drying time between coats of two-component systems shall be followed.

E. Fillers

Concrete and masonry surface voids shall be filled; however, surface irregularities need not be completely filled. The dried filler shall be uniform and free of pinholes. Filler shall not be applied over caulking compound.

F. Cement-Emulsion Filler

Immediately before filler application, surfaces shall be dampened uniformly and thoroughly, with no free surface water visible, by several applications of potable water with a fog spray, allowing time between the sprayings for water to be absorbed. Cement-emulsion filler shall be scrubbed into the surface vigorously with a stiff-bristled brush having tampico or palmyra bristles not longer than 2-1/2 inches. At least 24 hours shall elapse before applying exterior emulsion paint over cement-emulsion filler. When the ambient temperature is over 85 degrees F, cement-emulsion filler surfaces shall be dampened lightly with a fog spray of potable water immediately prior to application of the subsequent paint coat.

G. Latex Filler

Latex filler shall be applied according to the manufacturer's instructions. Surface voids shall be filled and excess filler shall be removed from the surface with a rubber squeegee. The filler shall be allowed to dry the length of time specified by the manufacturer prior to applying successive coats of paint.

H. Ferrous-Metal Primer

Primer for ferrous-metal shall be applied to surfaces to receive paint other than asphalt varnish prior to deterioration of the prepared surface. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified primer prior to application of finish coats.

3.05 COLOR CODE MARKING

- A. Pipes and equipment in exposed areas and in accessible spaces shall be painted using the following color code scheme.

COLOR CODES

Item	Color Shade
Piping (force main)	Gray
Valves (force main)	Gray
Valve Hand Wheels	Red
Metal Pipe Supports	Gray
Electrical Conduit	Red
Fuel Oil Lines and Vent Piping	Black
Potable Water	Dark Blue
Pump Air Bleed Lines	Gray
Miscellaneous Metal (Except aluminum or galvanized)	Gray
Emergency Pump Connection	Green

- B. Vertical concrete surfaces of housekeeping pads and curbs shall be painted Safety Yellow.

- |    |                       |                |           |
|----|-----------------------|----------------|-----------|
| C. | Pump Station Building | Interior Walls | White     |
|    |                       | Interior Trim  | White     |
|    |                       | Exterior Trim  | Per Owner |

3.06 SURFACES TO BE PAINTED

Surfaces listed in the painting schedules at the end of this section, other than those listed in paragraph SURFACES NOT TO BE PAINTED, shall be painted as scheduled.

### 3.07 SURFACES NOT TO BE PAINTED

Unless otherwise specified or indicated the following surfaces shall not be painted:

- Surfaces of hardware, fittings, and other factory finished surfaces
- Stainless Steel Surfaces
- Factory finished surfaces or Control Panel Cabinets, Pumps and Generators
- Fiberglass doors and frames
- Anodized surfaces
- Galvanized surfaces
- Aluminum Surfaces
- Plastic Pipe

### 3.08 CLEANING

Cloths, cotton waste and other debris that might constitute a fire hazard shall be placed in closed metal containers and removed at the end of each day. Upon completion of the work, staging, scaffolding, and containers shall be removed from the site or destroyed in an approved manner. Paint and other deposits on adjacent surfaces shall be removed and the entire job left clean and acceptable to the Owner.

### 3.09 PAINTING SCHEDULES

The following painting schedules identify the surfaces to be painted and prescribe the paint to be used and the number of coats of paint to be applied. MDFT is minimum dry film thickness per coat, 1.5 mils unless otherwise noted. Colors as specified or as selected by the Owner.

#### EXTERIOR PAINTING SCHEDULE

<u>Surface</u>	<u>First Coat</u>	<u>Second Coat</u>	<u>Third Coat</u>
Wood	Alkyd 1.5 mils MDFT	Waterborne Acrylic Epoxy 1.5 mils MDFT	Waterborne Acrylic Epoxy 1.5 mils MDFT
Ferrous metal	Zinc-Rich Urethane 2.5 mils MDFT	Polyamide Epoxy 2 mils MDFT	Epoxy Polyurethane 2 mils MDFT
Masonry & Concrete (above grade)	Acrylic Emulsion 4 mils MDFT	Acrylic Emulsion 4 mils MDFT	None

#### INTERIOR PAINTING SCHEDULE

<u>Surface</u>	<u>First Coat</u>	<u>Second Coat</u>	<u>Third Coat</u>
Concrete masonry units	Waterborne Acrylic Epoxy Filler	Waterborne Acrylic Epoxy - Gloss	None

	60-80 ft <sup>2</sup> /gal	4 mils MDFT	
Concrete	Waterborne Acrylic Epoxy Filler 60-80 ft <sup>2</sup> /gal	Waterborne Acrylic Epoxy – Gloss 4 mils MDFT	None
Concrete floor – control room	Polyamine Epoxy primer 6 mils	Polyamine Epoxy (non-skid) 1/8 inch          6 mils	Polyamine Epoxy
Ferrous Metal exposed	Polyamide Epoxy 3 mils MDFT	Polyamide Epoxy 2 mils MDFT	Polyamide Epoxy 2 mils MDFT
Ferrous metal immersion	Vinyl Ester 18 mils MDFT	Vinyl Ester 18 mils MDFT	None
Ferrous Metal: (non-immersion)	Epoxy Polyamide 3 mils MDFT	Epoxy Polyamide 4 mils MDFT	None
Electrical conduit runs, metallic tubing, and pipe in areas having painted adjacent surfaces.			
Ferrous metal factory-primed mechanical and electrical equipment.	Two coats of paint as recommended by the equipment manufacturer		None
Aluminum and Galvanized Surface metal (non-anodized)	Epoxy Polyamide 1.5 mils MDFT	Epoxy Polyamide 1.5 mils MDFT	None
Electrical conduit runs, metallic tubing, and pipe in areas having painted adjacent surfaces.			
Aluminum and Galvanized Surface metal (non-anodized) (immersion)	Epoxy Polyamide 3 mils MDFT	Epoxy Polyamide 5 mils MDFT	None
Electrical conduit runs, metallic tubing, and pipe in areas having painted adjacent surfaces.			
Wood:	Alkyd 2 mils MDFT	Waterborne Acrylic Epoxy 2 mils MDFT	Waterborne Acrylic Epoxy 2 mils MDFT

### 3.10 TOUCH-UP

Factory finished surfaces marred during construction shall be touched-up with factory supplied materials.

End of Section

SECTION 26 00 00  
ELECTRICAL - GENERAL

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide complete, tested and fully functional electrical systems as shown on the Drawings and as specified herein.
- B. Electrical equipment and installed systems shall be suitable for the application, shall be safe for the intended use, shall be fully rated for the available fault current, and shall conform to local building codes and statutory requirements.

1.02 RELATED DOCUMENTS

- A. The Drawings and General Provisions of the Contract apply to this Section.
- B. Electrical requirements specified in this Section apply to electrical equipment and materials described in other Sections of Division 26.

1.03 SCOPE OF WORK

- A. The work includes, but is not limited to, the work described in other Sections of Division 26, shown on the Drawings, and the following:
  - 1. Temporary lighting and power as required for construction and as hereinafter specified
  - 2. Field wiring for equipment provided under other Sections of the Specification
  - 3. Thorough cleaning of all equipment prior to energization
  - 4. Acceptance testing of all equipment installed under this Division
  - 5. Protection of all equipment under this Division until the final acceptance of the job
- B. Coordinate Division 26 requirements with work described in other Divisions of the Specification.
- C. Submit shop drawings, product data, test reports, certificates, manufacturer's instructions, manufacturer's field reports, operation and maintenance data, closeout submittals and other specified documents to the Owner for review and approval as described in the General Provisions, Special Provisions, this Section, and in other Sections of Division 26.
- D. Perform electrical acceptance tests described in Part 3 of other Division 26 Sections.
- E. The following principal items of work will be performed under other Sections unless otherwise noted:

1. Finish painting of exposed raceways, boxes, fittings, hangers, and supports as described in Division 09.
2. Motors for mechanical equipment will be furnished under other Divisions of this Specification.

#### 1.04 PROJECT CONDITIONS

- A. Ambient temperature, humidity, and elevation ranges:
  1. Ambient Temperature: 0 to 40 deg C.
  2. Humidity: Less than 90 percent (non-condensing).
  3. Altitude: Not exceeding 3300 feet (1000 m).
- B. Unusual service conditions:
  1. Exposure to vapors and gasses that may result in explosive conditions. Wet well is a Class I Division 1 Group C & D Hazardous (Classified) Location.
- C. Product Selection for Restricted Space: Drawings show allowable space to scale for anticipated equipment sizes. Comply with NEC requirements for working clearances and with manufacturer's recommendations for access for maintenance. Notify the Owner if insufficient space is available for available products.

#### 1.05 DEFINITIONS

- A. In addition to the Definitions in the General Provisions, the following definitions apply to Division 26:
  1. Acceptance Tests: power distribution and control equipment testing performed in conformance with NETA Acceptance Testing Specification
  2. AHJ: The statutory Authority Having Jurisdiction as defined in NEC Article 100 for enforcement of legally required compliance to local codes, standards, and ordinances.
  3. ANSI: American National Standards Institute
  4. AEIC: Association of Edison Illuminating Companies
  5. ASQ: American Society for Quality
  6. AWG: American Wire Gauge
  7. CFR: Code of Federal Regulations
  8. Cable: an assembly of insulated conductors
  9. Control panel: an electrical enclosure housing control logic devices and an operator control interface
  10. Commissioning: the process of testing system performance after the sequential steps of installation, testing, energization, startup (including initial adjustment and de-bugging) and functional testing of individual pieces of equipment have all been completed
  11. Contract: as used in the Electrical Specification, includes all Contract documents including Specifications and Appendices, Drawings, Addenda, and Change Orders
  12. ICEA: Insulated Cable Engineers Association
  13. Equipment: a general term including materials, fittings, devices, appliances, fixtures, apparatus, and the like, used as part of, or in connection with, an electrical installation (OSHA Section 29 CFR 1910.399(46) definition)

14. FM: Factory Mutual, Inc.
15. Field wiring: on-site installation of raceways & conductors to connect equipment in accordance with approved drawings
16. Field test: electrical test carried out on-site
17. Fail-safe: selection of control devices and contacts in a manner which results in safe shutdown of the equipment whenever one of the following events occurs:
  - a. Power supply failure
  - b. Loss of remote control RUN command (normal configuration: contacts close to run equipment)
  - c. Intentional and unintentional disconnection of device (normal configuration: contacts open to shut down equipment)
  - d. High contact resistance or high resistance connection
  - e. Loss of 4-20mADC signal
  - f. Definite-time sequence takes too long, e.g., reduced voltage motor starter fails to make transition from START mode to RUN mode after a reasonable time
  - g. Defined sequence does not occur, e.g., there is no flow from a motor driven pump within a reasonable time after the motor starter contactor is energized.
18. Furnish and install: same as "Provide" below.
19. Functional testing: verification of the satisfactory performance of control logic, with due attention to the functionality of equipment protective devices, for example, overload relays, temperature switches, pressure switches, flow switches, and similar devices, under actual operating conditions
20. HV: high voltage, operating voltage over 600V (NEC definition)
21. IEEE: Institute of Electrical and Electronics Engineers, Inc.
22. ISO: International Standards Organization
23. Lineup: with respect to switchgear, switchboards, and motor control centers, a contiguous group of vertical sections with common main busbars, and including bus tie breaker sections and control sections
24. LV: low voltage, operating voltage under 600V (NEC definition)
25. Megger: insulation tester with megohm scale
26. NEC: NFPA 70, the National Electrical Code
27. NETA: InterNational Electrical Testing Association, Inc.
28. NICET: National Institute for Certification in Engineering Technologies
29. NFPA: National Fire Protection Association
30. NRTL: Nationally recognized testing laboratory as defined in 29 CFR 1910.7 as it applies to testing and inspecting for safety in the workplace (OSHA definition)
31. Nonconformity: The non-fulfillment of a specified requirement (ASQ definition)
32. "Or approved equal": proposed "equal" product shall be in conformance with all specified requirements, shall be equivalent in materials of construction to specified manufacturers' products, shall have equal or superior performance in the conditions anticipated for use of the product in this project, and shall be approved by the Engineer
33. OSHA: Occupational Safety and Health Act
34. Panel: with respect to circuit breaker and fuse power distribution centers, panel is equivalent to "distribution board", e.g., lighting panel; with respect to control panels, refers either to the entire control panel itself or to a steel plate used for mounting devices inside the control panel

35. Provide: Throughout the Specification, use of this term includes project administration, quality assurance, human resources, tools & equipment, logistics and scheduling, submittals of shop drawings & samples for approval, managing suppliers, purchasing, manufacturing, factory testing, release for shipment, packing, delivery, storage, submittal of coordinated & dimensioned installation drawings for approval, installation, surface preparation & finishes, site testing, startup & commissioning, on-site supervision by equipment manufacturers' representatives, spare parts & tools, Operations and Maintenance (O&M) Manuals, training, guarantees and warranties, other work described in individual Sections of the Specification, and the Contractor's duties, responsibilities, risks, and liabilities under the Contract.
36. Punch list: document containing detailed descriptions of non-conformities
37. Quality: conformance to specified requirements.
38. RMS: root mean square
39. Raceways: cable ladder and tray, conduit, duct, wireway, and associated boxes and fittings which enclose, support, and protect wires and cables
40. Shop drawings: a complete package of manufacturer's equipment drawings, bill of materials, catalog data sheets, performance curves, calculations, and other data provided to demonstrate conformance to the equipment specification
41. Substitution: an alternative, nonconforming product proposed by the Contractor in lieu of a specified, conforming product
42. Substantial Completion: an electrical system may be considered substantially complete when the equipment has passed the specified tests required prior to energization, has been energized, has passed the Electrical Acceptance Tests, and all related Specification requirements have been met except for well-defined minor items which, in the opinion of the Engineer, may be repaired or replaced prior to Final Acceptance without adversely affecting process performance.
43. Terminal box: an electrical enclosure containing labeled terminal blocks for connection of wiring
44. UL: Underwriters Laboratories, Inc.
45. VFC: variable frequency controller
46. VFD: variable frequency drive, the combination of VFC and inverter-duty motor that drive mechanical loads using the principle of variable frequency motor control
47. Wiring: conductors and connections to equipment terminals. 'Wiring' and 'cabling' shall be considered equivalent terms. Fiber optic cables shall be included in the scope of electrical wiring.

#### 1.06 REFERENCE STANDARDS IN EFFECT

- A. Notwithstanding revision dates shown in this and other Sections of Division 26, the codes and standards applicable to this project shall be those in effect when bids are submitted.

#### 1.07 QUALITY ASSURANCE

- A. In consultation with the equipment and materials Suppliers, the Contractor shall prepare and submit a Compliance Statement as described in "SUBMITTALS" with each submittal requiring approval.

- B. The Engineer's review of a submittal shall not relieve the Contractor of any Contractor responsibilities under the Contract. Review of a submittal that is incomplete, or one that has nonconformities that are not described in the Compliance Statement, followed by the discovery of unapproved nonconformities, will result in replacement of the non-conforming items at no additional cost to the Owner. Substitutions require the approval of the Engineer as described in the General Provisions.
- C. Manufacturers of electrical equipment shall have quality certification to ISO 9000:2000 or an equivalent Quality Management System acceptable to the Owner.
- D. Equipment, materials, and installation shall conform to NEC requirements and shall be NRTL-listed and labeled.
- E. On-site electrical acceptance testing shall be performed as specified in Part 3 of other Sections of the Specification.
- F. Manufacturers, manufacturer's representatives, subcontractors, supervisors, installers, and testing agencies shall have qualifications and experience as described in other Sections of the Specification. Qualifications and experience submittals for firms and individuals shall be submitted, re-submitted, or updated whenever requested by the Owner.

#### 1.08 SAFETY IN THE WORKPLACE

- A. Electrical equipment and materials, and the Contractor's installation practices, shall conform to the following:
  - 1. Current edition of OSHA sections of the Code of Federal Regulations (CFR): Part 29 CFR 1910 for General Industry and Part 19 CFR 1926 for Construction Activities
  - 2. NFPA 70, the National Electrical Code
  - 3. Current edition of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces
- B. These regulations and standards impose obligations on equipment manufacturers to obtain NRTL certification, listing, and labeling to comply with OSHA (Occupational Safety and Health Act) and Department of Labor regulations.
- C. All electrical equipment for which NRTL test procedures have been established shall be certified, listed, and labeled, or otherwise determined to be safe for its intended use, by a NRTL. The absence of a specific reference to NRTL-listing in other Sections shall not relieve the Contractor of the requirement to provide NRTL-listed equipment, and to obtain certification as required by the AHJ in cases where NRTL listing and labeling is not a manufacturer's standard offering for a particular product.
- D. Equipment shall not be modified in any manner adversely affecting safety for the intended use, nor shall any equipment be modified on-site without the approval of the manufacturer.

- E. Equipment sound levels shall not exceed limits established by reference standards and local regulations. In the absence of reference standards and local regulatory requirements, sound pressure levels shall not exceed 85 dB (A) measured three feet from the equipment.
- F. Equipment with moving parts shall be fully guarded in compliance with OSHA rules and regulations.

#### 1.09 INSPECTIONS BY THE AHJ

- A. The Contractor shall make arrangements for electrical inspection of the project by the AHJ. Upon completion of the work, final certificate of approval documents shall be submitted to the Engineer for forwarding to the Owner. This certificate shall be submitted prior to request for final payment. The Contractor shall pay all fees required for permits and inspections.

#### 1.10 WORKMANSHIP AND MATERIALS

- B. Materials and equipment shall be new and undamaged, shall be marked by the manufacturer, and shall be delivered to the construction site in the original factory packaging.
- C. Materials and equipment shall be installed in accordance with the Drawings, the Specification, the manufacturer's installation, operation, and maintenance instructions, and NECA installation standards that have been adopted by ANSI. In the event of apparent conflicts or discrepancies, the Owner shall be informed of the apparent conflict or discrepancy in writing, and will instruct the Contractor how to proceed.

#### 1.11 RESOURCES AND CONSTRUCTION SCHEDULE

- A. The Contractor shall provide sufficient resources, including qualified and experienced project managers, electrical engineers, superintendents, technicians, supervisors, electricians, tools and construction equipment to complete the electrical work in accordance with the activity durations and sequences shown on the Construction Schedule for this project.
- B. The construction schedule shall include the following activities and milestones, in realistic sequence, for each major item of electrical equipment at the pump station:
  - 1. Review of shop drawings
  - 2. Approval of shop drawings (milestone)
  - 3. Factory testing
  - 4. Shipping
  - 5. Delivery to site (milestone)
  - 6. Concrete formwork ready for sleeves, openings, and inserts
  - 7. Equipment installation
  - 8. Tests on completion of installation (prior to energization)
  - 9. Energization (milestone)
  - 10. Acceptance testing

11. Functional testing
  12. Installation, acceptance testing, and functional testing and commissioning complete (milestone)
- C. The construction schedule shall include the following activities and milestones, in the following sequence, for electrical raceways and wiring at the pump station:
1. Preparation of coordination drawings
  2. Materials delivery to site (milestone)
  3. Surface raceway installation
  4. Wire & cable installation
  5. Acceptance testing complete (milestone)

#### 1.12 CONTRACT DRAWINGS

- A. The Electrical Drawings show scaled layouts of “basis of design” equipment but do not include "approved for construction" dimensions for equipment, which shall be based on approved equipment shop drawings.

#### 1.13 COORDINATION OF ELECTRICAL WORK WITH OTHER TRADES

- A. Work under this Division shall be performed in conjunction with the work of other trades. Coordinate electrical installation work with the overall construction schedule. Examine the plans and specifications prior to commencement of work and become familiar with all phases of work involved prior to commencing installation work.
- B. The Contractor shall be responsible for coordinating dimensions of equipment and working clearances in accordance with the NEC, and in all cases shall bring to the attention of the Owner any discrepancies on the plans and in the specifications prior to installation. Any work that installed without conformance to NEC requirements shall be removed and reinstalled at the Contractor’s expense. The layout for sleeves, chases, openings, etc., must be arranged prior to construction in order to prevent unnecessary cutting. Examine Architectural drawings for doors swings, countertop heights, built-in furniture and casework, and other factors affecting electrical outlet locations prior to roughing-in raceways, boxes, fittings, and outlets.

#### 1.14 COORDINATION DRAWINGS

- A. Following approval of equipment shop drawings, the Contractor shall create dimensioned electrical equipment layout drawings for electrical and telecommunications rooms and areas, showing the relationships of approved electrical equipment with the building structural and architectural components, walls, floors, ceilings, doors, windows, louvers, access hatches, concrete equipment pads, anchors and bracing. One set of these Coordination Drawings shall be maintained at the construction site throughout the construction phase.

## 1.15 CODES AND STANDARDS

- A. All equipment and materials shall be manufactured, tested, and installed in accordance with the National Electrical Code (NEC) and local codes and standards, in accordance with the requirements of the AHJ.
- B. In addition, work shall be in accordance with the versions of the following referenced standards in effect at the time of bid opening:
  - 1. American Association for Laboratory Accreditation (A2LA) (establishes NRTL accreditation)
  - 2. American National Standards Institute (ANSI)
  - 3. American Society for Testing and Materials (ASTM)
  - 4. Americans with Disabilities Act (ADA)
  - 5. Code of Federal Regulations (29 CFR 1903, 1910, and 1926)
  - 6. Factory Mutual Engineering & Research (FME&R)
  - 7. Illuminating Engineering Society of North America (IESNA)
  - 8. Institute of Electrical and Electronic Engineers (IEEE)
  - 9. Insulated Cable Engineers Association (ICEA)
  - 10. International Building Code
  - 11. International Organization for Standardization (ISO)
  - 12. National Electrical Contractors Association (NECA)
  - 13. National Electrical Manufacturers Associates (NEMA)
  - 14. National Fire Protection Association (NFPA)
  - 15. Occupational Safety and Health Act (OSHA)
  - 16. Underwriters Laboratory, Inc. (UL) and other NRTL standards and test procedures

## 1.16 HAZARDOUS AREAS

- A. Electrical equipment for use in hazardous areas shall be NRTL listed and labeled for the application. Equipment and installation shall be in accordance with NEC requirements for the hazardous area classification indicated on the Drawings.
- B. Equipment and installation inside the Wet Well shall be in accordance with NEC requirements for Class I Division 1 Group D Hazardous (Classified) Locations. Provide conduit seals outside the Hazardous Location boundary.
- C. Equipment and installation inside the Valve Vault shall be in accordance with NEC requirements for Class I Division 2 Group D Hazardous (Classified) Locations. Provide conduit seals outside the Hazardous Location boundary.

## 1.17 SUBMITTALS

- A. In addition to conforming to the requirements described in the General Provisions, submittals shall conform to the following requirements.
- B. One complete shop drawing submittal is required for all of the electrical equipment described in a single Division 26 Section of the Specification. Incomplete shop drawing

submittals will be reviewed to the extent needed to determine incompleteness, and returned to the Contractor for re-submission.

- C. **Compliance Statement:** with each Shop Drawing submittal, include a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed nonconformities. Provide short description of minor nonconformities, and detailed explanation of other nonconformities.
- D. **Submittal Format**
1. Each submittal shall be accompanied by a transmittal letter showing the submittal category and Specification Section reference number(s). Submittals shall be 3-hole punched and neatly bound in a 3-pin or 3-ring binder. Stapled bindings are not acceptable.
  2. Submittals shall have a complete Table of Contents with tabs corresponding to the Table of Contents headings.
  3. Submittal transmittal letters shall clearly identify the reason for submittal, e.g., for approval, as manufactured, or as-built / record.
  4. Each page of each submittal shall be numbered. Page numbers shall be listed on the Table of Contents. Content shall be printed on 8-1/2 x 11 inch paper, or 11 x 17 paper (folded). Larger size drawings shall be folded and placed in labeled individual clear plastic pockets.
  5. Product Data shall be clearly marked to show which items are proposed for this project. Information that does not apply to this project shall be crossed out.
- E. **Submittal Categories**
1. Preconstruction Submittals, including proposed substitutions, supplier and manufacturer qualifications and experience, construction scheduling
  2. Shop Drawings, including equipment drawings with a complete bill of materials and supporting manufacturer's catalog data. One separate and complete shop drawing submittal for all of the equipment specified in each Section is required.
  3. Product Data, marked to indicate precisely which items are proposed for this project. One complete and separate Product Data submittal for all of the equipment and materials described in each Section requiring a product data submittal, is required. See Submittals requirements in other Sections in Division 26 to determine if Product Data is to be included in Shop Drawing submittals.
  4. Test Reports, including prototype tests, factory tests, field tests, acceptance tests, and functional tests. A test report is required for each specified test.
  5. Certificates, including seismic qualification certification, welding certificates, factory training certificates for manufacturer's representatives
  6. Manufacturer's Installation Instructions, including unloading, hoisting, rigging, short term storage, long term storage, method of field assembly, and other installation instructions
  7. Manufacturer's Field Reports, including inspections and training records
  8. Operation and Maintenance Manuals, including manufacturer's standard published literature and specially prepared descriptions of operation
  9. Closeout Submittals, including black line paper copy of Record Drawings marked in red illustrating changes during construction

10. Spare Parts and Special Tools List

- F. Coordination Drawings: Prepare dimensioned layout and coordination drawings of electrical equipment room and generator room, for coordination with NEC accessibility requirements and the work of other trades, sufficiently in advance to allow for review by other trades prior to starting related work, in accordance with the Construction Schedule.
- G. Record Drawings: Maintain a full size paper set of "black-line" working drawings throughout the project, and carefully record in red ink the locations and sizes of each major piece of electrical equipment, as well as manholes, handholes, and duct bank routing, to scale. Upon Substantial Completion of the work, deliver the marked-up set of prints to the Owner. The Owner reserves the right to withhold final payment until "As-Built" drawings are received.
- H. Operation and Maintenance Manuals: Provide copies of electrical Operation and Maintenance Manuals in conformance with the General Provisions. O&M Manuals shall be organized according to Division 26 Section numbers. Each copy shall be bound in a durable, 3-ring hardback binder, with data sheets individually punched and reinforced to prevent tear-out. Data sheets shall be grouped, and binder dividers shall be provided to match the Table of Contents. Each Manual shall have an identifying label on the spine and front cover and shall include the following:
  - 1. List of all O&M Manuals in the front of each manual.
  - 2. Table of Contents for each manual and each binder
  - 3. Copy of each of the following:
    - a. Shop Drawings
    - b. Product Data
    - c. Design Data
    - d. Test Reports
    - e. Certificates
    - f. Manufacturer's Instructions
    - g. Manufacturer's Field Reports
    - h. Operation and Maintenance Data
    - i. Panelboard directories (as-built)
- I. Spare Parts and Special Tools List: 90 days prior to the scheduled Substantial Completion date, submit a complete list of Spare Parts and Special Tools included in other Sections of Division 26 to the Owner, and request a time and location for delivery of the Spare Parts and Special Tools to the Owner.
- J. Spare Parts and Special Tools List: 90 days prior to the scheduled Substantial Completion date, submit a complete list of manufacturer's recommended Spare Parts and Special Tools for equipment to the Owner, with prices firm for 90 days and estimated delivery dates.

1.18 ELECTRICAL AND TELECOMMUNICATIONS SERVICES

- A. Provide electrical and telecommunications services as shown on the Drawings and specified in Division 26 Section "Incoming Services".

## 1.19 OUTAGES

- A. Electrical outages: 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 if required by the Specification.
  - 1. Submit written requests to the Owner for approval of proposed electrical outages a minimum of 30 days in advance of proposed interruption of electrical circuits, with step-by-step sequence and schedule for proposed outage. If required to maintain critical processes in operation during an outage, submit proposed method of providing temporary electrical circuits and power supplies.
  - 2. Confirm approved interruption of electrical service one week in advance of Owner-approved date.
  - 3. Do not proceed with interruption of electrical service without written approval from the Owner.

## 1.20 TEMPORARY LIGHTING AND POWER

- A. Refer to the General Provisions.
- B. The Contractor shall provide all temporary electric services for power and lighting including panels, feeders, lighting, outlets, branch circuits, etc.
- C. The Owner's electrical power shall not be used without permission of the Owner.
- D. All temporary work shall be in accordance with the NEC, OSHA, and NFPA safety requirements and shall be completely removed upon completion of the project.

## PART 2 - PRODUCTS

### 2.01 EQUIPMENT AND MATERIALS

- A. Provide equipment and materials in compliance with other Sections of Division 26. The requirements in this Section apply to all Sections in Division 26.

### 2.02 ELECTRICAL IDENTIFICATION

- A. Electrical equipment, raceways, boxes, fittings, wires and cables shall be marked in the field in accordance with Division 26 Section "Electrical Identification".

### 2.03 ELECTRICAL ENCLOSURES

- A. In the absence of other specified NEMA enclosure ratings in other Sections of the Specification, and where cross-referenced in other Sections of Division 26, electrical enclosures shall have degree of protection ratings suitable for the intended application (e.g., watertight, dust-tight, explosion-proof) and environmental conditions.

- B. Electrical equipment enclosures shall have the following NEMA 250 ratings for the following specified non-hazardous locations unless otherwise indicated:
  - 1. NEMA 1: inside Pump Station Control Panel
  - 2. NEMA 4X stainless steel: outdoors
- C. Enclosures located in hazardous areas shall be epoxy powder-coated cast aluminum NEMA 7 with NRTL listing and labeling for the hazardous area classification.
- D. Where different enclosure ratings and enclosure materials are specified in other Sections of the Specification, the Contractor shall submit a written request for clarification of the intent of the Specification to the Owner.

#### 2.04 ELECTROMAGNETIC INTERFERENCE

- A. Power conversion equipment, including variable frequency controllers, battery-powered inverters, computer power supplies, frequency converters, and Uninterruptible Power Supplies, shall be fitted with EMI (electromagnetic interference), RFI (radio frequency interference) and telephone interference filters to limit interference effects on other equipment in the area in accordance with IEEE standards and recommendations applicable to the equipment.

#### 2.05 DISSIMILAR METALS

- A. Dissimilar metals shall not be connected, spliced, or joined except where specifically approved in writing by the Engineer. Copper busbars, aluminum busbars, and copper-to-aluminum busbar connections shall be tin-plated at joints and at cable lugs. Bolted electrical conductor connections shall be made with [silicone-bronze] [grade 3 or better plated steel] bolts, nuts, and washers. Belleville washers & tin-plated flat washers shall be used at aluminum-to-copper and aluminum-to-aluminum busbar joints.

#### 2.06 WARRANTIES

- A. Warranties for equipment and materials shall conform to the General Provisions.
- B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all equipment and materials. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.
- C. All components of electrical systems that are not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage of fully operational equipment unless otherwise approved by the Owner.

## PART 3 - EXECUTION

### 3.01 DELIVERY AND HANDLING

- A. Equipment delivered to site shall be handled in accordance with manufacturer's recommendations by experienced riggers, crane operators, and fork lift truck operators.

### 3.02 STORAGE AND PROTECTION OF EQUIPMENT

- A. All electrical equipment to be used in construction shall be properly stored and protected against the elements. General construction materials shall be stored in covered trailers. Switchgear, unit substations, motor controllers, panelboards, emergency lighting, solid state equipment, engine generator shall be stored in a clean, dry, indoor location, under cover, until the building is weather-tight and the area where the equipment is to be installed has been completed to the satisfaction of the Owner, including completion of overhead work by other trades.
- B. Long term storage instructions of the manufacturer shall be followed.
- C. Equipment enclosures exposed to construction damage such as paint spots, spackling, waterproofing, insulation etc. shall be covered and protected against damage.

### 3.03 INSPECTIONS PRIOR TO COVERING-UP

- A. Raceways embedded in concrete or otherwise concealed shall be inspected in the presence of the Owner prior to placement of concrete. Sufficient time shall be allowed to make corrections if required.

### 3.04 ON-SITE INSPECTIONS AND NONCONFORMITIES

- A. Equipment shall be inspected on delivery to site for physical damage and for compliance with the Specification and approved equipment shop drawings.
- B. Installed equipment, raceways, and wiring shall be inspected on completion of installation for compliance with the Specification and approved installation drawings.
- C. A Punch List will be prepared by the Engineer during inspections and testing, and issued to the Contractor for corrective action.
- D. Repairs, replacement, and other corrective action that requires de-energizing any part of the Electrical Power Distribution and Control System shall be completed prior to the scheduled date for Substantial Completion of the project.

### 3.05 PENETRATIONS AND SEALING

- A. Sleeves and rectangular openings shall be provided for raceways provided under this Contract, and for raceways for future equipment where future equipment is shown on the Drawings. Sleeves and rectangular openings for the passage of raceways and conductors shall be sealed after the raceways and conductors have been installed. Spare sleeves and rectangular openings shall also be sealed.
- B. Penetration of Waterproof Construction: Coordinate the work to minimize penetration of waterproof construction, including roofs and exterior walls. Where penetrations are necessary, provide sleeves and sealing fittings to make each penetration watertight. Conduit sleeves and openings shall be sealed watertight with mechanical seals. Watertightness shall not rely on caulking.

### 3.06 ELECTRICAL SAFETY AND TEST EQUIPMENT

- A. Maintain the following test instruments and calibration certificates less than 12 months old on-site as a minimum:
  - 1. True RMS digital volt-ohm meter with resistance scale
  - 2. Clip-on ammeter with range from 1 to 400 amps
  - 3. 1000V DC battery-powered megger insulation tester
- B. Provide electrical safety equipment, including personal protective equipment, test instruments, lighting, ventilation, and instructions in the use of safety equipment, and perform the work under this Contract in accordance with applicable safety rules and regulations. The Contractor's attention is directed to safety issues related to confined spaces as defined in OSHA regulations.

### 3.07 CLEANING AND PAINTING

- A. Conform to the General Provisions.
- B. After installation and wiring work is completed, all dust and debris shall be removed from the interior and exterior of each electrical equipment enclosure and motor by vacuum-cleaning with circuits de-energized. Do not use compressed air for cleaning. Vacuum cleaner wands and brushes shall be non-conducting. Anti-static protection shall be provided for static-sensitive devices.
- C. Clean and remove all rust, scale, oil, grease, and dirt from panelboard enclosures, conduits, pull, junction and terminal boxes, fittings and hangers, leaving surfaces in condition for final surface preparation and painting under Division 9.
- D. All ferrous materials that are concealed, or exposed in unfinished areas, including fittings, hangers, junction, pull and terminal boxes, that are not plated or painted with a factory-applied finish, shall be painted under this Section with one coat of zinc-chromate primer and one finish coat of paint approved by the Owner. Nonferrous materials shall be cleaned only and left unpainted.

- E. Equipment furnished with a factory finish coat shall have finish carefully touched-up where it is scratched or otherwise damaged. Touch-up work shall match the color and type of the original finish.

### 3.08 INSPECTION AND TESTING ON-SITE

- A. The Contractor shall hire a NETA-certified or NICET-certified specialist electrical testing firm to perform on-site inspection and electrical testing.
- B. Perform Electrical Acceptance Tests in accordance with NETA Acceptance Testing Specifications ATS-2007 listed in Part 3 of each Section of Division 26.
- C. Submit manufacturer-endorsed field test data sheets & procedures for approval, test equipment and materials on-site prior to site visit by manufacturer's factory-trained representative, test equipment on-site under the supervision of the Owner's Representative and the equipment manufacturer's factory-trained representative(s), and submit manufacturer's statement of acceptance of installation prior to energization of equipment. Invite the Owner's Representatives to witness field testing.
- D. Electrical equipment shall not be energized without the approval of the Owner.
- E. A complete certified electrical test report shall be compiled by the electrical testing firm, checked for completeness, and submitted for the record.
- F. The Contractor shall notify all parties whose presence is necessary for the test; and in all cases, the Engineer shall be notified at least one week prior to the actual test.

### 3.09 ELECTRICAL POWER DISTRIBUTION SYSTEM FUNCTIONAL TESTS

- A. Conform to the General Provisions.
- B. After testing and commissioning for equipment has been completed, the following functional tests of the electrical power distribution and control system shall be carried out by the Contractor's specialist electrical testing firm in the presence of the Engineer or Owner's representative:
  - 1. Demonstrate manual changeover of power supply for all equipment with dual supply.
  - 2. Simulation of electric utility company power failure: trip incoming supply main circuit breaker(s) and transfer load to the plug-in standby generator set. Leave normal electric utility supplies off for 2 hours and note any abnormal operation of electrical devices.
  - 3. Restoration of electric utility company power: restore incoming supplies and re-transfer load.
  - 4. Using a precision laboratory voltmeter with certified 0.1 % accuracy, record incoming supply voltages for each power supply source in the presence of the Owner's Representative. Measurements shall be taken under no-load and normal

load conditions. Readings which indicate more than 1% voltage difference between phases will require corrective action.

5. Using a precision harmonic voltage and current measuring and recording instrument, measure the total harmonic voltage distortion at the circuit breaker panelboard bus. Measurements shall be taken at two or three different operating load conditions determined by the Engineer.

- C. Additional testing shall be carried out where recommended by equipment suppliers or requested by the Engineer.

### 3.10 LOAD BALANCING

- A. Single phase circuits in single and three-phase circuit breaker panelboards shall be balanced initially based on the load calculations. Load currents shall be measured under actual operating conditions, and under conditions described by the Engineer. Circuiting shall be re-arranged as necessary to obtain current balancing within 10% on each busbar under normal operating conditions.

### 3.11 DISTURBING EXISTING PAVEMENT AND LANDSCAPING

- A. Where cutting existing pavement and disturbing existing landscaping is necessary to perform work included in this Contract, the Contractor shall employ professional subcontractors to restore the appearance of disturbed areas to their original condition.

### 3.12 DEMONSTRATION AND TRAINING

- B. Conform to the General Provisions.
- C. Upon completion of all work furnished and installed under Division 26, instruct and train the Owner's representatives in the operation and maintenance of all the various apparatus and equipment to the complete satisfaction of the Owner. Training shall be as specified in each Section of Division 26, and shall start when the completed systems have been put in operational condition and tested as specified. A complete Training Course syllabus together with copies of the training materials shall be submitted with the Contractor's proposed schedule for instruction and training.
- D. Provide classroom and on-site training of the Owner's staff by an authorized representative of the equipment manufacturer during commissioning of the following electrical equipment:
  1. Pump Station Control Panel: 1 day for startup, 1 day for operation and maintenance
- E. Submit qualifications and experience of manufacturer's proposed training personnel for approval.
- F. Additional requirements for training are described in other Sections of the Specification.

End of Section

## SECTION 26 05 19

### WIRE AND CABLE

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Provide a complete system of wiring and cabling, including wire and cable pulling, splicing, and termination accessories, as shown on the Drawings and in conformance with the requirements in this Section.

##### 1.02 RELATED DOCUMENTS

- A. Related requirements are also specified in the following Sections:
  - 1. Division 26 Section "Electrical Identification" for identification and color coding requirements.
  - 2. Division 26 Section "Grounding" for grounding and bonding.

##### 1.03 DEFINITIONS

- A. In addition to the definitions in Division 26 Section "Electrical - General", the following definitions apply to this Section:
  - 1. NMC: non-metallic jacketed cable
  - 2. RTD: resistance temperature detector
  - 3. THHN: NEC and UL designation for flame-retardant and heat resistant thermoplastic insulation, gas and oil resistant nylon jacketed, suitable for dry locations only, 90 deg. C. max in dry locations
  - 4. THW: NEC and UL designation for flame-retardant, moisture resistant thermoplastic insulation suitable for dry and wet locations, 75 deg. C. max
  - 5. THWN: NEC and UL designation for flame retardant and moisture-resistant thermoplastic insulation, gas and oil resistant nylon jacketed, suitable for dry and wet locations, 75 deg. C. max in wet locations
  - 6. TSP: twisted shielded pair
  - 7. XHHW: NEC and UL designation for (thermoset) cross-linked synthetic polymer insulation suitable for dry and wet locations, 90 deg. C. max in dry locations, 75 deg. C max in wet locations
  - 8. XHHW-2: NEC designation for (thermoset) cross-linked synthetic polymer insulation suitable for dry and wet locations, 90 deg. C. max in wet and dry locations.

##### 1.04 REFERENCE STANDARDS

- A. Conform to the following standards in effect at the time of bid submittal:
  - 1. ICEA S-58-679-1996 Standard for Control Cable Conductor Identification

2. ICEA S-95-658 / NEMA WC70 Non-Shielded Power Cables Rated 2000 V or Less
3. ICEA T-22-294-1983 Test Procedures for Extended Time-Testing of Wire and Cable Insulations for Service in Wet Locations
4. IEEE 576-2000 Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications
5. UL 4 Armored Cable
6. UL 44 Thermoset-insulated Wires and Cables
7. UL 62 Flexible Cord and Fixture Wire
8. UL 83 Thermoplastic Insulated Wires and Cable
9. UL 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
10. UL 486C Splicing Wire Connectors
11. UL 486D Insulated Wire Connector Systems for Underground Use in Damp or Wet Locations
12. UL 493 Thermoplastic Insulated Underground Feeder and Branch Circuit Cables

#### 1.05 SUBMITTALS

- A. Submit manufacturers' data in accordance with the provisions of Division I, General Provisions. See Section 105, Sub-section IV of the General Provisions, for submittal requirements
- B. Product Data: For each type of product specified herein, including catalog data, technical specifications, evidence of UL listing, and evidence of manufacturer's certification to ISO 9000:2000 or an equivalent quality management system certification acceptable to the Owner.
- C. Electrical Acceptance Test reports.
- D. Operation and maintenance data is not required, however, approved submittals are required to be included for the record in the Operation and Maintenance Manuals, as described in Division 26 Section "Electrical - General".

#### 1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain all wire and cable of a particular type through one source from a single qualified manufacturer.
- B. To be a qualified manufacturer, wire, cable, splice and termination components manufacturers shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Owner, and shall offer NRTL-listed and labeled products.
- C. Wire and cable and accessories: Listed and labeled as defined in NEC Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## PART 2 - PRODUCTS

### 2.01 APPLICATIONS

- A. Refer to Part 3 for wire and cable applications.

### 2.02 MANUFACTURERS

- A. MANUFACTURERS

### 2.03 BUILDING WIRE

- A. Manufacturers:
  1. Alcan Cable, Div. of Alcan Aluminum Corp.
  2. American Insulated Wire Corp.
  3. Belden Wire and Cable Co.
  4. Cerro Wire and Cable Co., Inc.
  5. General Cable Industries Inc.
  6. Okonite Co.
  7. Southwire Co.
- B. Conductor Material: Copper, stranded conductor.
- C. Multi-conductor Cable Insulation Types: Type XHHW.

### 2.04 CONTROL AND INSTRUMENTATION WIRE AND CABLE

- A. Manufacturers:
  1. Belden Wire and Cable Co.
  2. Clifford of Vermont / TVC
  3. General Cable Co., Inc.
  4. Okonite Co.
  5. Southwire Co.
- B. Control wire: 600V type XHHW insulated stranded copper conductors in conduit, minimum size #14 AWG, UL listed and suitable for installation in conduit.
- C. Instrumentation cable, TSP for 4-20 mA DC circuits:
  1. For installation in dedicated shielded signal cable raceways: 300 V TFFN insulated #16 AWG stranded tinned copper twisted pair, with #18 AWG or larger stranded tinned copper drain wire, overall aluminum-on-mylar shield (100% coverage), with chrome PVC outer jacket, maximum outside diameter 0.25 inches. NRTL listed and suitable for installation in conduit, cable tray, and direct burial.

## 2.05 WIRE AND CABLE CONNECTORS AND SPLICES

- A. Manufacturers:
  - 1. 3M Company, Electrical Products Division
  - 2. AMP Incorporated / Tyco International
  - 3. Burndy
  - 4. Square D
  - 5. Thomas and Betts
- B. Description: Factory fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- C. Wirenuts: Spring type rated for copper wire, sized for the actual number of wires connected.
- D. Splices: Tin-plated copper compression type. Pre-insulated crimp-on connectors may be used for #14 AWG control wires. Long barrel splices shall be used for #1/0 AWG and larger.
- E. Connection lugs: Tin-plated copper compression type with NEMA drilling. Long-barrel lugs shall be used for #1/0 AWG and larger wire.
- F. Connections at molded case circuit breakers, disconnect switches, and other equipment provided with wire termination lugs: NRTL-listed, suitable for use with the copper wire size to be connected.

## PART 3 - EXECUTION

### 3.01 INSPECTION

- A. Ensure that raceways, boxes, and fittings are clean and clear of construction debris prior to installation of wire and cable.

### 3.02 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire and cables to construction site and unload in accordance with manufacturer's recommendations.
- B. Store and transport reels in conformance with the manufacturer's printed instructions.
- C. Wire and cable ends shall be taped watertight until terminations and splices are completed.

### 3.03 WIRE AND CABLE APPLICATIONS

- A. Power and Control Wiring: Type XHHW, single conductors in raceway

### 3.04 CABLE LAYING AND PULLING

- A. Install cables in accordance with manufacturer's installation instructions, IEEE 576 and AEIC CG5-90.
- B. Run wires and cables in raceways as shown on the Drawings and as specified in Division 26 Section "Raceways, Boxes, and Fittings".
- C. Pull wire and cables in accordance with the manufacturer's installation recommendations and requirements, with emphasis on the following:
  - 1. Do not exceed manufacturer's recommended maximum pulling tensions and side-wall pressure values
  - 2. Lubricate cables with pulling compound or lubricant that is approved by the cable manufacturer and will not deteriorate conductor or insulation materials of construction.
  - 3. Follow cable manufacturer's recommendations for attaching pulling means to cables, including fish tape, cable, rope, and basket-weave cable grips. Do not attach to cable jacket alone for pulling.
  - 4. Rig pulleys and use pull ropes for pulling cables into raceways.
  - 5. Use tension indicators and electric-motor driven capstan rollers for pulling cables that are too large for pulling by hand.
  - 6. Observe manufacturer's recommendations for the minimum wire and cable bending radius for each type and size of wire and cable provided for this project.
- D. Install "buried-cable" warning tape in the backfill above the cables.
- E. Identify and color-code conductors and cables according to Division 26 Section "Electrical Identification."

### 3.05 WIRE AND CABLE CONNECTIONS AND TERMINATIONS

- A. Tighten electrical connectors and terminals according to the manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. For compression lugs and splices, use the lug manufacturer's compression tools and conform to the manufacturer's written instructions.
- C. Control wires shall be run from terminal to terminal without splices, and no more than two wires under a terminal screw.
- D. Splices and terminations shall be insulated with boots, heat shrink tubing, or tape to 600 volts in accordance with the insulation product manufacturer's written instructions.
- E. Feeder taps shall be made with cast bronze 2-bolt or 4-bolt connectors with built-in conductor spacer, suitable for the run and tap conductor sizes. Split bolt connectors shall not be used unless approved by the Owner.

- F. Wiring at Device Outlets: Install conductor at each outlet, leaving 8 inches (200 mm) of wire coiled in the box for connection to wiring devices. Wiring devices that are suitable for solid wire only shall be pigtailed to stranded wire with solid wire 6 inches long using wrenuts.
- G. Install a green insulated NEC-sized grounding jumper from a green ground screw in the outlet box to the receptacle or switch green ground screw.
- H. Wiring to terminals at transformers and busbars shall be connected with tin-plated copper compression connectors and insulated for 600 volts with tape, boots, or heat-shrink tubing rated for the temperature specified by the equipment manufacturer. Two hole lugs shall be used for power cable terminations # 1/0 AWG and larger.
- I. Building wire connections to flexible motor leads shall be made with compression connectors bolted back-to-back with silicone-bronze bolts and insulated for 600 volts. For motors with busbar connections, connections shall be made with long-barrel two-hole tin plated copper lugs, copper-plated belleville washers, and silicone bronze bolts.
- J. Multi-conductor cables shall be installed and terminated in accordance with the cable manufacturer's installation instructions.
- K. Shielded cable conductors shall be terminated with insulated crimp-on connectors suitable for the terminals provided with the equipment, or tinned for connection to terminals which are not suitable for crimp-on connectors. A minimum two inch length of heat shrink tubing shall be applied over each insulated conductor and the insulated portion of the crimp-on connector, and a separate piece of larger diameter heat shrink tubing shall cover the end of the cable jacket and cut shield, and overlap the individual conductor heat shrink tubing. Connect drain wire to the ground bus at the transmitter end only except where otherwise indicated on the Contract Drawings and approved shop drawings.

### 3.06 ELECTRICAL ACCEPTANCE TESTING

- A. Testing: Engage a qualified testing agency to perform the following field quality control testing:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test for conformance with requirements.
  - 2. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification, Section 7.3.2 "Cables, Low Voltage, 600 Volt Maximum". Certify conformance with test parameters.
- B. Test Reports: Prepare a written report to record the following:
  - 1. Test procedures used.
  - 2. Test results that conform to requirements.
  - 3. Test results that do not conform to requirements and corrective action taken to achieve conformance with requirements.

End of Section

## SECTION 26 05 26

### GROUNDING

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Provide a complete system of grounding electrodes, grounding electrode conductors, main bonding jumpers, equipment grounding conductors, and bonding in accordance with NEC requirements, in conformance with this Section and as shown on the Drawings.
- B. This Section includes requirements for grounding separately derived electrical systems and equipment.
- C. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

##### 1.02 RELATED DOCUMENTS

- A. Related Sections include the following:
  - 1. Division 26 Section "Wire and Cable" for wire connector and equipment grounding conductor requirements.
  - 2. Division 26 Section "Raceways, Boxes, and Fittings" for grounding bushing requirements.

##### 1.03 DEFINITIONS

- A. Refer to NEC for definitions of grounding terms used in this Section.

##### 1.04 QUALIFICATIONS

- A. **Manufacturer's Factory Qualifications:** Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Owner. The manufacturing company shall be listed in a published NRTL directory of companies offering NRTL-listed and labeled products.
- B. **Testing Firm Qualifications:** An independent firm, with experience and capability to conduct specified tests, and is a member company of NETA or is an NRTL as defined by OSHA in 19 CFR 1910.7, acceptable to the AHJ.
- C. **Testing Firm's Field Supervisor Qualifications:** person currently certified by NETA or NICET to supervise on-site testing specified in Part 3.

##### 1.05 REFERENCE STANDARDS

- A. Comply with the following standards:

*Old Wormley Creek Road Lift Station #23  
September 2013  
County of York, Virginia  
IFB Number: 1862*

1. IEEE 81-1983 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
2. IEEE 118-1978 (R1992) Standard Test Code for Resistance Measurements
3. IEEE 142-1991 Recommended Practice for Grounding of Industrial and Commercial Power Systems (IEEE Green Book)
4. NFPA 70 The National Electrical Code

## 1.06 SUBMITTALS

- A. Conform to the General Provisions.
- B. Product Data: Submit manufacturer's catalog data and specification sheets for each manufacturer's product described in Part 2 of this Section, marked to show which products are proposed for this project.
- C. Qualification Data: For firms and persons specified in "Qualifications" in Part 1 of this Section.
- D. Acceptance Test Reports: Submit written test reports to include the following:
  1. Test procedures used.
  2. Test results that comply with requirements.
  3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with the requirements described in this Section, provide products by one of the listed manufacturers in the Sub-Sections below.
  1. Ground Rods:
    - a. Copperweld Corp.
    - b. Eritech / Erico International Corporation
    - c. Galvan Industries, Inc.
    - d. Harger Lightning and Grounding, Inc.
    - e. Robbins Lightning, Inc.
  2. Grounding electrode connectors:
    - a. Exothermic type:
      - 1) Cadweld / Erico International Corporation
      - 2) Furseweld
      - 3) Harger Lightning and Grounding, Inc. (Ultraweld)
      - 4) ThermOweld, a division of Continental Industries
  3. Ground test (access) wells
    - a. Eritech / Erico International Corporation
    - b. Harger Lightning and Grounding
    - c. Robbins Lightning, Inc.

## 2.02 GROUNDING ELECTRODES

- A. Ground Rods: 3/4 in. x 10 ft. copper-clad steel, sectional type, with silicone bronze threaded connectors.
- B. Ground Ring: Class A stranded copper conductor (7 strand). 17 strand ground wire is not acceptable in contact with earth.
- C. Test (Access) Wells: Provide PVC test wells approximately 12 inches in diameter x 2 ft. deep for access to grounding electrode conductor connections to grounding electrodes as shown on the Drawings. Covers shall be cast iron, engraved "Ground Test Well".

## 2.03 GROUNDING ELECTRODE CONDUCTORS

- A. Grounding Electrode Conductors: Solid for #6 AWG and smaller, Class A stranded for #4 AWG and larger, bare copper conductor, size(s) as indicated on the Drawings. Class B stranding is not acceptable for conductors in contact with earth.
- B. Comply with the following:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Assembly of Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.

## 2.04 BONDING JUMPERS

- A. Main Bonding Jumpers: as furnished with the service equipment by the equipment manufacturer.
- B. Equipment Bonding Jumpers: insulated copper building wire, sized to match the largest equipment grounding conductor in the associated conduits.
- C. Bonding Jumper: insulated copper wire, protected by conduit where exposed to physical damage

## 2.05 EQUIPMENT GROUNDING CONDUCTORS

- A. Equipment Grounding Conductors: Insulated building wire in accordance with Division 26 Section "Wire and Cable". #6 AWG and smaller shall have green insulation, #4 AWG and larger shall have green insulation or shall be marked with green tape at each end.

## 2.06 CONNECTOR PRODUCTS

- A. Comply with IEEE 837 and UL 467. Products shall be NRTL-listed and shall be suitable for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure type silicone bronze connectors for test joints at ground rods with test (access) wells, and two-hole long barrel tin-plated copper

compression type at equipment busbars, electrical enclosures, and bonding connections to structural steel.

- C. Grounding clamps for metal water pipe connections: all cast bronze parts with silicone bronze bolts.
- D. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.
- E. Wirenuts: Use only for branch circuit wiring in switch and receptacle outlet and junction boxes containing #10 AWG and smaller wires.

## PART 3 - EXECUTION

### 3.01 INSTALLATION – GENERAL

- A. Install grounding electrodes, grounding electrode conductors, main bonding jumpers, equipment grounding conductors, equipment bonding jumpers, and bonding, in accordance with NEC requirements and as shown on the Drawings.
- B. Provide only copper and bronze grounding materials in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- C. 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. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- D. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

### 3.02 INSTALLATION: GROUNDING ELECTRODES

- A. Ground Rods: Install ground rods in the configuration shown on the Drawings.
  - 1. Drive ground rods until tops are 12 inches below finished floor or final grade, unless otherwise indicated.
  - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds below grade, except at test wells. Make connections without exposing steel or damaging copper coating.
- B. Install one ground test (access) well for each service at a convenient location outside the building. Set top of well flush with finished grade. Tag the mechanical connection to the

ground rod “Grounding Connection – De-Energize Service Prior to Disconnecting for Ground Resistance Tests”.

- C. Metal Water Service Pipe: Provide insulated copper grounding electrode conductor, in conduit, from the building main service equipment ground bus to the closest main metal water service entrance to the pump station. Connect grounding electrode conductor to main metal water service pipe with ground clamp. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting.
- D. Remove paint and surface corrosion from structural steel and metal water pipes at grounding connection points down to bright metal, and coat dissimilar metals with anti-corrosion compound after making grounding connections wrench-tight.
- E. Water Meter Piping: Use braided-type bonding jumpers, with cross sectional area at least equal to the NEC-required grounding electrode conductor size, to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- F. Ground Rod Clamps at Test Wells: Use bolted-pressure clamps of same material as ground rod (or silicone bronze with copper-clad rods) with at least two silicone bronze bolts.

### 3.03 INSTALLATION: GROUNDING ELECTRODE CONDUCTORS

- A. Grounding Electrode Conductors: Route along shortest and straightest paths possible, unless otherwise indicated on the Drawings. Avoid obstructing access or placing conductors where subject to strain, impact, or damage.
- B. Connect grounding electrode conductor(s) to the service entrance equipment ground bus and to the generator case as shown on the Drawings. The generator will be a separately derived system.
- C. For connections to structural steel and for underground connections, provide exothermic-welded connections except at test (access) wells, where bolted mechanical connections are required.
- D. Bond grounding electrode conductors in metal conduits to each end of each conduit run using a bronze conduit-to-wire grounding fitting.

### 3.04 INSTALLATION: EQUIPMENT GROUNDING CONDUCTORS

- A. Provide separate insulated equipment grounding conductors in raceways, boxes, and fittings, as shown on the Drawings and specified herein.

### 3.05 INSTALLATION: EQUIPMENT BONDING JUMPERS

- A. At sheet metal junction, pull and outlet boxes, and electrical enclosures, use conduit hubs bolted to enclosure or double locknuts to bond enclosure to conduit, and connect grounding bushings to equipment grounding conductors. Install equipment bonding

jumpers between conduit bushings entering and leaving boxes, using the lugs provided with the grounding bushings.

- B. At cast enclosures, connect equipment grounding conductors together with a mechanical connector. Use mechanical connectors in conformance with Division 26 Section "Wire and Cable".
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

### 3.06 INSTALLATION: MAIN BONDING JUMPERS

- A. Install main bonding jumpers at service entrance equipment in accordance with service equipment manufacturer's written instructions.

### 3.07 INSTALLATION: EQUIPMENT BONDING JUMPERS

- A. Bonding Straps and Jumpers: Install so equipment vibration is not transmitted to rigidly mounted equipment support structure. Use long-barrel tin-plated compression connectors and galvanized steel or silicone bronze hex head cap screws in drilled and tapped holes to bond miscellaneous equipment to equipment grounding conductors.
- B. Bond reinforcing steel, metal piping systems, and metal air ducts in conformance with NEC Article 250 and as shown on the Drawings.

### 3.08 CONNECTIONS

- A. 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.

### 3.09 ACCEPTANCE TESTING

- A. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
  - 1. After installing grounding system and before electrical circuitry has been energized, test for conformance with requirements.
  - 2. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification, Section 7.13 "Grounding Systems". Certify conformance with test parameters.
- B. Test Reports: Prepare a written report to record the following:
  - 1. Test procedures used.
  - 2. Test results that conform to requirements.
  - 3. Test results that do not conform to requirements and corrective action taken to achieve conformance with requirements.

4. Excessive Ground Resistance: If resistance to ground exceeds specified value(s), drive rods deeper with a connecting rod. If driving the rods to twice the original depth does not yield specified values, notify the Owner and include recommendations to reduce ground resistance.

### 3.10 GRADING AND PLANTING

- A. Restore surface features, including pavement and vegetation, at areas disturbed by Work of this Section.

End of Section

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## SECTION 26 05 33

### RACEWAYS, BOXES, AND FITTINGS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Provide a complete system of raceways, including conduit, fittings, terminal boxes, hangers, supports, and accessories, as shown on the Drawings and specified herein.

##### 1.02 RELATED DOCUMENTS

- B. Related requirements are also included in the following Sections:
  - 1. Division 26 Section "Grounding" for equipment grounding requirements.

##### 1.03 DEFINITIONS

- A. In addition to the definitions in Division 26 Section "Electrical - General", the following definitions apply to this Section:
  - 1. Clamp-back: spacer used with conduit one-hole strap to provide air gap between surface and conduit
  - 2. Equipment bonding jumper: suitable for connecting sections of conduit used for equipment grounding conductor (see NEC definition)
  - 3. FMC: Flexible metal conduit (NEC definition)
  - 4. ID: inside diameter
  - 5. LFMC: Liquidtight flexible metal conduit (NEC definition)
  - 6. NPT: National pipe thread
  - 7. OD: outside diameter
  - 8. PVC: Polyvinyl chloride
  - 9. RGS: Rigid galvanized steel conduit
  - 10. RMC: Rigid metal conduit (NEC definition)

##### 1.04 REFERENCE STANDARDS

- A. Comply with the following standards:
  - 1. NEMA Standards applicable to raceways, boxes, and fittings.
  - 2. UL Standards applicable to raceways, boxes, and fittings. Each raceway, box, and fitting shall be NRTL-listed and labeled.
  - 3. ANSI and ASTM standards mentioned in this Section and included in the UL and NEMA Standards applicable to raceways, boxes, and fittings.

##### 1.05 ENVIRONMENTAL CONDITIONS

- A. Provide raceways, boxes, and fittings fabricated from materials resistant to corrosion and suitable for the application in the locations where installed, in conformance with NEC requirements for installation in "damp", "wet", and hazardous (classified) areas.

## 1.06 SUBMITTALS

- A. Product Data: For raceways, boxes, fittings, hangers, and supports.
- B. Coordination Drawings: For electrical enclosures mounted on or in brick construction, coordinate electrical enclosure dimensions and mounting with masonry construction. Submit dimensioned brickwork and electrical equipment plan, elevation, and section view installation drawings for approval before starting work.

## 1.07 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70 and NEMA standards.
- C. PVC-coated conduit, boxes, and fittings that are connected together shall be from the same manufacturer.

## PART 2 - PRODUCTS

### 2.01 CONDUIT, BOX, AND FITTING MANUFACTURERS

- A. Provide products by the following manufacturers:
  - 1. Adalet / A Scott Fetzer Company
  - 2. AFC Cable Systems, Inc.
  - 3. Alflex Inc.
  - 4. Allied Tube & Conduit Corporation
  - 5. Allied Tube and Conduit Div. / A TYCO International Ltd. Company
  - 6. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 7. Appleton
  - 8. Bell
  - 9. Carlon
  - 10. Cooper / B-Line
  - 11. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  - 12. Electri-Flex Co.
  - 13. Emerson/General Signal; Appleton Electric Company.
  - 14. Erickson Electrical Equipment Co.
  - 15. Hoffman.
  - 16. Hubbell, Inc. / RACO
  - 17. Hubbell, Inc. / Killark Electric Manufacturing Co.
  - 18. Lew Electric Fittings Co.
  - 19. LTV Steel Tubular Products Company
  - 20. Myers
  - 21. O-Z Gedney
  - 22. Perma-Cote
  - 23. Pittsburgh Standard Conduit Co.,

24. RACO; Division of Hubbell, Inc.
25. Robroy Industries
26. Robroy Industries, Inc.; Enclosure Division.
27. Scott Fetzer Co.; Adalet-PLM Division.
28. Spring City Electrical Manufacturing Co.
29. Thomas & Betts Corporation.
30. Triangle PWC Co.
31. Wheatland Tube Co.

## 2.02 RIGID METAL CONDUIT (RMC)

- A. Rigid Galvanized Steel Conduit (RGS): hot dip galvanized exterior and interior to ANSI C80.1, threads hot dip galvanized after fabrication, for use in accordance with NEC Article "Rigid Metal Conduit: Type RMC", NRTL-listed and labeled under UL 6. Threads shall be hot dip galvanized after fabrication.
- B. PVC-Coated RGS: RGS with .040 inch PVC exterior coating, and .002 urethane or epoxy interior coating. Threads shall be protected with urethane coating over galvanizing.
- C. Provide RMC locknuts, bushings, fittings, conduit bodies, junction boxes, pull boxes, and outlet boxes as follows:
  1. NEMA ratings: in accordance with Part 3 of this Section
  2. Locknuts: galvanized steel.
  3. Explosion-proof conduit hubs: galvanized steel or malleable iron, UL listed for Class I Div. 1 Group C&D applications.
  4. Bushings: galvanized steel or malleable iron, insulated-throat grounding type, with thermoset plastic insulation insert, complete with mechanical ground lug for connection to ground wire.
  5. Fittings: ANSI 80.4, hot-dip galvanized cast steel or malleable iron. Conduit hubs or similar approved fittings shall be provided for conduit entry to water and dust-resistant enclosures.
  6. Conduit bodies: galvanized cast steel or malleable iron Form 7 or 8 with oil-resistant gasket and galvanized cast steel or malleable iron cover.
  7. Junction boxes: galvanized cast steel or malleable iron with oil-resistant gasket and galvanized cast steel or malleable iron cover in non-hazardous areas, cast or malleable iron external screw cover type in hazardous (classified) areas for other than aluminum conduit.
  8. Pull boxes: painted or stainless steel fabricated sheet metal type with hinged screw cover in non-hazardous areas, cast aluminum with hinged bolted cover in hazardous (classified) areas.
  9. Outlet boxes: Type FS or FD for exposed locations in non-hazardous areas, cast or malleable iron external screw cover type in hazardous (classified) areas.
  10. PVC-coated fittings, conduit bodies, junction boxes, pull boxes, and outlet boxes: Same as RGS described above, with exterior and interior coatings similar and equal to PVC-coated RGS conduits, and shall have PVC sleeves extending approximately one conduit diameter beyond threaded hub for conduit overlap. Provide stainless steel cover screws.

11. Explosion-proof flexible couplings: UL listed and labeled for the hazardous (classified) area location, with stainless steel outer braid. Non-stainless steel parts shall be PVC-coated when used with PVC-coated RGS conduit.
12. Explosion-proof sealoffs: : UL listed and labeled for hazardous (classified) area location, cast metal, combination horizontal and vertical type, oversized for 40% wire fill to match allowable wire fill in conduit, with breather and drain. Non-stainless steel parts shall be PVC-coated when used with PVC-coated RGS conduit. Use hub-type sealoffs for conduit terminations at flush-mounted enclosures.
13. Terminal boxes: Enclosures for terminal blocks and electrical equipment and components: NEMA 250, with interior white painted steel panel, and hinged cover. Stainless steel sheet metal with flush 1/4-turn latch for non-hazardous areas, cast aluminum with hinged and bolted cast cover for hazardous (classified) locations.

### 2.03 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Liquidtight flexible metal conduit (LFMC): Flexible steel type UA conduit with PVC jacket, for use in accordance with NEC Article "Liquidtight Flexible Metal Conduit: Type LFMC", NRTL-listed and labeled under UL 360. Non-UL listed LFMC is not acceptable.
- B. Fittings: Insulated-throat screw-in connectors, NEMA FB 1, UL 514B, galvanized malleable iron or steel. Connectors shall be suitable for use as grounding fittings. Provide fittings with bonding jumper connections for exterior bonding jumpers at motors. Non-stainless steel parts shall be PVC-coated when used with PVC-coated RGS conduit.

### 2.04 SINGLE CONDUIT HANGERS

- A. Manufacturers:
  1. Appleton
  2. Crouse-Hinds
  3. Erico International Corporation (Caddy)
  4. Killark
  5. Thomas and Betts (Kindorf, Steel City)
  6. Unistrut
- B. Single RMC attachment to structural steel: galvanized malleable iron PC (parallel clamp), EC (edge clamp), and RC (right angle clamp) type conduit-to-structural-steel clamps, or galvanized steel clevis hangers on galvanized steel threaded rods attached to galvanized malleable iron beam clamps. Bolts shall be galvanized steel.
- C. Single RMC attachment to concrete and masonry surfaces: galvanized malleable iron one-hole clamp and galvanized malleable iron clamp-back, or galvanized steel clevis hangers on galvanized steel threaded rods attached to galvanized steel rod hanger fitting bolted to concrete with expansion bolts. Bolts shall be galvanized steel.

- D. PVC-coated rigid galvanized steel conduit hangers shall be same as specified for RGS except with epoxy or PVC coating, and 316 stainless steel bolts.

## 2.05 MULTIPLE CONDUIT HANGERS (CHANNEL SUPPORTS)

- A. Manufacturers:
  - 1. Aickinstrut
  - 2. Cooper B-Line
  - 3. GS Metals Inc.
  - 4. Thomas & Betts (Kindorf)
  - 5. Unistrut
- B. Channel and associated hardware and fittings:
  - 1. 1-1/2 x 1-1/2 inch nominal size, minimum. UL 5B listed and labeled. Thickness as required for the application, minimum 0.071 inches.
  - 2. Deflection of individual support channels shall not exceed 1/180 of span when loaded with conduit plus 200 pounds.
  - 3. Stainless steel: Type 304 or better
  - 4. Fiber-reinforced polyester: as manufactured by Aickinstrut, or approved equal.
  - 5. Bolts: Grade 3 or better. Finish and materials to match channel, except that electroplated bolts shall be used with electro-galvanized steel channel, and stainless steel bolts shall be used with pre-galvanized, galvanized channel.
  - 6. Conduit straps: PVC-coated galvanized steel with corrosion-resistant bolt.

## 2.06 CONDUIT SLEEVES AND SEALING FITTINGS

- A. Manufacturers:
  - 1. Appleton
  - 2. Crouse-Hinds
  - 3. Spring City Electric
  - 4. Thomas & Betts
  - 5. O.Z. Gedney
- B. Wall and Floor Sleeves:
  - 1. Hot-dip galvanized steel or stainless steel pre-fabricated conduit sleeves with welded water-stop ring.
  - 2. Galvanized steel, PVC, and polyethylene sleeves that are part of a manufacturer's standard wall seal assembly are also acceptable, subject to compliance with the fire resistant rating of the related walls and floors.
- C. Conduit-to-Sleeve Sealing Fittings:
  - 1. Synthetic elastomeric gland with galvanized steel or stainless steel compression plates sized for the conduit OD and sleeve ID, or a manufactured assembly of hot-dip galvanized or stainless steel pressure plates, neoprene sealing grommets, and cast or malleable iron sealing bodies with zinc-rich epoxy coating, with factory-assembled galvanized steel, PVC, or polyethylene pipe sleeve. Segmented seals are also acceptable for conduit 4-inch trade size and larger.

2. Sealing fittings for wall penetrations with water or soil on one side shall have seals installed at both ends of the conduit sleeve or core-drilled hole.
3. Where single conductors pass through a single sleeve, select materials to mitigate the effects of inductive heating.
4. Provide ground wire attachment bolts for manufactured sleeve assemblies.
5. Seals shall have fire ratings equal to the fire-resistant rating of the wall.

## 2.07 CONDUIT INTERIOR SEALING FITTINGS

### A. Manufacturers:

1. Crouse-Hinds
2. O.Z. Gedney
3. Thomas & Betts

### B. Conduit-to-Cable Sealing Fittings:

1. For exposed conduit ends without pull and junction boxes: Conduit fitting with synthetic elastomeric sealing gland with galvanized stainless steel compression plates drilled for the conduit ID and cable(s) OD, retained by threaded collar at the end of the conduit.
2. For exposed conduit ends entering pull or junction box: Conduit fitting suitable for installation of locknuts at conduit entry to sheet metal box, and bushing with synthetic elastomeric sealing gland with galvanized stainless steel compression plates drilled for the conduit ID and cable(s) OD, retained by threaded collar at the end of the conduit.
3. Seal shall be watertight at 20 feet of water pressure.
4. Where single conductors pass through a seal, select materials to mitigate the effects of inductive heating.
5. Where bare stranded copper conductors pass through sealing fittings, place an exothermic weld in the stranded cable to prevent water from leaking through the strands.

## 2.08 CONDUIT EXPANSION AND DEFLECTION FITTINGS

### A. Manufacturers:

1. Crouse-Hinds
2. Spring City Electric
3. O.Z. Gedney
4. Thomas & Betts

### B. Conduit expansion and deflection fittings:

1. Suitable for the anticipated expansion joint elongation and deflection at each expansion joint.
2. Materials of construction: Hot dip galvanized ductile iron body, neoprene sealing sleeve, stainless steel clamps, tinned flexible copper equipment bonding jumper.

## 2.09 BOXES, ENCLOSURES, AND CABINETS

- ### A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

*Old Wormley Creek Road Lift Station #23  
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1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  2. EGS/Appleton Electric.
  3. Erickson Electrical Equipment Company.
  4. Hoffman.
  5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
  6. O-Z/Gedney; a unit of General Signal.
  7. RACO; a Hubbell Company.
  8. Robroy Industries, Inc.; Enclosure Division.
  9. Scott Fetzer Co.; Adalet Division.
  10. Spring City Electrical Manufacturing Company.
  11. Thomas & Betts Corporation.
  12. Walker Systems, Inc.; Wiremold Company (The).
  13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- C. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum, with gasketed cover.
- D. Hinged-Cover Enclosures: NEMA 250, with continuous-hinge cover with flush latch, unless otherwise indicated.
1. Type 4X Enclosures: Stainless steel.

## 2.10 FACTORY FINISHES

- A. Finish: For painted steel enclosures, provide manufacturer's standard commercial and industrial coating in ANSI 49 or 61 light gray color, or different color when required by the NEC.
- B. Field painting will be required for uncoated cast iron, steel, galvanized, zinc-coated, and factory primed surfaces. Products shall be degreased and made suitable for field painting prior to packaging for shipment.

## PART 3 - EXECUTION

### 3.01 RACEWAY APPLICATIONS

- A. Raceways, boxes, and fittings:
1. Indoor: RGS in above-grade, exposed locations.
  2. All other locations: PVC-coated RGS.
  3. Boxes and fittings: as described for PVC-coated RGS in each raceway subsection, and recommended as suitable for the particular application by the manufacturer.
  4. Enclosures: refer to Division 26 Section "Electrical - General"
  5. Connections to transformers, motor-driven equipment, vibrating equipment, and equipment requiring position adjustment, e.g., rail-mounted motors: liquidtight flexible metal conduit in non-hazardous areas, explosion-proof flexible couplings in hazardous areas.

6. Conduit Support Channels: stainless steel or fiber-reinforced polyester with PVC-coated RGS conduit.

B. Minimum Raceway Size: 3/4-inch trade size

### 3.02 INSTALLATION – GENERAL

- A. Deliver raceways, boxes, and fittings to job site in factory packaging. Store in clean, dry weatherproof location. Handle in accordance with manufacturer's recommendations.
- B. Install raceways, boxes, and fittings in accordance with manufacturer's installation instructions and NEC requirements as a minimum, and comply with the additional requirements described in this Section.
- C. Conduits shall be electrically and mechanically continuous, and suitable for use as an equipment-grounding conductor. Make up threaded joints wrench tight.
- D. When Coordination Drawings are specified in Part 1 of this Section, do not commence work until coordination drawings are approved.
- E. Install and route emergency system raceways independently of other raceways systems, except where specific exceptions are permitted by the NEC.
- F. Fasten boxes in wet and damp areas using external mounting feet. Do not drill through boxes.
- G. Comply with NEC requirements for sizing outlet and junction boxes to accommodate wires, splices, and devices.
- H. Bends and offsets between pull points shall not exceed a cumulative total of 270 degrees unless otherwise approved by the Engineer. Maximum distance between pull points in conduit systems inside buildings shall be 100 feet unless otherwise approved by the Engineer.
- I. Raceways shall be routed in conformance with the following guidelines:
  1. Run conduits exposed, concealed, and underground as indicated on the Drawings.
  2. The preferred location for horizontal conduit runs is just below the ceiling structural supports.
  3. Do not obstruct access to equipment for operation and maintenance. Coordinate conduit runs with the work of other trades. Plan conduit runs to avoid lighting fixtures, and leave space for easy access to HVAC equipment, motors, and duct access hatches and doors.
  4. Coordinate conduit stub-ups and routing with concrete, masonry, and brickwork construction. Stub-ups shall either be 6 inches above finished floor or flush-mounted, and have a PVC-coated rigid steel coupling. Stub-ups shall have an PVC-coated RGS plug with hex wrench recess.
  5. Comply with raceway, boxes, and fitting details shown on the Drawings.

6. Where conduits enter the top of electrical equipment enclosures and control panels, install conduit interior sealing fittings to prevent entry of water and condensation from conduit.
  7. Terminate conduits with hub-type explosion-proof sealoffs at the Pump Station Control Panel and other locations where conventional sealoffs would become inaccessible.
- J. Cut conduits square with roller-wheel pipe cutter. Hacksaw cuts are acceptable only if the entire conduit is swabbed clean after cutting and threading is completed. Conduits cut in the field shall be threaded with sharp, standard NPT dies to achieve a fully cut tapered thread with a minimum of five full tapered threads at the end of the conduit. Running threads are not acceptable. Over- and under-threading are not acceptable. After threading, ream conduit ends, remove cuttings and debris from inside and outside of conduit, degrease, and apply cold spray-on zinc-rich paint.
- K. Conduit bends shall be made with conduit bending tools manufactured for the purpose. Comply with conduit and bending tool manufacturers' instructions. Use specially sized shoes in bending tools for PVC-coated rigid galvanized steel conduits.
- L. Do not cut or drill holes in structural beams and columns, or other structural members. Do not weld raceway supports to structural steel.
- M. Join raceways with fittings designed and approved for that purpose and make joints wrench tight. Comply with NEC requirements for minimum thread engagement in Hazardous Classified areas.
- N. Provide expansion, deflection, or expansion & deflection couplings at expansion joints. Expansion and deflection fittings shall comply with UL 467 and UL 514B, and shall be suitable for the anticipated amount of movement and direction(s) of movement.
- O. Three-piece (Erickson) couplings shall be used where it is not possible to turn conduits to make up threaded joints. Threadless fittings are not generally acceptable. Application for permission to use threadless fittings at particular locations shall be made in writing to the Engineer, and threadless fittings shall not be used unless approved.
- P. Complete raceway installation before starting conductor installation.
- Q. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- R. Terminations:
1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box. Install bushings wrench-tight.
  2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

3. Install temporary closures to prevent foreign matter from entering raceways.
- S. 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.
- T. Install explosion-proof and moisture seal-off fittings at suitable, approved, and accessible locations and fill them with UL-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 at the following points:
  1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. At hazardous classified locations and where otherwise required by the NEC.
- U. Flexible Connections:
  1. Motors and equipment subject to vibration or movement: maximum 36 inches of LFMC up to 2 inch trade size, up to 72 inches in larger sizes, and explosion-proof couplings of adequate length for the installed conditions in hazardous (classified) locations.
  2. Install separate equipment bonding jumper across flexible connections where required by the NEC.
- V. PVC Coated Rigid Galvanized Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

### 3.03 INSTALLATION – EXPOSED RACEWAYS, BOXES AND FITTINGS

- A. Install raceways, boxes, and fittings exposed as indicated on the Drawings.
- B. Install exposed raceways parallel or at right angles to nearby surfaces or structural members.
  1. Run raceways together in-groups on common supports wherever possible.
  2. Do not use mechanical piping or ceiling supports to support conduit runs.
- C. Make concentric bends in parallel exposed conduit runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- D. Surface-mounted channel supports shall be 1-1/2 inch x 1-1/2 inch channel bolted to wall or ceiling with expansion anchors.
- E. Installation near mechanical piping: Keep raceways at least 6 inches away from parallel runs of mechanical ducts, vents, and mechanical piping, measured from the insulation. Do not install horizontal raceway runs directly below water and steam piping except for right angle crossings.
- F. Install electrical enclosures and cabinets square and plumb. Support at each corner.

- G. At building interior floor and roof penetrations, provide floor sleeves 2 inches above finished floor level with fire-rated conduit sealing fittings. Provide flashing at roof penetrations in accordance with roofing system manufacturer's recommendations.

#### 3.04 PROTECTION DURING CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure coatings and finishes without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanize finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

#### 3.05 CLEANING & PAINTING

- A. Swab conduits clean after installation and plug ends until conductors are installed.
- B. Remove dust, construction debris, plaster and paint spatters from raceways, boxes, and fittings after all trades have completed their work, and prior to painting.
- C. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes, touch up damage, and prepare for finish painting in accordance with Division 9 Section "Painting".

End of Section

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## SECTION 26 05 53

### ELECTRICAL IDENTIFICATION

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Provide electrical equipment nameplates, junction, pull and outlet box labels, raceway identification, wiremarkers, circuit identification, field instrument tags, and warning signs for electrical equipment included in this Contract, as specified herein.
- B. This Section includes product and installation requirements for identification of electrical equipment, raceways, conductors, circuits, and outlets, and warning signs.

##### 1.02 CODES AND STANDARDS

- C. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
  - 1. National Electrical Safety Code (NESC)
  - 2. Nationally Recognized Testing Laboratory (NRTL)
  - 3. NFPA 70E Standard for Electrical Safety in the Workplace®
  - 4. NFPA 79 Electrical Standard for Industrial Machinery

##### 1.03 QUALITY ASSURANCE

- A. Manufacturers: Manufacturers shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Owner, and shall offer NRTL-listed and labeled products.
- B. Comply with NFPA and OSHA standards.

##### 1.04 SUBMITTALS

- A. Submit shop drawings and manufacturers' data in accordance with the General Provisions. See Section 105, Sub-section IV of the General Provisions, for submittal requirements.
- B. Submittals shall include the following:
  - 1. Product data
  - 2. Complete list of all engraved nameplates.
  - 3. Sample of each of the following:
    - a. engraved equipment nameplate
    - b. computer-generated label
    - c. wiremarkers
    - d. safety sign

- e. laminated instrument tags

## PART 2 - PRODUCTS

### 2.01 EQUIPMENT NAMEPLATES

- A. Provide custom nameplates for all equipment listed in Part 3 of this Section.
- B. Nameplates shall have white letters engraved on black field, and shall be fabricated from 3-layer (black-white-black) thermoset plastic.
- C. Drill holes in nameplates to be fastened with tie-wraps as described in Part 3 of this Section.
- D. Nameplate lettering to be uppercase Roman block letters, minimum height as follows:
  - 1. Panelboards: 1/2 inch.
  - 2. Control Panels: 1/2 inch.
  - 3. Other equipment: 1/4-inch minimum.

### 2.02 WIREMARKERS

- A. Wiremarkers shall be computer-printed on white wrap-around paper with clear plastic protective "tail" and pressure-sensitive adhesive.
- B. Manufacturer: Brady, T&B, Panduit, or approved equal.

### 2.03 WIRE COLOR CODING

- A. Comply with NEC requirements for applying color-coding.
- B. Color Coding for service, feeder, and branch circuit wiring shall be as follows:
  - 1. 240 / 120 VOLTS      A-B-N-G      Black - Red - White – Green
- C. Color coding for 120 VAC control wiring shall be as follows:
  - 1. Line – Black
  - 2. Neutral – White
  - 3. Ground – Green
  - 4. Switched - any color except black, white, and green.
- D. Color coding for twisted shielded pair and twisted shielded triple signal cable conductors shall be the manufacturer's standard insulation colors.
- E. Color coding for DC power and control circuit wires:
  - 1. Negative polarity – Black

2. Positive polarity – Red
3. Switched - any color except black, red, white, and green.

#### 2.04 CONDUIT IDENTIFICATION

- A. Identify exposed unpainted conduits with a black indelible felt-tip marker.
- B. Identify exposed painted conduits with laminated tags fastened with nylon ties.

#### 2.05 INSTRUMENT TAGS

- A. All instruments shall be permanently labeled/marked with a metallic (non-corrosive) tag containing the “Tag ID” and “Description”. A sample tag shall be submitted to the Owner’s Representative for review and approval before commencing instrument tagging.
- B. Working instrument tags shall be laminated vinyl type, minimum 3 inches by 5 inches with preprinted insert and “write on” type laminate for calibration and servicing information. Tag shall include a pre-punched hole for fastening to instrument with a nylon cable tie. Tags shall be Panduit No. PST-5 with lamination on front and back, or approved equal.
- C. Each instrument tag shall include the following information:
  1. Front (printed, laminated) FIT - 5021 (instrument tag number)
  2. xxxxxx TRANSMITTER (instrument type)
  3. Manufacturer: xxxxx
  4. Model No.: xxxxx
  5. Serial No. xxxxx
  6. Calibrated Range: xxxxxx
  7. Power Supply: xxx V AC or xx V DC
  8. Installed by: xxxxxx (Company Name)
  9. Anytown, Anystate, USA (Company Address)
  10. Telephone Number (Company Service telephone number)
  11. Back (printed except as noted, laminated)
    - a. FIT - 5021 (instrument tag number)
    - b. xxxxxx TRANSMITTER (instrument type)
    - c. Calibrated Range: xxxx - xxxx GPM
    - d. Output: 4-20 mA
    - e. Alarms Set @ High: xxxxx
    - f. Low: xxxxx
    - g. Recommended Service Interval: xx months
    - h. Last Serviced on: \_\_\_\_\_ (handwritten)
    - i. Last Serviced by: \_\_\_\_\_ (handwritten)

#### 2.06 WARNING SIGNS

- A. Provide warning signs on electrical room doors and automatically started mechanical equipment in accordance with NEC and OSHA requirements.

- B. Electrical Room warning signs shall have the legend "Danger - High Voltage - Authorized Personnel Only".
- C. Automatically started motor-driven equipment shall have warning signs with the legend: "Warning - This Equipment Starts and Stops Automatically".

### PART 3 - INSTALLATION

#### 3.01 NAMEPLATES

- A. Fabricate equipment nameplates using the description and tag number nomenclature shown on the Drawings.
- B. Provide equipment nameplates for circuit breakers, transfer switches, panelboards, variable frequency controllers, and transformers.
- C. Fasten nameplates to clean flat metal surfaces with pressure-sensitive two-sided adhesive tape.

#### 3.02 RECEPTACLES

- A. Label all receptacle circuits on device faceplates with computer-generated text on tape.
- B. Provide the following information after load balancing is complete:
  - 1. Panel Designations (as shown on the Panelboard Schedules)
  - 2. Branch Circuit Breaker Number

#### 3.03 WIRE COLOR CODING AND MARKING

- A. Color code each phase, neutral, and ground wire for service conductors, feeders, and branch circuits, at points of origin and termination of wires.
- B. Provide wiremarkers on all control and signal wires, as shown on the approved Loop Diagrams, Motor Control Wiring diagrams, and Control Panel field wiring diagrams.

#### 3.04 INSTRUMENT TAGS

- A. Fill out and sign the field instrument tags and fasten each one to its respective field instrument.

#### 3.05 WARNING SIGNS

- A. Fasten Electrical Room warning signs to doors with self-tapping tamper-resistant stainless screws.
- B. Suspend automatically started equipment warning signs above motors with chain hangers.

- C. Install warning signs required by OSHA in accordance with OSHA recommendations.

### 3.06 PANELBOARD DIRECTORIES

- A. During construction, provide handwritten panelboard schedules. After load balancing has been completed, provide complete typewritten directory with protective clear plastic cover for each panelboard, with name of load as shown on the Panelboard Schedules on the Drawings for each individual branch circuit.
- B. Lighting, receptacle, and appliance branch circuits shall be identified with room names in the panel directory.
- C. When branch circuits are relocated, the panel directory shall be updated to indicate functions and locations.
- D. When branch circuits are removed the panel directory shall be updated to indicate a spare.
- E. Handwritten directory shall be provided until all circuits are connected. After panelboard acceptance testing and load balancing, install the permanent directory.

End of Section

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SECTION 26 09 00  
FIELD INSTRUMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide field instruments and accessories as shown on the Drawings, and as specified in this Section.

1.02 RELATED WORK

- A. Division 26 Section "Wire and Cable" for field wiring.
- B. Division 26 Section "Grounding" for equipment grounding.
- C. Division 26 Section "Electrical Identification" for field instrument tagging.

1.03 REFERENCES

- A. The latest revisions to the following standards and codes shall be met except where more stringent requirements have been specified:
  - 1. ANSI - American National Standards Institute
  - 2. ASME - The American Society of Mechanical Engineers
  - 3. ASTM - The American Society for Testing Materials
  - 4. AWWA - American Water Works Association
  - 5. EPA - Environmental Protection Agency
  - 6. ISA - Instrument Society of America
  - 7. NEC - National Electrical Code
  - 8. NEMA - National Electric Manufacturers Association
  - 9. UL - Underwriters Laboratories, Inc.

1.04 QUALITY ASSURANCE

- A. Uniformity: All field instruments of a particular type shall be products of one manufacturer, new, and of the latest design. Approved manufacturers may submit newer proven variations of substantially equivalent instruments to those specified.
- B. Suitable for the intended application: all field instruments and accessories shall be suitable for potable water applications.

## 1.05 SUBMITTALS

- A. Submit shop drawings and manufacturers' data in accordance with the provisions of Division I, General Provisions. See Section 105, Sub-section IV of the General Provisions, for submittal requirements.
- B. Submittals for individual pieces of equipment such as indicators, flow meters, level meters, etc. shall include quantity supplied, the tag IDs, point-by-point compliance with the specifications and standards, and Product Data: "Catalog cuts" and spec sheets marked to specifically indicate the equipment and materials proposed for this project. Indicate selections with arrows, and cross out irrelevant data. Include parts layouts and indicate all options, to include calibration ranges and setpoints.
- C. Power requirements and connection information for all components requiring external power.

## PART 2 - PRODUCTS

### 2.01 DETAILED MATERIAL REQUIREMENTS

- A. Enclosures for field instruments shall be NEMA 4X or explosion-proof, as required to suit the installation location.
- B. Dry contact outputs shall be Form C (SPDT) rated for 10 amps at 120 Vac, in conformance with NEMA Standard ICS 5 contact rating designation A150.
- C. Special cables, where required by the manufacturer for the field instrument provided, shall be supplied with the field instrument.
- D. Current outputs shall be 4-20 mA DC, able to drive a 600 ohm minimum load.
- E. All 4-20 mA DC analog loops containing field-mounted (i.e. remote from control panel) transmitters shall include transient overvoltage protection at the transmitter. Transient protectors shall be Joslyn cat. no. 1020-30, Rosemount Model 470, or approved equal.

### 2.02 EQUIPMENT

- A. Level Transducer
  - 1. The level transducer shall be a submersible pressure sensing 2-wire 4-20 mA DC device with 0.25% full scale accuracy, stainless steel housing, Teflon-coated elastomeric diaphragm, aneroid bellows, 40 ft. PTFE insulated cable, with ½ inch NPT conduit threads and full lightning protection.
  - 2. Level transducer shall be KPSI 705 series cat. no. 705S14C4B000.000-004.334C20040B, or approved equal.

3. Schedule:

Tag #	Description	Range	Units
LE-100	Wet Well Level	0-15	ft. H <sub>2</sub> O (gauge)
-	Spare	0-15	ft. H <sub>2</sub> O (gauge)

B. Level Switches

1. Level switches shall be non-mercury float type suitable for continuous submersion in wastewater.
2. Mechanical tilt float level switch, with a sealed cable and an impact & corrosion resistant 316 Stainless steel float.
3. Float switch cable shall be provided with sensor as an integral assembly. The cord shall be 16 gauge 2 or 3 conductor SJOW oil resistant CPE, of sufficient length to allow connection at junction box (without splices, unless otherwise shown).
4. The SPDT contacts' rating shall be 1 amp at 120 VAC.
5. Install float with cable weights such that float actuates below restraint.
6. Cables shall be of sufficient length to mount the float switches at the locations shown on the Contract Drawings, plus an additional 10 feet (minimum) of cable. Cables shall be provided in continuous lengths between the float and the associated junction box or control panel. Excess cable shall be coiled and tie-wrapped to the cable mounting supports.
7. Manufacturer: Flygt Cat.ENM-10 by Flygt.
8. Level Switch Schedule:

Tag #	Description	Range	Units
LSHH-100	Wet Well High-High Level	0-6	Inches (actuation range)
LSH-100	Wet Well High Level	0-6	Inches (actuation range)
LSL-100	Wet Well Low Level	0-6	Inches (actuation range)
LSLL-100	Wet Well Low-Low Level	0-6	Inches (actuation range)
LSHH-101	Valve Vault	0-6	Inches (actuation range)
	Spare	0-6	Inches (actuation range)

PART 3 - EXECUTION

3.01 GENERAL

- A. All analog electronic instruments and systems shall operate on 4-20mA<sub>dc</sub> signal carriers unless otherwise noted, and shall be installed in the instrument loop so that the failure or

removal of any instrument from the loop, other than primary element or power supply, will not affect the remaining instruments on the loop or the overall integrity of the loop. This shall be accomplished through the use of bias resistors or signal isolators/repeaters at each receiver.

- B. The instrument enclosures shall be solidly connected to the power supply equipment grounding conductor as specified in Division 16 Section "Grounding".
- C. Field calibrate field instruments in conformance with the Manufacturer's instructions, and apply field instrument tags as specified in Division 16 Section "Electrical Identification".
- D. Temporary storage of all instrumentation equipment shall be in a humidity controlled environment heated to a minimum of 55° F, maximum of 85° F.
- E. Furnish and install all mounting stands, supports structures, brackets and accessories as required or detailed for the installation of the instruments furnished. Unless otherwise specified or required, supports shall be stainless steel. All mounting hardware shall be stainless steel. Equipment mounted on walls in contact with ground or water shall be mounted offset from the wall a minimum of ¼-inch.
- F. Installation: Install equipment in neat and workmanlike manner; align, level and adjust for satisfactory operation as recommended by the manufacturers. Installation shall be such that parts are easily accessible for inspection, operation, maintenance and repair. Indicating instruments shall be mounted so as to be readily visible.
- G. Tagging: All instruments shall be permanently tagged with a corrosion-resistant metal tag containing the "Tag ID" and "Description". A sample tag shall be submitted to the Engineer for review and approval before commencing instrument tagging. Descriptions may be abbreviated.
- H. Power cabling, discrete control signal wiring, analog control signal wiring, and network cabling shall each be installed in separate conduits.

### 3.02 STARTUP

- A. General
  - 1. The services of competent factory trained representatives of the respective manufacturers shall be provided to supervise the installation, startup, and operation of their equipment and to conduct the field tests.
- B. Field Tests
  - 1. After installation, instrumentation equipment shall be checked and the required adjustments shall be made by representatives of the manufacturer.
  - 2. Equipment shall be field tested in the presence of the Engineer and shall be demonstrated to operate satisfactorily over the specified ranges.
  - 3. The Supplier shall provide the necessary test equipment and qualified test personnel.

4. In the event of failed field test, the Supplier shall perform the necessary corrections and retest the equipment as directed by the Engineer. This process shall be provided at the expense of the contractor and repeated as necessary.

### 3.03 INSTRUMENTATION TRAINING

- A. Combine Field Instrument Training with Pump Control Panel training.

End of Section

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## SECTION 26 09 16

### ELECTRICAL CONTROL COMPONENTS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Provide electrical control components as shown on the Drawings and specified herein.

##### 1.2 RELATED WORK

- A. The requirements in this Section also apply to the following Sections:
  - 1. Division 40 Section "Pump Station Control Panel".

##### 1.3 REFERENCES

- A. Equipment and installation shall be in conformance with the latest revisions of the following codes and standards :
  - 1. NFPA 70 – The National Electric Code (NEC)
  - 2. NFPA 79-2002 Electrical Standard for Industrial Machinery
  - 3. National Electrical Manufacturers Association - NEMA
  - 4. Underwriters Laboratories, Inc. - UL

##### 1.4 SUBMITTALS

- A. Submittals shall conform to the General Provisions.
- B. Submit manufacturer's catalog data for each electrical control component, clearly marked to show what is proposed for this project. Cross out inapplicable data. Include manufacturers catalog data with the Shop Drawings for the equipment making reference to this Section.

#### PART 2 - PRODUCTS

##### 2.1 ELECTRICAL ENCLOSURES

- A. Enclosure NEMA ratings and materials of construction shall be in conformance with Division 26 Section "Electrical – General".
- B. Enclosures shall have interior steel panel for device mounting. Interiors shall be painted white.
- C. Control panels and cabinets shall be wall-mounted or free-standing, as shown on the Drawings or as required for the application.

- D. Provide 3-point latch and key lock for enclosures taller than 48 inches.

## 2.2 POWER SUPPLY DISCONNECTS

- A. Power supply disconnects shall be circuit breaker type, fully rated for the available fault current, with padlockable exterior operating handle.

## 2.3 CONTROL POWER TRANSFORMERS

- A. Control power transformers have 120 volts AC grounded single phase secondary for control circuits. Provide two primary fuses rated 100,000 amperes interrupting capacity at 600 volts, and one secondary fuse rated 300 volts.

## 2.4 CONTROL RELAYS

- A. Control relays shall be 8-pin or 11-pin plug-in type. 120 VAC relays to be round pin type with indicator light. 24 volt relays to be blade type with indicating light. Provide restraining straps and relay bases recommended by the relay manufacturer.
- B. Control relays shall be provided with a check push-button for testing operation of the relay contacts.
- C. Control relays shall be provided with an integral indicating light showing the position of the relay (de-energized or energized).
- D. Contacts for all control and timing relays as shown on the Contract Drawings shall be silver cadmium oxide type with the following NEMA Standard ICS5 A300 contact ratings:
  - 1. 10 amps continuous, 1/3 HP at 120 VAC
  - 2. 10 amps continuous, 1/2 HP at 240 VAC
  - 3. 10 amps continuous at 24 VDC
- E. Solid State Timing Relays (TR) shall have adjustable time settings within adjustable time ranges.
  - 1. Time delay range shall be field-adjustable from 0.05 seconds to 999 minutes unless otherwise indicated on the Drawings.
  - 2. Timing relays shall have four selectable modes: On-delay, off-delay, one-shot and repeat cycle.
- F. Control relays shall be as manufactured by:
  - 1. Square D - Class 8501 - Type K for control relays and Square D - Class 9050 Type JCK70
  - 2. Equal by Idec
  - 3. Equal by Potter & Brumfield
  - 4. Or approved equal

## 2.5 PUSHBUTTONS, SELECTOR SWITCHES, INDICATING LIGHTS

### A. General

1. All control devices shall be heavy duty, watertight and oiltight, with die cast operator bodies of nominal 1-1/4 inch (30.5 mm) diameter , and molded modular type contact for blocks.
2. All control devices exposed to the environment shall be rated NEMA 4 and NEMA 13.
3. Colors shall conform to NFPA 79-2002 Electrical Standard for Industrial Machinery.
4. Pushbuttons, selector switches, and indicator lights shall be suitable for operation on 120 volts 60 Hz unless otherwise indicated.

### B. Pushbuttons

1. Pushbuttons shall have button operator with color inserts and guards, engraved legend plates, and contact blocks as required for the specified functionality.
2. Emergency Stop Pushbuttons shall be two-position maintained-contact push-pull type with red mushroom operator.
3. Start pushbuttons shall be fully guarded, with green color insert, and momentary contacts.
4. Stop pushbuttons shall be unguarded (button extends above ring), with red color insert, and momentary contacts.

### C. Selector Switches

1. Selector switches shall have gloved hand type operators, engraved legend plates, and contact blocks as required for the specified functionality.

### D. Indicator (Pilot) Lights

1. Indicator lights shall be wired for push-to-test operation.
2. Indicator lights shall be LED type unless otherwise indicated.
3. Indicator lights shall be provided with color caps matching the LED color.
4. Indicator lights shall be provided with engraved legend plates indicating function.

### E. Manufacturers

1. Siemens (Furnas)
2. General Electric CR 2940
3. Square D Class 9001, Type K
4. Allen Bradley
5. Or approved equal.

## 2.6 ANTI-CONDENSATION HEATERS

- A. Anti-condensation heaters shall be 120 VAC, in NEMA 1 enclosure, with adjustable thermostat. Integral heat circulating fans shall be provided for anti-condensation heaters mounted in outdoor enclosures.

## 2.7 CONTROL STATIONS

- A. Control Stations shall have enclosure ratings and types in conformance with Division 26 Section "Electrical - General", with pre-punched openings for pushbuttons, indicator lights, and selector switches.

## 2.8 TERMINAL BLOCKS

- A. Provide terminal blocks for all field wiring connections. Terminal blocks shall be rail-mounted, 600 volt, 30 amp, nylon, with recessed tubular screw terminals suitable for #12 through #18 AWG stranded copper wire terminations, "fingersafe" to DIN57470.
- B. Terminal blocks shall be Square D "GM" series, or approved equal.

## 2.9 ELAPSED TIME METERS

- A. Elapsed time meters shall be 6-digit 0-99999.9 hours 120 VAC, NEMA 4 and 12 (with gasket), quartz crystal based, 2.8 inch round flange 3-hole mount for 2 inch cutout, ENM Counting Instruments Series T50 Quartz AC Hour meter, or approved equal.

## 2.10 DIGITAL INDICATORS

- A. Indicators shall operate on 120 VAC, single phase power source. Provide 24 volt control power transformer for units requiring 24 volt power supply.
- B. Indicators shall have an operating temperature range of 0 deg. C to +50 deg. C.
- C. Digital indicators shall provide 24 VDC power supply for the transmitters, shall scale and display a 4-20 mA dc input signal in actual Engineering Units (feet of water, psi, gpm, MGD etc.), and shall have the following features:
  - 1. NEMA 4 rating
  - 2. Power supply: 115 VAC
  - 3. 7 digit red LED display 1 inch high (nominal)
  - 4. 2 adjustable current trip alarm outputs
  - 5. 4-20 mA retransmitted signal from the instrument
  - 6. Provide mounting kit
  - 7. Manufacturer/Model: Magnetrol 009-5765-506, MorHEAT N1500, Redlion, or approved equal.

## 2.11 INTRINSICALLY SAFE RELAYS AND BARRIERS

- A. Intrinsically safe relays shall be U.L. listed for Class I Division 1 Groups C and D Hazardous (Classified) Locations, similar and equal to Gems Sensors and Controls "Safe-Pak"

- B. Intrinsically safe barriers for 4-20 mADC signals shall be U.L. listed for Class I Division 1 Groups C and D Hazardous (Classified) Locations, similar and equal to Gems Sensors and Controls “Single Channel Zener Barriers”.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install control devices in conformance with the manufacturer's installation instructions and recommendations, and as shown on the Drawings.

#### 3.2 ACCEPTANCE TESTS

- A. Acceptance testing shall be performed as specified in the individual Specification Sections utilizing the control components.

End of Section

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SECTION 26 21 00  
INCOMING SERVICE

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide incoming secondary electrical service as shown on the Drawings and specified herein.
- B. The electric utility is Dominion Virginia Power.
- C. The Contractor shall be responsible for making arrangements with the electric utility company to complete the installation of the incoming electric service in conformance with the approved Project Schedule, and for coordination with the electrical utility installation requirements.

1.02 QUALITY ASSURANCE

- A. The incoming service installations shall be inspected and approved by the utility company.
- B. The incoming service shall be inspected and approved by the AHJ.
- C. Inspection certificates shall be submitted prior to energization and use of the incoming service.

1.03 COORDINATION REQUIREMENTS

- A. Pre-Installation Meetings: The Contractor shall request a meeting with the Owner and the electric utility company prior to commencing work. The Agenda shall include the following items as a minimum:
  - 1. Review of scheduling requirements
  - 2. Discussion of the coordination requirements
  - 3. Review of Owner's needs for continuity of service.
- B. Scheduling: The following milestones and activities shall be included in the Contractor's schedule for the project:
  - 1. Kickoff meeting with the service provider
  - 2. Procurement of equipment and materials, including utility service provider equipment and materials.
  - 3. Installation of equipment and materials, including utility service provider equipment and materials
  - 4. Inspections
  - 5. Energization

## 1.04 SUBMITTALS

- A. Certificates: copy of the inspection certificates from the AHJ, and copy of the inspection certificate from the electrical utility company, for the record
- B. Test Reports for equipment and materials specified in other Sections
- C. Manufacturer Instructions for handling, storing, installing, operating, and maintaining service equipment and materials
- D. Field Quality Control Submittals: copy of the inspection certificate from the AHJ, and copy of the inspection certificate from the electrical utility company, for the record
- E. Closeout Submittals
  - 1. Operation and Maintenance manuals for service equipment
  - 2. Utility service provider contact information

## PART 2 - PRODUCT

### 2.01 ELECTRIC SERVICE

- A. Products shall conform to the service utility's requirements.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Electrical
  - 1. Dominion Virginia Power will perform the following work:
    - a. Furnish and install service transformer(s). Transformer(s) secondary voltage shall be 240/120 VAC, 1- phase, 3- wire, 60 Hertz.
    - b. Furnish revenue meter socket and meter.
    - c. Inspect and approve the completed installation prior to connecting the incoming service.
  - 2. Contractor shall perform the following work:
    - a. Install revenue meter socket.
    - b. Furnish and install conduit and wires from service entrance main circuit breaker to the service transformer.
    - c. Installation shall follow Dominion Virginia Power standards and be approved by Dominion Virginia Power upon completion.
  - 3. Before the final power connections are made, the incoming service shall be inspected by the local electrical agency responsible for such inspections.
  - 4. A certificate of inspection shall be obtained and a copy sent to the Owner.

End of Section

## SECTION 26 24 16

### PANELBOARDS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Provide panelboards as shown on the Drawings and specified herein.
- B. This Section includes the following:
  - 1. 208/120 V Transient voltage surge suppression panelboards.

##### 1.02 RELATED DOCUMENTS

- A. Additional requirements are described in the following Division 26 Sections:
  - 1. "Grounding" for grounding requirements.

##### 1.03 DEFINITIONS

- A. In addition to the definitions in Division 26 Section "Electrical", the following definitions apply to this Section:
  - 1. EMI: Electromagnetic interference
  - 2. GFCI: Ground-fault circuit interrupter
  - 3. RFI: Radio-frequency interference
  - 4. RMS: Root mean square
  - 5. SPDT: Single pole, double throw
  - 6. AFCI: Arc fault circuit interrupter

##### 1.04 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, transient voltage surge suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment, submit the following:
  - 1. Specially prepared drawing for each panelboard showing dimensions, busbars, circuit breakers, doors and trim, latches and locking devices, and complete bill of materials listing all components. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Bus configuration, current, and voltage ratings.
    - c. Short-circuit current rating of panelboard and overcurrent protective devices
    - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. Wiring Diagrams: Power (for all panelboards) and control wiring (for panelboards with control devices).

- C. Qualification Data: For testing agency.
- D. Field quality-control test reports including the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Panelboard Schedules: For installation in panelboards.
- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. Include the following:
  - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  - 2. Time-current curves, including selectable ranges for each type of adjustable overcurrent protective device.

#### 1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70
- F. Comply with UL 67 and UL 50
- G. When used as service equipment the panelboard shall be UL label for Service Equipment.

#### 1.06 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

#### 1.07 EXTRA MATERIALS

- A. Furnish extra materials described below 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.

2. Key all panelboards alike
3. Arc flash warning label as specified in latest edition of NFPA 70
4. 20% spare breakers.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
    - a. Eaton Corporation; Cutler-Hammer Products
    - b. General Electric Co.; Electrical Distribution & Protection Div.
    - c. Siemens Energy & Automation, Inc.
    - d. Square D.
  2. Transient Voltage Suppression Panelboards:
    - a. Advanced Protection Technologies.
    - e. Current Technology.
    - f. Liebert Corporation
    - g. Eaton/Cutler Hammer.
    - h. United Power.

### 2.02 MANUFACTURED UNITS

- A. All panelboards shall be dead front design
- B. Enclosures: Surface-mounted cabinets in conformance with NEMA PB 1.
  1. Rated for environmental conditions at installed locations, and in conformance with Division 26 Section "Electrical" enclosure requirements.
  2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Provide full height piano hinge.
  3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
  4. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
  5. The manufacturer's nameplate shall be of corrosion resistant metal such as stainless steel and have the pertinent ratings embossed in raised letters and numerals. The pertinent ratings shall include at least the following; amperage, voltage, phase, wires, AIC, manufacturer and model number.
- C. Phase and Neutral Buses: Tin-plated hard-drawn copper, 98 percent conductivity.
- D. Equipment Ground Bus: Hard-drawn copper, adequate connections for feeder and branch-circuit equipment ground conductors; bonded to box.
- E. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

- F. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box, in addition to equipment ground bus.
- G. Split Bus: Vertical buses divided into individual vertical sections.
- H. Conductor Connectors: Suitable for use with conductor material.
  - 1. Main and Neutral Lugs: Mechanical type.
  - 2. Ground Lugs and Bus Configured Terminators: Mechanical type.
  - 3. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- I. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switch.

### 2.03 PANELBOARD SHORT-CIRCUIT RATING

- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

### 2.04 208/120 V TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) PANELBOARDS

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- B. Main Overcurrent Devices: Bolt-on circuit breaker.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.
- D. Bus: Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.
- E. Transient Voltage Surge Suppression Device: IEEE C62.41, integrally mounted, plug-in-style, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules.
  - 1. Minimum Single-Impulse Current Ratings:
    - a. Line to Neutral: 100,000 A.
    - b. Line to Ground: 100,000 A.
    - c. Neutral to Ground: 50,000 A.
  - 2. Protection mode shall be as follows:
    - a. Line to neutral.
    - b. Line to ground.
    - c. Neutral to ground.
  - 3. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
  - 4. Maximum UL 1449 Clamping Levels: 400 V, line to neutral and line to ground on 120/208 V.
  - 5. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.
  - 6. Accessories:
    - a. Audible alarm activated on failure of any surge diversion module.
    - b. Six-digit transient-counter set to total transient surges that deviate from the sine-wave envelope by more than 125 V.

## 2.05 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.
  - 2. GFCI Circuit Breakers: Single- and two-pole configurations with 5 or 30-mA trip sensitivity.
- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
  - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
  - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - 4. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.

## 2.06 ACCESSORY COMPONENTS AND FEATURES

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Furnish portable test set to test functions of solid-state (electronic) trip devices without removal from panelboard.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mount within Pump Station Control Panel as indicated on the Drawings.
- C. Mount plumb and rigid without distortion of box.
- D. Install overcurrent protective devices and controllers.
- E. Install filler plates in unused spaces.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

### 3.02 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification".

- B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

### 3.03 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding".
- B. Connect wiring according to Division 26 Section "Wire and Cable".

### 3.04 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

### 3.05 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
  - 1. Perform electrical test and visual and mechanical inspections described in the following NETA Acceptance Testing Specification Inspection and Test Procedures that are applicable to the products furnished for this project:
    - a. 7.1 "Switchgear and Switchboard Assemblies"
    - b. 7.6.1.1 "Circuit Breakers, Air, Insulated-Case, Molded-Case"
    - c. 7.19.1 "Surge Arresters, Low-Voltage"
    - d. 7.16.1.1 "Motor Control, Motor Starters, Low-Voltage"
  - 2. Certify compliance with test parameters.
  - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

End of Section

## SECTION 26 28 16

### ENCLOSED SWITCHES AND CIRCUIT BREAKERS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Provide enclosed AC switches and circuit breakers rated 600 V and less, of the following types, as shown on the Drawings and specified herein:
  - 1. Non-Fused Disconnect Switches
  - 2. Manual Transfer Switches
  - 3. Enclosed Circuit Breakers

##### 1.02 RELATED DOCUMENTS

- B. Related Sections include the following:
  - 1. Division 26 Section "Electrical Control Components" for relays, pushbuttons, indicator lights, selector switches, elapsed time meters, terminal blocks, and control stations.

##### 1.03 SUBMITTALS

- A. Submit shop drawings and manufacturers' data in accordance with the provisions of Division I, General Provisions. See Section 105, Sub-section IV of the General Provisions, for submittal requirements.
- B. Product Data: For each type of enclosed switch and circuit breaker. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, UL listing, and finishes.
- C. Qualification Data: For testing agency.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. Include the following:
  - 1. Routine maintenance requirements for enclosed switches and circuit breakers and all installed components.
  - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

#### 1.04 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. **Testing Agency Qualifications:** An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 1. **Testing Agency's Field Supervisor:** Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- C. **Source Limitations:** Obtain enclosed switches and circuit breakers of a single type through one source from a single manufacturer.
- D. **Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NFPA 70.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store enclosed switches and circuit breakers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed switches and circuit breakers from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- B. If stored in areas subject to weather, cover enclosed switches and circuit breakers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside switches and circuit breakers; install electric heating of sufficient wattage to prevent condensation.

#### 1.06 COORDINATION

- A. Coordinate layout and installation of enclosed switches and circuit breakers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate features of enclosed switches and circuit breakers and accessory devices with pilot devices and control circuits to which they connect.

## PART 2 - PRODUCTS

### 2.01 GENERAL

- A. Enclosure types shall be as specified in Division 26 Section "Electrical - General".
- B. Enclosed switches and circuit breakers shall be UL listed.

### 2.02 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Corporation; Cutler-Hammer Products.
  - 2. General Electrical Company; GE Industrial Systems.
  - 3. Schneider Electric / Square D.

### 2.03 MANUAL TRANSFER SWITCHES

- A. Manual transfer switches shall be multi-pole, double throw, center off, 600 volt, with ampere ratings and number of poles as shown on the Drawings.
- B. Provide cover interlock to prevent opening the door with the switch closed.
- C. Provide external operating handle with padlocking provisions in all three positions.
- D. Manual transfer switches shall have withstand ratings suitable for the available fault current. Series ratings with separate overcurrent protection devices are acceptable. If withstand ratings are not adequate without fuses, provide current-limiting fuses.
- E. Provide 1 SPDT contact to monitor each switch position.
- F. Provide tin-plated copper insulated neutral bus and copper ground bus for equipment grounding conductors.
- G. Manual transfer switches shall be similar and equal to Square D Class 3140 Double Throw Safety Switches.

### 2.04 ENCLOSED CIRCUIT BREAKERS

- A. Enclosed circuit breakers shall be molded-case thermal-magnetic type with trip and frame ratings as shown on the Drawings, with cover interlock to prevent opening the enclosure door with the circuit breaker closed.

- B. Provide external operating handle with padlocking provisions. Circuit breaker shall be closed when the handle is in the UP position, and open in the DOWN position. Rotary handles are not acceptable.
- C. Circuit breakers shall be rated 10,000 A.I.C. at 240 volts, 1-phase, 60 Hz.
- D. Provide insulated neutral bus and main bonding jumper for utility main circuit breaker shown on the Drawings, which shall be UL listed and labeled "Suitable for Use as Service Entrance Equipment".
- E. Provide copper ground bus for grounding electrode conductor and equipment grounding conductors.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Coordinate installation of enclosed circuit breakers, manual transfer switches, and disconnect switches with concrete and masonry work.
- B. Connect manual transfer switch auxiliary contacts to the Pump Station Control Panel PLC as specified in Division 40 Section "Pump Station Control Panel".

#### 3.02 IDENTIFICATION

- A. Identify enclosed circuit breakers, components, and control wiring in conformance with Division 26 Section "Electrical Identification."

#### 3.03 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  1. Test insulation resistance for each enclosed switch and circuit breaker.
  2. Test continuity of each circuit.
- B. Perform the following field tests and inspections and prepare test reports:
  1. Perform each electrical test and visual and mechanical inspection, except optional tests, stated in the following NETA Acceptance Testing Specification Inspection and Test Procedures:
  2. 7.5.1.1 "Switches, Air, Low-Voltage"
  3. 7.6.1.1 "Circuit Breakers, Air, Insulated-Case, Molded-Case".

4. Certify compliance with test parameters.
5. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

End of Section

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## SECTION 26 32 13

### DIESEL-ENGINE-DRIVEN GENERATOR SETS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Provide diesel engine driven generator set for optional standby service, as shown on the Drawings and as specified herein.

##### 1.02 RELATED DOCUMENTS

- A. Related requirements are included in the following Division 26 Sections:
  1. "Enclosed Switches and Circuit Breakers" for transfer switches including sensors and relays to initiate automatic starting and stopping signals for engine-generator sets.
  2. "Electrical Identification" for labeling.
  3. "Grounding" for generator grounding.
  4. Enclosed Switches and Circuit Breakers for generator overcurrent and ground fault protection.

##### 1.03 SUMMARY

- A. This Section includes packaged diesel engine driven generator sets with the following components and accessories:
  1. Engine
  2. Generator
  3. Generator set control panel
  4. Engine starting battery with charger
  5. Engine coolant heater
  6. Engine exhaust silencer
  7. Exhaust piping external to engine

##### 1.04 DEFINITIONS

- A. In addition to the definitions in Division 26 Section "Electrical - General", the following definitions apply to this Section:
  1. Emergency Systems: refer to NEC Section 700 for definition
  2. EPSS: emergency power supply system (NFPA 110 definition)
  3. Generator: commonly used term for a rotating three phase brushless alternator with 60Hz output voltage
  4. Generator set: a complete assembly of engine and generator set components capable of generating electricity
  5. Legally Required Standby Systems: refer to NEC Section 701 for definition
  6. Optional Standby Systems: refer to NEC Article 702 for definition
  7. 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.

8. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hertz or cycles per second.

#### 1.05 QUALIFICATIONS

- A. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Owner. The manufacturing company shall be listed in a published NRTL directory of companies offering NRTL-listed and labeled products.
- B. Supplier Qualifications: Manufacturer's authorized representative who is factory-trained and manufacturer-approved for installation of units required for this Project. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
  1. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- C. Testing Firm Qualifications: An independent firm, with experience and capability to conduct specified tests, and is a member company of NETA or is an NRTL as defined by OSHA in 19 CFR 1910.7, acceptable to the AHJ.
- D. Testing Firm's Field Supervisor Qualifications: person currently certified by NETA or NICET to supervise on-site testing specified in Part 3.
- E. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- F. Product Options: Drawings indicate size, profiles, and dimensional requirements of packaged generator sets and are based on the specific system indicated.
- G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the AHJ, and marked for intended use.

#### 1.06 REFERENCE STANDARDS

- A. Comply with the following standards in effect at the time of bid submittal unless otherwise noted in Division "General Requirements":
  1. ANSI/IEEE C37.13-1990, Standard for Low-Voltage AC Power Circuit Breakers Used In Enclosures,
  2. ANSI/IEEE C37.14-1993, Standard for Low-Voltage DC Power Circuit Breakers Used In Enclosures,

3. ANSI/IEEE C37.20.1- 1993, Standard for Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear,
4. ANSI C37.50- 1989 (R1995) Test Procedures for Low-Voltage AC Power Circuit Breakers Used In Enclosures,
5. Conformance Testing of Metal-Enclosed Low-Voltage AC Power Circuit Breaker Switchgear Assemblies, ANSI C37.51-1989 (R1995).
6. ANSI/IEEE 43-2000 IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machinery
7. ANSI/IEEE 95-2002 IEEE Recommended Practice for Insulation Testing of AC Electric Machinery (2300 V and Above) With High Direct Voltage
8. ANSI/IEEE 112-1996 IEEE Standard Test Procedure for Polyphase Induction Motors and Generators
9. ANSI/IEEE 115-1995 (R2002) IEEE Guide: Test Procedures for Synchronous Machines, Part I--Acceptance and Performance Testing, Part II--Test Procedures and Parameter Determination for Dynamic Analysis
10. ANSI/IEEE 117-1974 (R1991) IEEE Standard Test Procedure for Evaluation of Systems of Insulating Materials for Random-Wound AC Electric Machinery
11. ANSI/IEEE 275-1992 IEEE Recommended Practice for Thermal Evaluation of Insulation Systems for Alternating-Current Electric Machinery Employing Form-Wound Preinsulated Stator Coils for Machines Rated 6900 V and Below
12. ANSI/IEEE 286-2000 IEEE Recommended Practice for Measurement of Power Factor Tip-Up of Electric Machinery Stator Coil Insulation
13. ANSI/IEEE 429-1994 IEEE Recommended Practice for Thermal Evaluation of Sealed Insulation Systems for AC Electric Machinery Employing Form-Wound Preinsulated Stator Coils for Machines Rated 6900V and Below
14. ANSI/IEEE 522-1992 (R1998) IEEE Guide for Testing Turn-to-Turn Insulation on Form-Wound Stator Coils for Alternating-Current Rotating Electric Machines
15. ANSI/IEEE 1107-1996 IEEE Recommended Practice for Thermal Evaluation of Sealed Insulation Systems for AC Electric Machinery Employing Random Wound Stator Coils
16. ANSI/IEEE 1434-2000 IEEE Trial-Use Guide to the Measurement of Partial Discharges in Rotating Machinery
17. NEMA ICS 6 Industrial Control and Systems Enclosures
18. NEMA MG 1 Motors and Generators
19. UL 50 Safety Enclosures for Electrical Equipment
20. UL 489 Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
21. UL 508 Industrial Control Equipment
22. UL 1066 Standard for Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures
23. NFPA 37 Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
24. NFPA 101 Life Safety Code
25. NFPA 110 Standard for Emergency and Standby Power Systems - requirements for Level 2 EPSS.

#### 1.07 ENVIRONMENTAL CONDITIONS

- A. Equipment specified in this Section shall be suitable for operation within the range of indoor temperatures, humidity, and altitude specified in Division 26 Section "Electrical -

General".

- B. Environmental Conditions: Engine-generator system shall withstand the ambient environmental conditions without mechanical or electrical damage or degradation of performance capability.

#### 1.08 SUBMITTALS

- A. Submittals shall conform to the General Provisions.
- B. Preconstruction Submittals
  - 1. Qualification data for equipment Manufacturer(s), including quality certification.
- C. Shop Drawings
  - 1. Detail drawings for equipment assemblies indicating dimensions, weights, structural design recommendations for dynamic loading, required clearances for maintenance and operations, method of field assembly, components, and location and size of each field connection.
  - 2. Dimensioned outline plan and elevation drawings of engine-generator set and other specified components.
  - 3. Wiring Diagrams: Power, signal, and control wiring. Show factory wiring and field wiring, phase rotation and grounding connections.
  - 4. Duct work, piping, and insulation system details.
- D. Product Data: Include the following:
  - 1. Manufacturer's engine and generator technical data, including the following:
    - a. Ratings
    - b. Performance
    - c. Governor data
    - d. Voltage regulator data
    - e. Exciter and excitation power supply data
    - f. Accessories
- E. Design Data
  - 1. Generator electrical ratings and winding characteristics, including thermal damage curve, subtransient reactance, transient reactance, short circuit ratings, voltage regulation, and nameplate data
  - 2. Detailed description of engine overspeed device.
  - 3. Time-current characteristic curves for generator overcurrent protective device
  - 4. Design Calculations: Signed and sealed by a qualified registered professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
  - 5. Vibration Isolation Base Details: Signed and sealed by a qualified registered professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
  - 6. Coordination Drawings: Submit drawings specially prepared by the Contractor for this Project, including floor plans and sections, drawn to scale. Include conduit stub-up and connection locations with dimensions for the generator power terminal box, generator accessories terminal box, control panel, battery, coolant heater, and other specified engine accessories requiring field wiring.

Show the following:

- a. Clearances for access to generator and engine components.
- b. Connections to exhaust piping.
- c. Exhaust silencer and insulation.
- d. Anchor bolts and vibration isolators.
- e. Location of adjacent construction elements including light fixtures, HVAC and plumbing equipment, floor drains, fire suppression sprinklers and piping, and other nearby equipment.

F. Test Reports

1. Factory test reports, including sound measurement and exhaust emission test reports.
2. Retain subparagraph just below.
3. Acceptance test reports.

G. Certificates:

1. Certification of Torsional Vibration Compatibility: Comply with NFPA 110.

H. Manufacturer's Instructions

1. Unloading, hoisting, rigging, short term storage, long term storage, and installation instructions
2. Method of field assembly, and location and size of each field connection
3. Battery filling, initial charging, battery charger settings
4. Generator set installation, testing, and commissioning instructions with checklists

I. Manufacturer's Field Reports

1. Inspection of equipment installation (prior to energization and startup)
2. Acceptance test report
3. Training, including notification to Owner's Representative and class attendance list
4. Maintenance service

J. Operation and Maintenance Data

1. Operation and Maintenance Manuals for engine, generator, and accessories.

K. Closeout Submittals

1. Training course materials
2. Callback and follow-up service reports

L. Warranty: Special warranty specified in this Section.

1.09 QUALITY ASSURANCE

- A. Source Limitations: Obtain generator sets and auxiliary components from a single Supplier.
- B. Engine Exhaust Emissions: Comply with applicable state and local government regulations in effect at the project location.

- C. Noise Emissions: Comply with applicable state and local government requirements applicable to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

#### 1.010 COORDINATION

- A. Coordinate layout and installation of generator sets with switchgear, fuel system, transfer switches, remote starting switches, remote radiators, overhead structural supports, and the work of other trades.
- B. Coordinate size and location of concrete bases with structural design. Cast anchor bolt inserts for vibration isolators in accordance with approved shop drawings. Comply with generator set manufacturer's installation requirements and recommendations. Reinforced concrete requirements are specified in Division 03 "Concrete".
- C. Submit specially prepared Coordination Drawings, including floor plans and sections, drawn to scale. Include scaled equipment layout and relationship between equipment and adjacent structural, mechanical, HVAC, and electrical components in the generator area. Include the following:
  - 1. Vertical and horizontal raceways
  - 2. Clearances for access
  - 3. Connections to generator terminal box for power, control, and grounding.
  - 4. Support locations, type of support, and weight on each support
  - 5. Location of generator components and nearby structure, walls, doors, windows, light fixtures, piping, HVAC ducts and equipment, intake and exhaust louvers, fire sprinklers and piping, fire alarm devices, signal and control devices, and other important components.

#### 1.011 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months full maintenance by factory-trained employees of manufacturer's designated service organization. Include quarterly 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. Maintenance agreements shall include parts and supplies as used in manufacture and installation of original equipment. Replace any spare parts taken from Owner's inventory.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Manufacturers:
  - 1. Caterpillar, Inc.
  - 2. Cummins, Inc.

#### 2.02 ENGINE-GENERATOR SET

- A. Generator set shall be a coordinated assembly of compatible components.

- B. Power Output Ratings: 60 kW / 60 kVA standby rating to operate as a unit as evidenced by records of prototype testing.
- C. Output Voltage: 240 / 120V single-phase 3-wire 60 Hz.
- D. Engine Starting Time: 10 seconds maximum.
- E. Safety Standard: Comply with ASME B15.1.
- F. Nameplates: Each major system component shall be equipped with a nameplate to identify manufacturer's name and address, and model and serial number of component.
- G. Mounting Frame: Adequate strength and rigidity to maintain alignment of mounted components without depending on concrete foundation. Mounting frame shall be free from sharp edges and corners and shall have lifting attachments arranged for lifting with slings without damaging components.
  - 1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator set center of gravity.

#### 2.03 GENERATOR SET PERFORMANCE

- A. Steady-State Voltage Operational Bandwidth: 4 percent of rated output voltage from no load to full load.
- B. Steady-State Voltage Modulation Frequency: Less than 1 Hz.
- C. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
- D. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
- E. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
- F. Transient Frequency Performance: Less than 5 percent variation for a 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
- G. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. The telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
- H. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, the system shall 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.

## 2.04 ENGINE

- A. Fuel: No. 2 diesel fuel oil, to ASTM D975.
- B. Rated Engine Speed: 1800 rpm maximum.
- C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).
- D. Lubrication System: The following items are mounted on engine or skid:
  - 1. Lube Oil Filter: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow. Provide automatic bypass.
  - 2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and be designed to be fail-safe.
  - 3. 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. Engine Fuel System:
  - 1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
  - 2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.
- G. Governor: Adjustable isochronous, with speed sensing.
- H. Overspeed protection: Separate overspeed protection device, independent from governor, designed for fail-safe operation in the event of loss of engine speed sensing and circuit faults.

## 2.05 ENGINE COOLING SYSTEM

- A. Description: Closed loop, liquid cooled, with integral radiator, factory mounted on engine-generator set mounting frame and integral engine-driven coolant pump.
- B. Integral Radiator: Rated for specified coolant, cooled by engine-driven fan.
  - 1. Radiator Core Tubes: Nonferrous-metal construction (not aluminum).
  - 2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
- C. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
- D. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
- E. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer

covering of aging-, ultraviolet-, and abrasion-resistant fabric.

1. Rating: Working pressure suitable for the application, and noncollapsible under vacuum.
2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

## 2.06 FUEL SUPPLY SYSTEM

- A. Comply with NFPA 30.
- B. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:
  1. Tank level indicator.
  2. Capacity: Fuel for twenty four hours' continuous operation (130 gallons) at 100 percent rated power output.
  3. Fill cap shall be located behind a lockable access cover.
  4. Containment Provisions: Provide double wall containment construction with leak detection contacts for local and remote monitoring. Containment shall comply with requirements of the authority having jurisdiction.

## 2.07 ENGINE EXHAUST SYSTEM

- A. Exhaust silencer: Critical type, sized as recommended by engine manufacturer; sound level measured at a distance of 10 feet (3 m) from exhaust discharge shall be 85 dBA or less.
- B. Condensate Drain for silencer: Schedule 40, black steel pipe connected to silencer drain outlet through a full port ball valve.
- C. Connection from Engine to Exhaust System: Flexible section of corrugated stainless-steel pipe.
- D. Connection from Exhaust Pipe to Silencer: Stainless-steel expansion joint with liner.
- E. Indoor Exhaust Piping after Exhaust Silencer: ASTM A 53/A 53M, Schedule 40, welded, black steel, with welded joints and fittings.
- F. Outdoor Exhaust Piping after exhaust silencer: ASTM A 53/A 53M, Schedule 40, welded, black steel, with welded joints and fittings.
- G. Insulation: Engine exhaust system shall be insulated when located within generator housing or indoors as noted on the Drawings.

## 2.08 COMBUSTION-AIR INTAKE

- A. Air filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element.
- B. Indication: "Change filter" indicator for engine generator sets up to 500 kW. For sets 500 kW and larger, provide differential pressure gauge with maximum recommended differential pressure clearly marked in red.

- C. Controls: SPDT contacts from engine control panel actuate to initiate opening of combustion air damper.

## 2.09 STARTING SYSTEM

- A. Description: 24 V DC from battery, with negative ground and including the following items:
  - 1. Starting System Components: Sized for reliable operation during two sequential engine-cranking cycles with ambient temperature at maximum.
  - 2. Cranking Motor: Heavy-duty units with solenoid engagement and mechanical release from engine flywheel.
  - 3. Cranking Cycle: As required by NFPA 110 for system level specified.
  - 4. Battery: Sized to provide specified cranking cycle power at least twice without recharging. Battery shall be Nickel-Cadmium.
  - 5. Battery Cable: Size as recommended by engine manufacturer. Include required interconnecting conductors and connection accessories.
  - 6. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 65-A minimum continuous rating.
  - 7. Battery Charger: Current-limiting, automatic equalizing and float-charging type. Unit shall be EZ-12-10 battery charger and comply with UL 1236 and include the following features:
    - a. Operation: Equalizing charge rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
    - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    - d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
    - e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall actuate SPDT contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

## 2.010 ENGINE-GENERATOR SET CONTROL PANEL

- A. Functional Description: When mode selector switch on the engine-generator set control panel is in the AUTOMATIC position, remote control contacts close to initiate starting and stopping the generator set after a cool-down period. When mode selector switch is switched to ON, the generator set starts. The OFF position of the same switch initiates generator set shutdown with engine cool-down period. During generator set operation, equipment failures automatically shut down the generator set and initiate alarms.

Operation of the remote EMERGENCY STOP switch shuts down the generator set without an engine cool-down period.

- B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common engine-generator set control panel mounted on the engine-generator set. Mounting method shall isolate the control panel from generator set vibration.
- C. Indicating and protective devices and controls shall include those required by NFPA 110 for a Level 1 system, and the following:
  - 1. AC voltmeter.
  - 2. AC ammeter.
  - 3. AC frequency meter.
  - 4. DC voltmeter (alternator battery charging).
  - 5. Engine-coolant temperature gage.
  - 6. Engine lubricating-oil pressure gage.
  - 7. Running-time meter.
  - 8. Ammeter-voltmeter, phase-selector switch(es).
  - 9. Generator-voltage adjusting rheostat.
  - 10. Overspeed shutdown device.
  - 11. Coolant high-temperature shutdown device.
  - 12. Coolant low-level shutdown device.
  - 13. Oil low-pressure shutdown device.
  - 14. Retain two subparagraphs below on most projects.
  - 15. Fuel tank derangement alarm.
  - 16. Fuel tank high-level shutdown of fuel supply alarm.
- D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
- E. Remote Emergency Stop Pushbutton: Flush; wall mounted, unless otherwise indicated; and labeled. Pushbutton shall be red mushroom type, maintained contact (pull to reset), fully guarded.

## 2.011 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.
  - 1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
  - 2. Trip Settings: Matched to generator thermal damage curve as closely as possible.
  - 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
  - 4. Mounting: Adjacent to generator terminal box or integrated with control and monitoring panel.

## 2.012 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1 and specified performance requirements.
- B. Drive Coupling: Generator shaft shall be connected to engine flywheel by means of a flexible steel coupling. Exciter shall be mounted on the generator rotor.
- C. Windings: 2/3 winding pitch stator with one slot skew to eliminate slot harmonics, and fully linked amortisseur winding.
- D. Subtransient Reactance: 10%, maximum.
- E. Generator Insulation: Class F, operated at Class F temperature rise.
- F. Excitation: Brushless rotating exciter. Sustain generator output performance under short-circuit conditions as specified.
- G. Exciter DC power supply: permanent magnet DC generator in-line coupled to generator shaft.
- H. Stator-Winding Leads: For multiple voltage units, bring out both ends to terminal box to permit future reconnection for other voltages. Generator leads shall be terminated at insulated copper busbars with NEMA standard drilling for units rated over 300 amps.
- I. Overspeed: Generator construction shall prevent mechanical, electrical, and thermal damage up to 125 percent of base speed.
- J. Enclosure: Open drip-proof, fully guarded, with stainless steel insect screens.
- K. Instrument Transformers: Mounted within generator enclosure.
- L. Voltage Regulator: Solid-state type, three phase true RMS voltage sensing, providing specified performance.
  - 1. Adjusting rheostat (or potentiometer) on engine generator set control panel shall provide plus or minus 5 percent adjustment of output voltage operating band.

## 2.013 FINISHES

- A. Indoor Enclosure and Components: Manufacturer's standard enamel over corrosion-resistant pretreatment and compatible standard primer.

## 2.014 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
  - 1. Tests: Comply with NFPA 110, Level 1 energy converters in Paragraphs 3.2.1, 3.2.1.1, and 3.2.1.2.
  - 2. Generator Tests: Comply with IEEE 115.
  - 3. Components and Accessories: Items furnished with installed unit that are not identical to those on tested prototype shall have been factory tested to

demonstrate compatibility and reliability.

- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
1. Full load run.
  2. Maximum power.
  3. Voltage regulation.
  4. Transient and steady-state governing.
  5. Single-step load pickup.
  6. Safety shutdown.
- C. Report factory test results within 10 days of completion of test.

#### 2.015 SPARE PARTS AND SPECIAL TOOLS

- A. Furnish extra materials described below 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 not less than six of each.
  2. Indicator Lamps: Not less than ten of each type.
  3. Filters: Two sets each of lubricating oil, fuel, and combustion-air filters.

#### 2.016 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of generator sets and associated auxiliary components that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION PREREQUISITES

- A. Floor, wall, and ceiling finishes shall be substantially complete, and area shall be "broom clean", prior to commencing installation of the generator sets.
- B. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting generator set performance.
- C. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before generator set installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 CONCRETE BASES

- A. Coordinate dimensional requirements for concrete bases, inserts, and stub-ups with

generator set manufacturer.

- B. Concrete base is specified in Division 03 Section "Cast-in-Place Concrete"

### 3.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle generator sets and accessories in accordance with manufacturer's instructions.

### 3.04 INSTALLATION

- A. Comply with generator set manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Vibration Isolation: Mount generator sets on vibration isolation equipment base as specified in part 1.08 E.5.
- C. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- D. Install exhaust-system piping. Extend to point of termination 2'-0" above the roof within 10'-0" of pipe. Size piping according to manufacturer's written instructions.
  - 1. Provide vertical discharge of exhaust pipe with rain cap.
- E. Electrical Wiring: Install and wire electrical devices furnished by equipment manufacturers but not specified to be factory wired.

### 3.05 CONNECTIONS

- A. Install fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.
- B. Connect exhaust-system piping to engines.
- C. Ground equipment according to Division 26 Section "Grounding".
- D. Connect wiring according to Division 26 Section "Wire and Cable".
- E. 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 and UL 486B.

### 3.06 MANUFACTURER'S FIELD SERVICES

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in acceptance testing. Report results in writing.
- B. Engage a factory-authorized service representative to perform startup service.

### 3.07 ACCEPTANCE TESTING

- A. Perform the following field tests and inspections and prepare test reports:
1. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specifications INSPECTION AND TEST PROCEDURES 7.15.2 and 7.22.1 (except for vibration baseline test). Certify compliance with test parameters.
  2. Perform tests recommended by manufacturer.
  3. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, the following:
    - a. Single-step full-load pickup test.
  4. Battery Tests: Equalize charging of battery cells according to 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.
  5. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
  6. 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.
  7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
  8. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
- B. Coordinate tests with tests for transfer switches and run them concurrently.
- C. Test instruments shall have been calibrated within the last 12 months, traceable to standards of the National Institute for Standards and Technology, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- D. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- E. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- F. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- G. Remove and replace malfunctioning units and retest as specified above.

- H. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- I. 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.

### 3.08 STARTUP SERVICE

- A. Follow the instructions of the factory-authorized service representative during startup.
- B. Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
- C. Complete installation and startup checks according to manufacturer's written instructions.

### 3.09 DEMONSTRATION AND TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain generator sets.
  - 1. Coordinate this training with training for automatic transfer switches and automatic transfer switchgear.

End of Section

## SECTION 26 50 00

### LIGHTING

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Provide luminaires with lamps, ballasts, poles, hangers, options, and accessories required for a complete lighting system installation, as shown on the Drawings and specified herein.

##### 1.02 RELATED WORK

- A. Refer to Division 26 Section "Raceways, Boxes, and Fittings" for conduit, box, and fitting requirements.
- B. Refer to Division 26 Section "Wire and Cable" for wiring requirements.
- C. Refer to Division 26 Section "Grounding" for grounding requirements.
- D. Refer to Division 26 Section "Panelboards" for panelboard requirements.
- E. Refer to Division 03 for concrete and reinforcing steel requirements for pole base construction.

##### 1.03 REFERENCES

- A. Materials and installation shall be in accordance with latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
  - 1. American National Standard Institute (ANSI)
  - 2. National Electric Code (NEC)
  - 3. National Electrical Manufacturers Association (NEMA)
  - 4. Underwriters Laboratories, Inc. (UL)
  - 5. Consortium for Energy Efficiency (CEE)

##### 1.04 DEFINITIONS

- A. **IES:** Illuminating Engineering Society
- B. **IES file:** The photometry IES file of a light fixture describes the way it distributes its light into space.
- C. **CRI:** Color Rendering Index (sometimes called *color rendition index*), is a quantitative measure of the ability of a [light source](#) to reproduce the [colors](#) of various objects in comparison with an ideal or natural light source
- D. **NRTL:** Nationally Recognized Testing Laboratory

## 1.05 SUBMITTALS

- A. Conform to the General Provisions.
- B. Compliance Statement: With each submittal, include a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed non-conformities. Provide short description of minor non-conformities, and detailed explanation of other non-conformities.
- C. Product Data: manufacturers' catalog data sheets for luminaires, lamps, ballasts, hangers, poles, controls, and accessories, with sufficient information to demonstrate conformance to specified requirements. Include photometric data for each fixture type.
- D. Isofootcandle Layout Drawings: submit computer-generated isofootcandle layout drawings for the following:
  - 1. Outdoor area lighting
- E. Samples: submit upon Owner's request.
- F. Manufacturer Instructions: for installation, operation, and maintenance.
- G. Closeout Submittals
  - 1. Operation and Maintenance Data
  - 2. Warranty Documentation

## 1.06 QUALITY ASSURANCE

- A. Qualifications of Manufacturer
  - 1. Manufacturer's Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Owner.
  - 2. T8 lamps and ballasts must be pre-qualified on the most recent product listing of the Consortium for Energy Efficiency (CEE).

## 1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver luminaires in original sealed factory cartons.
- B. Store luminaires in clean dry indoor rooms with a temporary dehumidifier and electric heating to maintain the storeroom between 5 and 40 deg. C with humidity less than 90%. Comply with manufacturer's additional written instructions for storing and periodic inspection and testing.
- C. Handle luminaires according to manufacturer's written instructions.

## 1.08 WARRANTY

- A. Provide parts and labor warranty in accordance with the General Provisions.

## PART 2 - PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers and catalog numbers are shown on the Drawings to establish a basis of design, and to establish the quality of materials of construction. Equivalent luminaires using the equal materials for housings, housing finishes, lenses, reflectors, refractors, gaskets, and latches, and with equivalent high efficiency, low glare, and photometrics, may be submitted, and shall be acceptable if approved by the Owner.
- B. Alternate submissions must include on a CD the manufacture's electronic IES file for the specific fixture and lamp alternate to be considered

### 2.02 LUMINAIRES

- A. Provide luminaires and accessories as shown on the Drawings.
- B. Luminaires shall be NRTL-listed and labeled.
- C. Adjustable luminaires shall be capable of being locked in position.
- D. Unpainted fixture parts shall be corrosion-resistant. Damp location, wet location, and hazardous (classified) location metallic fixture parts shall be anodized or high-purity aluminum, stainless steel, or equivalent corrosion-resistant materials.
- E. Recessed luminaires shall be designed to fit the make and type of ceiling to be installed, and shall include plaster frames where installed in plaster ceilings, mounting yokes where required for support from ceiling construction, and independent supports from ceiling grid.
- F. Outdoor wall-packs shall be full cutoff type.
- G. LED luminaires shall be tested following IES LM-79 and IES LM-80. Proof of testing and results shall be provided to the Owner on request..

### 2.03 BALLASTS

- A. Provide lighting ballasts as shown on the Drawings. Ballasts shall be "A" sound rated and NRTL listed and labeled, and shall be as recommended by the lamp manufacturer for optimum light output, lamp life, and energy efficiency.
- B. Provide low-temperature ballasts with minimum starting temperature of 0 deg. F. for all luminaires to be mounted outdoors and in low temperature areas (for example, garages and walk-in refrigerated areas). Interior ballasts shall be capable of starting at 50 deg. F.
- C. T8 and reduced wattage T8 ballasts shall be pre-qualified by the Consortium for Energy Efficiency (CEE). Ballast factor shall be as shown on the Drawings.
- D. Compact Fluorescent Electronic Ballasts: Rapid-start, solid-state, full-light-output, energy-saving type compatible with energy-saving lamps specified.

1. Conform to FCC Regulations Part 15, Subpart J. for electromagnetic interference.
  2. Conform to IEEE C62.41, "Guide for Surge Voltages in Low-Voltage AC Power Circuits," Category A, for resistance to voltage surges for normal and common modes.
  3. Minimum Power Factor: 90 percent.
  4. Total harmonic distortion: Less than 10%.
- E. Metal Halide Ballasts (except 250 watts, 277 volts, below): Energy-Saving constant wattage magnetic ballasts, 90% power factor (minimum), constant wattage autotransformer, full-light-output type, compatible with lamps indicated.
- F. Metal Halide Ballasts (250 watts, 277 volts): Energy-Saving pulse-start linear reactor type with integral igniter, full-light-output type, compatible with lamps indicated.
- G. Ballasts shall be as manufactured by Advance, GE, Magnetek, or equal.

#### 2.04 LAMPS

- A. Provide lamps as shown on the Drawings.
- B. Fluorescent lamps shall be 3200-3500K color temperature, CRI >79.
- C. Compact fluorescent lamps shall be 3000-3200K color temperature, instant-on type, with wattages as shown on the Drawings.
- D. Metal halide lamps shall be coated, ceramic, pulse-start type.
- E. Replace all lamps broken or missing at the time of Substantial Completion.

#### 2.05 LIGHT POLE

- A. Light poles shall be square cross-section, anodized aluminum, dark bronze color, and shall be furnished with stainless steel anchor bolts, washers, and nuts for installation in concrete pole bases, and shall be as shown on the Drawings.
- B. Provide handhole with gasketed screw cover with stainless steel tamper-resistant screws at base of pole for access to cables and ballasts.
- C. Poles and anchor bolts shall be rated for 110-mph (minimum) wind loading with the installed luminaires indicated on the Drawings.

#### 2.06 PROGRAMMABLE OUTDOOR LIGHTING CONTROLLERS

- A. Outdoor lighting controllers shall be microprocessor-based programmable type, with photocell input and timer controls for two channels, NEMA 1 enclosure, TORK DGLC Series, or approved equal.
- B. Lighting Contactors shall be electrically-held type, 30 amp 3-pole 600 volt, with 120 VAC coil, in NEMA 1 enclosure with HAND-OFF-AUTO selector switch.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine areas and conditions for compliance with manufacturer's installation recommendations and requirements.
- B. Examine walls, floors, roofs, and concrete bases for suitable conditions for installation, for example, all overhead and ceiling work of other trades is complete.
- C. Verify that ground connections are in place and that installation of equipment grounding conductors described in Division 26 Section "Grounding and Bonding for Electrical Systems" is complete.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. All lighting equipment shall have enclosures, hangers and supports, fittings and outlet boxes suitable for the location as specified in Division 26 Section "Electrical".
- B. Lighting fixture locations shown on the Drawings are approximate. Exact locations shall be coordinated with piping, ductwork, and structural components to avoid interferences with HVAC ducts and equipment, plumbing systems, process piping, roof drains, and other interferences.
- C. Mounting height for luminaires shall be as shown on the Drawings. Where no mounting height is shown, luminaires shall be mounted to give the minimum of shading from pipes, ducts, beams and other obstructions.
- D. Pendant type luminaires shall be suspended by means of conduit stems and ball hangers from outlet boxes in non-hazardous areas, and shall be mounted with 12 inch minimum length explosion-proof couplings in Hazardous (Classified) Locations. Threaded connections shall be locked with set screws or equivalent methods. Verify field conditions for mechanical and structural interferences prior to locating outlet boxes for pendant mounted luminaires..
- E. Reflectors, reflector cones and visible trim of all luminaires shall not be installed until completion of plastering, ceiling tile work, painting and general cleanup. Handle carefully handled to avoid scratching.
- F. Provide nighttime adjustment of all adjustable lighting units and floodlighting, etc. as required to satisfaction of Owner.
- G. Where luminaires are installed in suspended ceiling, each fixture shall be anchored securely to grid system by means of caddy clips or T-Bar hangers manufactured by Tomic Electric or equal.
- H. Wiring for Exit Lighting and Emergency Lighting circuits shall be installed in separate raceway systems in accordance with the NEC.

- I. Lighting circuits for battery-powered emergency lights and exit lights shall be connected to the unswitched room lighting circuit conductors in accordance with the NEC.
- J. Concrete pole bases shall be installed as shown on the Drawings. Refer to Division 03 for cast-in-place concrete and reinforcing steel requirements. Align poles plumb and grout pole bases on the day of pole installation.
- K. Three-lamp fluorescent fixture 1-lamp and 2-lamp ballasts shall be separately switched for 3-level lighting where indicated on the Drawings
- L. Fluorescent luminaires with double-ended lamps shall have a disconnect means either internal or external to each luminaire.

### 3.03 FIELD QUALITY CONTROL

- A. Prepare for lighting fixture circuit energization as follows:
  - 1. Test continuity and insulation resistance for each power supply circuit.
  - 2. After installing equipment but before power supply is energized, verify that grounding system is completed.
  - 3. Verify that equipment is installed and connected according to the Contract Documents
  - 4. Luminaires and rooms with occupancy sensors will be tested and commissioned immediately after the space is fully occupied. Commissioning procedure will be submitted by the contractor and approved by the Owner.

### 3.04 CLEANING

- A. On completion of installation, inspect interior and exterior of luminaires. Remove dust, dirt, paint splatters and other spots from exterior and wipe down with damp cotton cloth. Touch up exposed surfaces to match original finish. Vacuum interior surfaces “white glove clean”, removing all dirt and debris while taking care to protect static-sensitive and fragile parts from damage. Do not use compressed air to assist in cleaning.

### 3.05 PROTECTION

- A. Luminaires shall be left in clean, operational condition, free of dirt and cosmetic defects.
- B. Protect installed equipment from damage through Substantial Completion.

### 3.06 FOLLOW-UP SERVICE

- A. Monitoring and Adjusting: Approximately 6 months after Substantial Completion, and prior to Contract Closeout, perform the following monitoring and adjusting tasks:
  - 1. Inspect installed luminaires for non-functioning lamps.
  - 2. Inspect correct operation of photocell and timer controls.
  - 3. Test emergency luminaires for proper performance by de-energizing room lighting systems for 90 minutes.
  - 4. Corrective Action: If test results are unacceptable, determine the cause of failure and repair luminaires to fully functional operation.
  - 5. Retests: Repeat monitoring, after corrective action has been performed, until satisfactory results are obtained.

6. Report: Prepare a written report covering monitoring performed and corrective action taken.

End of Section

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SECTION 33 32 16.21

SUBMERSIBLE PUMP STATION

PART 1 GENERAL

1.01 REFERENCES

A. 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.

1. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)  
  
AASHTO M198 (1994) Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
2. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)  
  
ASME B1.20.1 (1983) Pipe Threads, General Purpose (Inch)  
  
ASME/ANSI B16.1 (1989) Cast Iron Pipe Flanges and Flanged Fittings
3. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)  
  
ANSI B16.3 (1992) Malleable Iron Threaded Fittings Classes 150 and 300  
  
ANSI B16.11 (1996) Forged Steel Fittings, Socket Welded and Threaded  
  
ANSI B31.1 (1996) Process Piping  
  
ANSI/AWWA C151/A21.51 (1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
4. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)  
  
ASTM A 53 (1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless  
  
ASTM A 48 (1994; ae1) Standard Specification for Gray Iron Castings  
  
ASTM A 123/A 123M (1997; Rev. A) Zinc (Hot-Galvanized) Coatings on Products  
  
ASTM A 153/A 153M (2000) Standard Specification for Zinc Coating (Hot-Dip) on Iron Steel Hardware

ASTM A 536	(1984; R 1993) Ductile Iron Castings
ASTM A 615/A 615M	(1996; Rev. A) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 443	(1994) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 478	(1997) Pre-cast Reinforced Concrete Manhole Sections
ASTM C 923	(2000) Standard for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM D 1784	(1996) Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(1996; Rev. B) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(1996; Rev.B)1980 Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR)
ASTM D 2464	(1996; Rev. A) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1997) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(1997; Rev. A) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 3139	(1996; Rev. A) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM F 477	(1996; Rev. A) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
5.	AMERICAN WATER WORKS ASSOCIATION (AWWA)
AWWA C104/A21.4	(1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(1993) Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. (75 mm

- |                  |  |
|------------------|--|
|                  | Through 1200 mm), for Water and Other Liquids                                    |
| AWWA C111/A21.11 | (1995) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings          |
| AWWA C115/A21.15 | (1994) Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges |
| AWWA C500        | (1993) Metal-Seated Gate Valves for Water and Systems                            |
| AWWA C509        | (1994) Resilient-Seated Gate Valves for Water and Sewerage Systems               |
| AWWA C600        | (1993) Installation of Ductile-Iron Water Mains and Their Appurtenances          |
| AWWA M23         | (1980) PVC Pipe - Design and Installation  |
| 6.               | AMERICAN WELDING SOCIETY (AWS)   |
|                  | AWS D.1.2 (1997) Structural Welding Code - Aluminum                              |
| 7.               | AMERICAN INSTITUTE OF STEEL INDUSTRIES (AISI)                                    |
| 8.               | NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)                                      |
|                  | NFPA 70 National Electric Code   |
| 9.               | NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)                             |
|                  | NEMA MG 1 (1993) Motors and Generators   |

## 1.02 DESCRIPTION OF WORK

The work includes construction of one duplex submersible sewage lift station and related work provided complete and ready for operation. The pumping station system including equipment, materials, installation, workmanship, and testing shall be as specified herein.

### A. Related work specified elsewhere includes:

1. Section 200 – Products and Materials
2. Section 303 – Earthwork
3. Section 309 – Aggregate Base Course
4. Section 802 – Sanitary Gravity Sewer Systems
5. Section 803 – Sanitary Force Main Systems

### 1.03 RELATED WORK

- A. Refer to Section 40 95 00 for Pump Station Control Panel and accessory requirements.

### 1.04 SUBMITTALS

Submit the following in accordance with Section 105 - Control of Work. All shop drawing submissions and resubmissions required for the pump station and controls shall be submitted in one complete package.

#### A. Product Data

##### 1. Pipe and Fittings

Manufacturers catalog data and installation instructions for pipe and fittings. Manufacturer's certification attesting that the pipe, fittings, gaskets and appurtenances meet or exceed the specified requirements.

##### 2. Check and Gate Valves

Manufacturers catalog data, shop drawing and installation instructions for gate and check valves. Manufacturer's certification attesting that the valves meet or exceed the specified requirements.

##### 3. Submersible Sewage Pumps and Motors

Manufacturers catalog data, shop drawings and installation instructions for pumps and motors including:

- a. Pump performance curves
- b. Dimensioned pump outline drawing, including exploded views of detail areas
- c. Dimensioned station drawing of accessories
- d. Motor electrical nameplate data, including operating voltage, phase, frequency, full load current, and NEMA Code letter.
- e. Control drawing and data
- f. Detailed installation instructions
- g. Technical manuals
- h. Parts list with materials of construction identified
- i. Manufacturer's warranty
- j. Manufacturer's equipment storage recommendations
- k. Manufacturer's recommended start-up procedures, testing and report forms.

Pump characteristic curves shall include capacity in gpm, net positive suction head (NPSH), head, shut-off head, efficiency, and pumping horsepower from 0 gpm to 110 percent of design capacity. The contractor shall submit a manufacturer's factory certified pump curve for each unit to be installed or maintained as a spare part to the Owner for approval prior to shipment. The certified pump curve shall include a certified quality assurance record

confirming successful completion of the required factory testing and compliance with these specifications.

4. Submersible Pump Installation and Retrieval System

Manufacturer's catalog data, dimensioned drawings, installation instruction, and operating and maintenance instructions for pump installation and retrieval system including quick disconnect system, guide bars, base, and guide bar brackets.

5. Wet Well and Valve Vault

Manufacturer's catalog data, dimensioned drawings, and installation instructions for pre-cast riser sections, gaskets, pipe connections, wall penetration seal system, wet well access hatch cover, and valve vault access hatch cover, wet well fiberglass basin insert, coating systems (interior and exterior), and manufacturer's certification of wetwell coatings Applicator(s).

6. Spare Parts

Spare parts data for each different item of material and equipment specified, after approval of the related submittals, and not later than 1 month prior to acceptance by the Owner. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

B. Drawings

Drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

C. Posting Instructions

Sewage pump system diagrams, instructions, and other sheets proposed for posting.

D. Reports

A detailed testing protocol at least 30 days prior to scheduled pumping system operational testing. The protocol shall describe all tests to be conducted and the inter-relationships thereof.

A detailed field testing and equipment adjustment report within 30 days of completion of successful operational testing and prior to acceptance by the Owner. Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of all control functions.

E. Operation and Maintenance Manuals

Submit three (3) copies of complete and comprehensive Operation and Maintenance Manuals for each pumping station in accordance with Section 105. The manuals shall address all operating systems requiring operation and maintenance manuals including sewage pumps, conveying systems, pump and level controls, emergency power system, telemetry, and similar. The manuals shall detail the step-by-step procedures required for system start-up, operation, and shutdown; operations of alarm functions; control settings; trouble-shooting; and, maintenance. Operation and maintenance manuals shall include the manufacturer's name, model and manufacture number, parts list, and brief description of all equipment and their basic operating features. The manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

1. During the course of the Work and within 6 weeks after approval of Shop Drawings, the Contractor shall collect and assemble three (3) copies each of the guarantees, manufacturers' specification sheets and/or working drawings, maintenance and operation instructions, parts lists including exploded views, recommended safety procedures, and recommended list of spare parts. The submittal shall be a complete set of all required operation and maintenance manuals as for the pumping and ancillary equipment. Submit all copies with an itemized listing to the Owner. Manuals must be approved prior to the field-training course.
2. The Operation and Maintenance manuals shall be assigned a value of 25% of the equipment cost and this assigned amount will be retained from progress payments until the manuals are submitted to and approved by the Owner.
3. Furnish Operation and Maintenance manuals on 8-1/2" x 11" sheets or booklets, loose bound in 3-ring binders with front and back page lifters, with binder contents indicated on the front and spine of the binder cover. All loose sheets shall be in vinyl page protectors with reinforced binding edge. Furnish drawings included in the manuals on 11" x 17" sheets, laminated and folded to 8-1/2" x 11", or folded and placed in vinyl "envelope pockets" incorporated into the binder. All materials in manuals shall be original print quality manufacturer's literature. Photostatic copies of printed quality manufacturer's literature is not acceptable. Provide an index of the contents of each manual or a master index for a system consisting of several manuals. Indexed sections shall include Installation, Start-up, Operation, Troubleshooting, Maintenance, Parts List, Recommended Spare Parts and Miscellaneous Components.
4. Include a detailed description of function of each principal component, procedures for starting, operation, overhaul and maintenance. Include safety precautions, test procedures and a catalog cross-reference to commercially available parts.
5. Submit a Preventative Maintenance and Lubrication Schedule for the equipment furnished which specifically explains the duties to be fulfilled by

the Owner during the guarantee period. List the Manufacturer's recommended lubricant(s) plus two equal substitutes for all equipment.

6. Contractor to supply one electronic copy of the PLC program on compact disk.

F. Record Drawings

One "As-Built" set of Contractor Drawings shall be kept at the job site and updated daily by the Contractor. The marked-up as-built drawings shall be transmitted to the Engineer for production of the Record Drawings after Substantial Completion of the work. One full sized set of Contract Drawings shall be marked to reflect all deviations, changes, and modifications. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Owner prior to the submission of each monthly pay estimate.

G. Warranty – Submersible Sewage Pumping System

The pump manufacturer shall warrant the pump units and motors being provided to the Owner against defects in workmanship and materials for a period of five (5) years or 10,000 hours under normal use, operation, and service. The warranty shall be in printed form and shall apply to all units.

The pump manufacturer shall warrant all other pumping system components provided to the Owner against defects in workmanship and materials for a period of eighteen months under normal use, operation, and service. The warranty shall be in printed form and shall apply to all units.

H. Warranty – Access Hatches

The valve vault access hatch manufacturer shall warrant the pre-assembled unit provided to the Owner against defects in workmanship and materials for a period of twenty-five (25) years. The warranty shall be in printed form and shall apply to all units provided.

The wet well access hatch manufacturer shall warrant the pre-assembled units provided to the Owner against defects in workmanship and materials for a period of twenty-five (25) years. The warranty shall be in printed form and shall apply to all units provided.

1.05 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

A. Delivery and Storage

1. General

Contractor shall inspect materials delivered to site for damage and shall unload and store with minimum handling. Store materials in enclosures or under protective covering. Store rubber gaskets not to be installed immediately under cover and out of direct sunlight. Do not store materials

directly on the ground. Keep interior of pipes and fittings free of dirt and debris during handling and storage. Store all materials off the ground.

## 2. Pumps

Pumps shall be protected against corrosion with factory-applied protective measures to ensure corrosion inhibition for the period between shipment and installation. All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants. All machined surfaces shall be slushed with heavy, non-corrosive oil, and all bearings shall be lubricated. If the pumps are to be stored for more than 90 days, the interior of the pump shall be filled with a high-grade non-corrosive oil, and all bearings shall be lubricated. The Contractor shall inspect the stored pumps weekly, manually rotate or slide all moving parts, and renew the slush oil as necessary. Before the pumps are put into operation, they shall be cleaned. Failure to maintain the pumps in like-new condition during storage and installation will be cause for rejection of the pumps.

### B. Handling

Handle all materials and equipment with care to ensure delivery in undamaged condition. Handle pipe, fittings, valves, and other accessories in such a manner as to ensure delivery to the installation in sound, undamaged condition. Avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry pipe to the installation; do not drag it.

## PART 2 PRODUCTS

### 2.01 GENERAL

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 5 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Owner, convenient to the site.

### 2.02 PIPE AND FITTINGS

Provide gravity sewer and pressure piping, all appurtenances, and related accessories for force main piping outside the sewage wet well and valve vault in accordance with Section 802, "Gravity Sewer Systems" and Section 803, "Sanitary Sewer Force Main Systems", unless otherwise specified.

### 2.03 VALVES AND OTHER PIPING ACCESSORIES

#### A. Gate Valves

Gate valves shall be resilient seated conforming to AWWA C509 featuring cast iron wedge completely encapsulated with permanently bonded resilient material, outside-screw-and-yoke, non-rising bronze or stainless steel stem, o-ring seals and flanged ends. Flanges shall be the 125 pound type complying with ASME B16.1. Provide

valves with handwheels that open by counterclockwise rotation of the valve stem. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair. Interior ferrous surfaces shall be epoxy coated in accordance with AWWA C550. The coating shall not contain lead, coal tar resins, lampblack, carbon black or bituminous material. The exterior surfaces shall receive a factory applied fusion bonded epoxy coating. Valves shall be of one manufacturer. Acceptable manufacturers include AFC, M&H Valve Company, or Mueller Company. All buried valves shall have stainless steel hardware.

B. Check Valves in Valve Vault

Check valves shall permit free flow of sewage forward and provide a positive check against backflow. Check valves shall be designed for a minimum working pressure of 150 psi or as indicated. Swing check valves shall comply with AWWA C 508 and shall be iron body, bronze mounted, and shall have flanged ends. Flanges shall be the 125 pound type complying with ASME B16.1. Valves shall be outside lever and weight with bronze seat and packing glands conforming to the applicable requirements of AWWA C 508. Interior ferrous surfaces shall be epoxy coated in accordance with AWWA C550. The coating shall not contain lead, coal tar resins, lampblack, carbon black or bituminous material. The exterior surfaces shall receive a factory applied fusion bonded epoxy coating. Valves shall be of the same manufacturer as the gate valves. Provide external rotating shaft and mounting bracket for mounting discharge check valve limit switches. Check valve limit switches shall have 10 amp single pole double throw contacts rated 120 VAC and 12 VDC, in NEMA 4X watertight and NEMA 7 explosion proof enclosure. Acceptable check valve manufacturers include AFC, M&H Valve Company or Mueller Company.

C. Pressure Gauges

Discharge pressure shall be continuously monitored with corrosion resistant diaphragm seal pressure gauges installed on the force main in the valve vault as shown on the plans. The seal pressure gauge shall be Red Valve Series 742 featuring 316 stainless steel construction, a Buna sleeve diaphragm, 1/2-inch NPT connections, and liquid filled gauge measuring in increments of two psi with a range of 0 to 60 psi. The device shall be equipped with an isolation ball valve.

D. Identification Tags and Plates

The manufacturer's name, initials, or trademark and also the size of the valve, working pressure, and direction of flow shall be directly cast on the body or bonnet of all valves sizes 3" and greater.

E. Pipe Support

Pipe shall be self-supported or as shown on the drawings. All pipe support metals shall be stainless steel. Dissimilar metals shall be gasketed with neoprene gasket material.

F. Miscellaneous Metals

Bolts, nuts, washers, anchors, and supports necessary for the installation of equipment shall be 316 stainless steel. Dissimilar metals shall be gasketed with neoprene gasket material.

G. Wet Well Vent

AWWA C115/A21.15, Class 54, flanged ductile iron pipe with No. 4 Mesh 304 stainless steel insect screening with 65% minimum open area.

H. Valve Vault Drain

ASTM D-1785 Schedule 80 solvent welded PVC.

I. Valve Vault Drain Check Valve

Check valve to be 2" Tideflex Model TF-1 slip on type with 316 SS clamp, neoprene rubber construction, and water and vapor tight.

J. Fiberglass Basin Wet Well Insert

Flygt Top Fiberglass Basin, model 150 or equal, including basin and all fittings and appurtenances which are part of or required for installation of the submersible pumps in the fiberglass basin.

2.04 SUBMERSIBLE PUMP SYSTEM

- A. Provide pumps of the vertical, centrifugal, heavy duty, non-clog, close-coupled, submersible type driven by an electric motor. Submersible pumping units shall be Factory Mutual certified for operation in Class I, Division 1, Group D hazardous areas. Design the pumping units to pump raw wastewater. Arrange the pumping equipment in the spaces shown on the Contract Drawings and in accordance with approved shop drawings.
- B. Provide pumps to operate at the capacities and heads and over the range of operating conditions specified without overloading, cavitation, undue noise or vibration. Pumps shall be capable of full reverse rotational speed with no damage occurring to the motor or pump. Furnish the pumps in accordance with the following requirements:

Parameters	Requirements
Model Number	CP3127.181, Type HT
Curve No.	63-481-00-3702
Design Capacity (gpm)	103
Design TDH (ft)	94
Rated Hp	10
RPM	1735
Pump efficiency at design point (percent minimum)	31

BEP (percent minimum)	70
Shutoff head (ft)	104
Discharge Dia. (in)	4
2 <sup>nd</sup> Point on Pump Curve	200 gpm @ 86' TDH
3 <sup>rd</sup> Point on Pump Curve	300 gpm @ 78' TDH

- C. Design each pump to have a continuously rising characteristic curve from the rating point to shutoff which passes through the rating point, and which meets or exceeds the specified heads and capacities, all within the Hydraulic Institute tolerances.
- D. Furnish pumping units that do not exceed 0.35 inches per second peak velocity filtered vibration when operating over the range of specified conditions
- E. General Construction
1. Provide stainless steel fasteners, bolts, nuts and washers where exposed to the pumped liquid or its atmosphere.
  2. Provide machined metal-to-metal joints on component parts that are assembled together. Fit with an "O" ring seal where watertight joints are required. Do not use flat gaskets or sealing compounds to obtain watertight joints. Furnish machined rabbet fits on component joints as required to provide automatic alignment of rotating parts.
  3. Provide eye bolts or lugs for lifting and handling the equipment.
  4. Provide flanged discharge connections with drilling and dimensions meeting the requirements of ANSIB16.1, Class 125.
  5. Provide each pump with a corrosion resistant metal name plates that indicate the pump's serial and model numbers, rated capacity, head, and speed.
  6. Provide each motor with a corrosion-resistant nameplate indicating motor horsepower, voltage, phases, frequency, full load amps, inrush current, sine wave service factor, and inverter duty service factor.
- F. Casing
1. Provide pump casing of the centrifugal single volute with integral suction and discharge nozzle arranged for centerline discharge. Do not use diffusion vanes. Furnish smooth water passages that are able to withstand the abrasive action of solids.
  2. Construct pump casing of ASTM A48 cast iron, Class 35B.
  3. Construct renewable wear rings of stainless steel.
- G. Impeller
1. Design impeller of the enclosed nonclog type. Provide pump-out vanes or a back ring, arranged with minimum clearances so as to preclude solids and

stringy material from damaging the mechanical seal, on the back of the impeller.

2. Construct the impeller of ASTM A48 cast iron, Class 35B.
3. Provide impellers that are statically and dynamically balanced.
4. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impellers shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

H. Oil Chamber.

1. Provide an oil chamber to function as a buffer between the pumped liquid in the casing and the motor. Arrange the oil chamber to accommodate thermal expansion of the oil. Furnish an oil chamber drain plug that is accessible from outside the pump unit and permits changing oil without dismantling pump components.
2. Construct the oil chamber of the same material as the pump casing. . Provide the oil chamber with a moisture sensor to initiate an alarm upon contamination of the oil by the pumped liquid.

I. Mechanical Seal

Provide each pump with double or tandem mechanical seals. Design the upper seal unit, between the oil chamber and motor housing, with one stationary tungsten-carbide ring and one positively driven rotating tungsten-carbide ring. Provide the lower seal unit, between the pump casing and oil chamber, with one stationary ring and one positively driven rotating ring. Furnish rings made of tungsten-carbide. Use stainless steel for metal parts. Protect the spring element of the lower seal from solids contained in the pumped liquid. Do not rely upon the pumped liquid for lubrication. No seal damage is to result from operating the pumping unit dry. Seals must be capable of rotation in either Direction without damage.

J. Motor

1. Provide inverter duty rated submersible pump motor for operation at 230-volt or 460-volt, 3-phase, 60-Hertz (ITT Flygt Model # 21-12-4AL). Motor voltage shall match the output voltage from the VFC. Motors shall be designed for continuous duty, submerged or unsubmerged. Motors shall be FM approved explosion proof design.
2. Ratings:
  - a. Horsepower: 10
  - b. NEMA Design B
  - c. NEMA Code J
  - d. Maximum rated full load current: 25 amperes
  - e. Starting current: 128 amperes
  - f. Minimum rated power factor at full load 0.89
  - g. Minimum rated efficiency at 100% load 83.5

3. Design the motor to have suitable output torque and speed characteristic to start and operate the pump over the range of specified conditions without exceeding the nameplate rating. Base the nameplate horsepower rating on an 80 degrees C temperature rise above an ambient temperature of 40 degrees C when operating with the VFC.
4. Motor shall have NEMA Class H insulated stator windings. Apply impregnation resin to stator assembly in three dip and bake steps.
5. Provide each motor with winding over-temperature and moisture protection sensors and a motor protection relay similar and equal to Flygt Mini-CAS.
6. Provide the motor with an ASTM A48 cast iron stator housing.
7. Provide the motor cable entry with a mechanical locking ring or compression type cord grip to protect the cable jacket from being pulled out of the motor. Do not use epoxy for this purpose. Arrange the cable entry so as to provide a watertight seal. Isolate the cable entry leads from the internal motor leads to prevent entry of water into the motor chamber by leakage or wicking. Provide cables suitable for submersible pump application and conforming to NEC specifications for cable sizing. Provide sufficient cable to run from the Pump Station Control Panel to the pump.
8. Shaft
  - a. Provide a one piece, fully machined pump and motor shaft. Design the shaft to limit shaft deflection under maximum pumping load to .002 inches at the lower mechanical seal face and to obtain a rotating assembly first critical speed of not less than 150 percent of the rated speed.
  - b. Provide shafts of either carbon steel or stainless steel. Protect carbon steel shafts from exposure to the pumped liquid by employing a stainless steel sleeve or chrome plating.
9. Bearings
  - a. Provide two antifriction bearing assemblies. Design one assembly to carry only radial loads and to be free to float axially within the frame. Design the other assembly to carry both radial and axial loads and to be restrained from axial movement.
  - b. Select bearings in accordance with AFBMA 9 and 11 Load Ratings and Fatigue Life for Ball and Roller Bearings, to have a 100,000 hours minimum L10 bearing life at maximum pumping load that occurs under the specified operating conditions.

K. Pump Motor Protection Relays

1. Provide each pumping unit with a monitoring system to protect critical machine functions during operation.
2. Motor protection relay shall be designed for base-mounting, and shall be shipped to the manufacturer of the Pump Station Control Panel for mounting and wiring.
3. Submersible motor stators shall incorporate three thermal switches in series to monitor the temperature of each phase winding. The thermal switches shall open at 125°C (260°F), stop the motor and activate an alarm.
4. Submersible motors shall be fitted with leakage sensors to detect water in the stator chamber. The Float Leakage Sensor (FLS) is a small float switch used to detect the presence of water in the stator chamber. When actuated, the FLS shall activate an alarm.

L. Mounting Accessories

Provide anchor bolts, nuts, washers, and accessories and other adapter equipment and fittings necessary for mounting the pumping equipment and appurtenances in a fiberglass basin (Flygt Top 150 or equal) installed in the wet well insert. Provide anchor bolts, nuts, washers, accessories and adaptor equipment made of Series 300 stainless steel. For bolts or studs engaging tapped holes in pump components, use silicon bronze or Series 300 stainless steel, as required for strength. Obtain approval from the Owner for details of pump mountings before starting work on any structure for this equipment.

M. Pump Control System

Pump control system shall be in conformance with Section 40 95 00 "Pump Station Control Panel".

2.05 WET WELL AND VALVE VAULT

Wet well and valve vault bases shall be pre-cast as indicated on the drawings with pre-cast riser sections.

A. Pre-Cast Concrete Base Structures

Provide pre-cast monolithic wet well base in accordance with the drawings with a compressive strength of 4000 psi at 28 days, an air entrainment of 6 percent, plus or minus 2 percent and in conformance with ASTM C 478 "Pre-Cast Reinforced Concrete Manhole Sections".

B. Pre-cast Concrete Structures

ASTM C 478 or ASTM C 76, except as specified herein. Provide pre-cast concrete structures with a compressive strength of 4000 psi at 28 days and an air entrainment of 6 percent, plus or minus 2 percent and a minimum wall thickness of 6 inches for 60"

diameter structures and 7 inches for 72" diameter structures. ASTM C 443 rubber o-ring, AASHTO M198 Type B preformed rubber, or butyl gaskets for joint connections.

C. Pipe Openings

The influent gravity sewer pipe connection shall be flexible rubber pipe-to-manhole connections of the locked in factory assembled rubber ring type utilizing a stainless steel band as manufactured by NPC, Inc. (Kor-N-Seal) or Press-Seal Gasket Corporation (PSX Positive Seal), or approved equal. Neoprene shall conform to ASTM C443 and ASTM C923 and all stainless steel elements shall be totally non-magnetic series 304 stainless steel. Both sides of the pipe openings shall be grouted for added rigidity once pipe is placed, fitted and aligned.

All other pipe openings shall be sleeved with steel or HDPE pipe sleeves that are grouted in place. All sleeves shall have waterstops. Annular space between the sleeve and carrier pipe shall be sealed with dual link-seal systems in accordance with the drawings. All grout shall be non-shrink and non-metallic as indicated below.

D. Wet Well Base Support Material

Provide crushed stone as indicated on the drawings and specified in Section 309, No. 57 stone bedding. Crushed stone shall be placed on a layer of geotextile as shown and specified on the drawings.

E. Grout

Grout utilized in the wet well and valve vault shall be 4,000 psi compressive strength non-shrink and non-metallic.

F. Pump

Contractor is to furnish three (3) and install two (2) pumps. Third complete pump assembly is to be provided and delivered to the Owner at 105 Service Drive, Yorktown, VA 23692

2.06 MISCELLANEOUS HARDWARE

All hardware including, but not limited to, anchor bolts, lifting bolts, eye lugs, guide rail hangers, bolts, nuts, and washers shall be AISI 316 stainless steel.

2.07 PUMP HARNESS

Provide a chain sling and grip eye, or approved equal, harness compatible with both the pumps and hoist provided. Each pump shall be equipped with a minimum 4 ft. length of 304 stainless steel lifting chain and the remainder being minimum 3/8" nylon rope. The rope and connection to chain shall have the same strength requirement as the stainless steel chain. Combined chain/rope length shall be of sufficient length to reach from the pumps to the top of the wet well. Consider nylon rope's loss of strength when wet for sizing. The lifting chain shall be sized according to the pump weight and shall be of sufficient strength to support a minimum of five times the combined weight of the pump and motor filled with water. The

chain shall be high tensile strength proof-tested chain of required capacity connected to the pump lifting eye or handle with a 304 stainless steel shackle. Provide appropriate stainless steel fasteners for attaching rope to wet well hatch when not in use. Provide one grip eye for use with the specified pump, lifting chain, and hoist.

## 2.08 SPARE PARTS AND SPECIAL TOOLS

One complete spare pump shall be provided that will operate within the design conditions of the pumping station. One spare impeller, one set of wear rings, one set of upper and lower seals, one set of upper and lower bearings, one set each of replacement seal and bearing gaskets, and one set of special tools, calibration devices, and instruments required for operation, calibration, and maintenance of the equipment shall also be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.

Spare parts shall be properly packaged and labeled for easy identification without opening the packaging and suitably protected for long term storage under humid conditions. Spare parts and tools shall be delivered to the Owner at the time of pump station start-up and training.

## 2.09 SUBMERSIBLE PUMP INSTALLATION AND RETRIEVAL SYSTEM

The pump installation and retrieval system shall feature a quick disconnect system with hydraulic sealing flange and be specifically manufactured for use with the specified pumps. The pumps shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the set well to remove or install the pumps.

The quick disconnect system shall consist of a cast iron base for supporting the pumps, a hydraulic sealing flange, pump guide rails with intermediate support brackets and the discharge pipe supports. The two guide rails shall be corrosion resistant pultruded FRP I-Beams or Type 316 stainless steel, schedule 40 and two inches in diameter in accordance with ASTM A 123/A 123M. The guide rails shall be supported at the base on the pump discharge mount system, at the top with stainless steel upper guide bar brackets and to the discharge piping with stainless steel guide bar brackets. The brackets shall be specifically manufactured for supporting guide rails in submersible sewage pumping stations. Guides shall be built onto the pump housing to fit the guide post in order to assure perfect alignment between the pump and guide rails.

The pump mount system shall include a cast iron base and discharge connection designed to support the weight of the pump and specifically for use with the specified pumps and the fiberglass basin insert. The cast iron base shall be capable of withstanding all stresses imposed upon it by vibration, shock, and direct and eccentric loads. No portion of the pump shall bear directly on the wet well floor.

All bolts, nuts, washers and anchors shall be AISI 304 stainless steel.

## PART 3 EXECUTION

### 3.01 INSTALLATION

Provide and install pump station in accordance with drawings and requirements of the respective equipment manufacturers. Dampen and isolate equipment vibration.

A. Access Hatches

Install wet well and valve vault access hatches in accordance with manufacturer's installation instructions. Route channel drainage with schedule 40 solvent welded PVC pipe to wet well.

B. Equipment Installation

Install equipment in accordance with these specifications and the manufacturer's installation instructions. Grout equipment mounted on concrete foundations before installing piping. Install piping to avoid imposing stress on any equipment. Match flanges accurately before securing bolts.

C. Stilling Well

Coordinate location of level transducer stilling well with level transducer cable bracket.

3.02 TESTS AND INSPECTIONS

Perform Factory, Operational and Acceptance Testing as specified herein. Power and water for testing shall be the responsibility of the Contractor

3.03 ADJUSTMENT

- A. Adjust discharge check valve limit switch to actuate when check valve is slightly open.

3.04 START-UP SERVICE AND TRAINING

A. The contractor shall provide and coordinate the services of a qualified factory trained field service engineer from the pump system manufacturers and control system manufacturer to inspect the installation, assist with operational testing and instruct the Owner's personnel on the operation and maintenance of the applicable equipment. Provide one 8-hour working day of instruction on operation and maintenance of the applicable equipment for the Owner's personnel by qualified factory trained field service personnel. Training shall be scheduled with the Owner at least 10 days prior to such training and conducted after the system is functionally complete but prior to acceptance by the Owner. Instruction shall include operation, starting, stopping, and servicing the equipment including all major elements of the operation and maintenance manuals. The course instructions shall include all routine maintenance operations.

B. After installation of the pumping units, control equipment and all appurtenances, subject each unit to a field running test as specified in Division 1, under actual operating conditions. Perform the field tests in the presence of and as directed by the Owner. Demonstrate that under all conditions of operation each unit:

1. Has not been damaged by transportation or installation.
2. Has been properly installed.

3. Has no mechanical defects.
4. Has been properly connected.
5. Is free of overheating of any parts.
6. Is free of overloading of any parts.
7. Is free of all objectionable vibration.

#### 3.04 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected and demonstrated to be satisfactory to the Owner and applicable regulatory agencies.

End of Section

SECTION 40 95 00

PUMP STATION CONTROL PANEL

PART 1 - GENERAL

1.01 GENERAL

- A. Provide a Pump Station Control Panel with float switches, level transducer, and accessories, for variable speed control of the sewage lift pumps in pump-out mode, as shown on the Drawings and specified herein.
- B. The variable frequency controllers in the Pump Station Control Panel shall provide single phase to three phase conversion of the 240 volt single phase power supply for the 230 volt 3-phase lift pump motors.
- C. Obtain approval for a preliminary harmonics analysis report for the proposed VFCs prior to submittal of shop drawings, and for a final harmonics analysis report with the VFC manufacturer's shop drawings.
- D. The Drawings indicate the extent and the general location and arrangement of equipment. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the equipment shall be properly integrated into the concrete and masonry work.
- E. The Pump Station Control Panel shall be a standard product of a manufacturer regularly engaged in the manufacture of UL 508A listed control panels.

1.02 RELATED WORK

- A. Refer to Division 26 Section "Field Instruments" for level transducers and float switches.
- B. Refer to Division 26 Section "Electrical Control Components" for control panel component requirements.
- C. Electrical enclosure types shall be as specified in Division 26 Section "Electrical - General".

1.03 REFERENCES

- A. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
  - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
  - 2. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches
  - 3. NEMA FU 1 - Low Voltage Cartridge Fuses
  - 4. NEMA ICS 1 - Industrial Control and Systems
  - 5. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors, Overload Relays Rated Not More Than 2,000 Volts AC or 750 DC
  - 6. NEMA ICS 3 - Industrial Control and Systems Factory Built Assemblies

7. NEMA ICS 6 - Industrial Control and Systems Enclosures
8. NEMA MG 1 - Motors and Generators

B. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

1. NFPA 70 - National Electrical Code
1. NFPA 79 - Electrical Standard for Industrial Machinery

C. UNDERWRITERS LABORATORIES (UL)

1. UL 50 - Enclosures for Electrical Equipment
2. UL 83 - Thermoplastic-Insulated Wires and Cables
3. UL 198B - Class H Fuses
4. UL 467 - Grounding and Bonding Equipment
5. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors
6. UL 486E - Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
7. UL 489 Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures
8. UL 508A - Industrial Control Panels

1.04 SUBMITTALS

A. Submit manufacturer's shop drawings with catalog data and installation instructions for the following:

1. Pump Station Control Panel and its associated components, including circuit breakers, switches, relays, fuses, instruments, enclosure, control devices, variable frequency drives, reactors, programmable logic controller, meters, surge protectors, intrinsically safe relays, and uninterruptible power supplies.
2. Wet well level float switches
3. Level transducer
4. Discharge check valve limit switches

B. Shop Drawings

1. Drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the Pump Station Control Panel has been coordinated with the pump motors and VFCs and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.
2. Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams, and other information necessary to define the installation. Detail drawings shall show the rating of items and systems and how the components of an item and system are assembled, function together, and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the

same equipment or system are not acceptable except where prior approval has been obtained from the Owner. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall show physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. Optional items shall be clearly identified as included or excluded. Detail drawings shall as a minimum include:

- a. Control panel outline, exterior and interior panel layouts
- b. Electrical drawings including three-line diagrams, and control schematics in elementary (ladder) diagram format meeting NFPA 79 drawing requirements, including line numbering and relay contact line references adjacent to relay coils; internal wiring and field wiring connection diagrams for each electrical device. Coordinate numbering of ID tags. Field wiring connections shall be clearly identified.

C. As-Built Drawings.

1. Submit "As-Built" drawings showing the Pump Station Control Panel and wiring as installed. The drawings shall include all the information shown on the Contract Drawings, deviations, modifications, and changes from the Contract Drawings and corrected wiring diagrams. Submit the following items with the "As-Built" drawings:
  - a. Electronic copy of PLC program on diskette.
  - b. Three hard copies of PLC program.
  - c. Electronic copies of drawings in AutoCAD (.dwg) or Portable Document File (.pdf) format.

D. Factory Test Reports.

1. Three copies of the information described below in 8 1/2 x 11 inch binders having a minimum of 3 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.
  - a. A list of equipment used, with calibration certifications.
  - b. A copy of measurements taken.
  - c. The dates of testing.
  - d. The equipment and values to be verified.
  - e. The conditions specified for the test.
  - f. The test results, signed and dated.
  - g. A description of adjustments made.

E. Initial Field Test Plan

1. Detailed testing protocol at least 30 days prior to scheduled initial field testing to demonstrate pumping system operational testing. The protocol shall describe all tests to be conducted and the inter-relationships thereof. The initial field testing will not be scheduled or performed until the contractors test plan is approved.

F. Initial Field Test Report

1. A detailed field testing and equipment adjustment report within 30 days of completion of successful initial field tests and prior to final acceptance testing. Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed systems. Each test report shall indicate the final position of all control functions.
2. Three copies of the information described below in 8 1/2 x 11 inch binders having a minimum of 3 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.
3. Contractor's certification that the initial field test was satisfactorily completed, all deficiencies were corrected and successfully retested, and that the pump station is ready for Final Acceptance Testing.
  - a. A list of equipment used, with calibration certifications.
  - b. A copy of measurements taken.
  - c. The dates of testing.
  - d. The equipment and values to be verified including acceptable reference values.
  - e. The conditions specified for the test.
  - f. The test results, signed and dated.
  - g. A description of adjustments made.
  - h. Final position of controls and device settings.

G. Final Acceptance Test Plan

1. Detailed testing protocol at least 14 days prior to scheduled final acceptance testing to demonstrate pumping system operations and compliance with the project requirements. The protocol shall describe all tests to be conducted and the inter-relationships thereof. The final acceptance testing will not be scheduled or performed until the contractors test plan is approved.

H. Final Acceptance Testing Report

1. A detailed final acceptance testing and equipment adjustment report within 30 days of completion of successful final acceptance tests and prior to final acceptance. Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed systems. Each test report shall indicate the final position of all control functions.
2. Three copies of the information described below in 8 1/2 x 11 inch binders having a minimum of 3 rings from which material may readily be removed and replaced,

including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. Contractor's certification that the Final Acceptance Testing was satisfactorily completed, all deficiencies were corrected and successfully retested, and that the pump station is ready for conveyance to the Owner and operation.
- b. A list of equipment used, with calibration certifications.
- c. A copy of measurements taken.
- d. The dates of testing.
- e. The equipment and values to be verified including acceptable reference values.
- f. The conditions specified for the test.
- g. The test results, signed and dated.
- h. A description of adjustments made.
- i. Final position of controls and device settings.

I. Operation and Maintenance Manuals

1. Submit operation and maintenance manuals for the control panel in accordance with Paragraph 1.3 of Section 105 - Control of Work and Section 11310.

J. Warranty

1. The manufacturer shall warrant the pump control system being provided to the Owner against defects in workmanship and materials for one-year after acceptance of the system. The warranty shall be in printed form and submitted with the Operation and Maintenance manuals.
2. Manufacturer's standard warranties for control panel components shall be provided in writing.

1.05 WORKMANSHIP

- A. Equipment shall be installed in accordance with NFPA 70, in accordance with manufacturer installation instructions, at the locations shown on the Drawings.

PART 2 - PRODUCTS

2.01 RATINGS

- A. The Pump Station Control Panel shall be rated for 10,000 amperes RMS symmetrical fault current, and shall be NRTL listed and labeled to UL 508A.
- B. Pump station electrical equipment enclosures ratings and materials of construction shall be as specified in Division 26 Section "Electrical - General".

## 2.02 PUMP STATION CONTROL PANEL

### A. Enclosures

1. The Pump Station Control Panel main circuit breaker, variable frequency controllers, panelboard, programmable controller, and TVSS shall be individually enclosed in NEMA 1 enclosures inside the wall-mount style NEMA 4X stainless steel enclosure equipped with a flange-mounted main circuit breaker operating mechanism, padlockable in both the OPEN and CLOSED positions.
2. No live parts shall be exposed inside the Pump Station Control Panel. Wiring between NEMA 1 enclosures shall be insulated wire in PVC wireways with covers. Provide insulated throat grounding bushings at each NEMA 1 enclosure.

### B. Panelboard

1. Provide an enclosed 240/120 volt panelboard with bolt-on circuit breakers and NEMA 1 surface-mounted enclosure with thermal-magnetic main circuit breaker mounted vertically near the incoming supply wires. Main circuit breaker shall conform to Division 26 Section "Enclosed Switches and Circuit Breakers".

### C. Wire Management

1. Control panels shall include plastic wireways with removable covers for organizing and supporting internal wiring, and insulated "finger-safe" terminal blocks for termination of conductors.
2. Control panel internal wiring shall be identified on each end with wire numbers corresponding to the control panel elementary ("ladder") diagrams.
3. DC signals, 120/240 VAC, intrinsically safe, and other wiring shall be kept separate and in conformance with NEC requirements, and wired to separate terminal strips. Low voltage signal wiring (e.g. 4-20 mA) shall be kept separate from power wiring.
4. Provide adequate space adjacent to the separate 240/120 VAC, 4-20 mA DC, and intrinsically safe terminal strips for incoming conduits.

### D. Pump Motor Protection Relays

1. Each pump/motor shall be provided with thermal switches and a leakage detection device. A motor protection relay shall be furnished with each pump motor and mounted adjacent to the motor Variable Frequency Controller enclosure.
2. The basis of design for the pump motor protection relay is Flygt Mini-CAS II, base-mounted type, with alarm indicating lights.
3. Pump motor winding over-temperature shall cause motor shutdown and actuation of a pump failure alarm contact for input to the RTU.
4. Pump/motor leak detection shall actuate a pump motor leakage alarm contact for input to the RTU. The pump motor shall continue to run.
5. Timing relays shall be provided, if needed, to prevent false alarms during initial energization.

E. Variable Frequency Controllers

1. Provide one PWM type variable frequency controller (VFC) for each sewage pump. VFCs shall be suitable for incoming power supply of 240 volts single phase 60 Hz, and outgoing pulse width modulated three phase voltage with output current greater than or equal to the 230 or 460 volt 3 phase 60 Hz pump motor full load amperes.
2. VFCs shall have NEMA 1 enclosures with extra space for the operator controls to be mounted on each VFC enclosure door.
3. Provide the following VFC door-mounted control devices:
  - a. CONTROL POWER ON white indicator light
  - b. PUMP 1 RUNNING green indicator light
  - c. PUMP 2 RUNNING green indicator light
  - d. PUMP 1 VFD FAULT amber indicator light
  - e. PUMP 2 VFD FAULT amber indicator light
  - f. PUMP 1 HAND-OFF-AUTO 3-position selector switch
  - g. PUMP 2 HAND-OFF-AUTO 3-position selector switch
  - h. PUMP 1 RUNNING TIME METER (0-999999 hours, non-resettable)
  - i. PUMP 2 RUNNING TIME METER (0-999999 hours, non-resettable)
4. Variable frequency controllers shall be Polyspede Spedestar PC1 Series with 230 volt 3-phase output, or Phase Technologies, LLC Aquaphase Series with 460 volt 3-phase output, or approved equal. The VFCs shall start,,stop, and vary the speed of the pumps over a 4:1 speed range (while keeping volts/hz ratio constant) in response to changes in wet well level, as described in the Programmable Logic Controller section. The VFCs shall be capable of automatic and manual operation. Automatic speed setting shall be from a proportional 4 20mA signal from the PLC. Manual control shall be accessible via keypad installed on the VFC door. Starting, stopping, H-O-A selection, speed control, and fault reset, shall be accessible to the operator without opening the VFC door.
5. Variable frequency controllers shall have the following features:
  - a. Auto restart after adjustable 0-30 second time delay after power supply voltage is restored
  - b. Ramp-up and ramp-down
  - c. Catch a spinning load
  - d. Operate at reduced capacity during “brownout” under-voltage events
  - e. Starting voltage boost

F. Programmable Logic Controller (PLC)

1. PLC shall be Allen-Bradley Micrologic Series, mounted in a NEMA 1 enclosure, with a touch-screen HMI and operator controls for pump-out control of the sewage pumps.
2. The PLC shall be in accordance with NEMA ICS3. In the normal operating mode, the PLC shall perform all control functions required for specified operation of the pumps. The PLC shall be microprocessor-based, and programmed using

relay ladder logic control diagrams. All control functions necessary for a fully operational control system as indicated in this Specification and on the Drawings shall be implemented wholly within the PLC. Chassis wired logic is not acceptable. Processor, memory, battery back up, power supply, and additional associated electronics, wiring, and electrical components shall be contained within the PLC enclosure. The PLC shall execute the complete ladder logic program, including internal state and value compute inputs and outputs as required. Optical isolation shall be incorporated to separate the PLC circuit from the field connections. Modules shall be of the plug in type and shall not require removal of power and wiring from either field devices or processor. Provide modules of the proper input and output levels. For each type of input and output provided, provide a minimum of four implemented spare discrete inputs and outputs of that type. Each discrete input and output shall have a status indicated LED. All components of the PLC shall operate satisfactorily under the following requirements/ environmental conditions: 0 to 95% relative humidity (non condensing) and ambient temperature from 32 to 131 degrees F, operational and to 176 degrees F for storage

3. The PLC shall receive a signal from the wet well level sensing system and shall transmit signals to the VFDs to achieve the following control sequence:
  - a. At a preset point during a rise in wet well level, the first variable speed pump (the lead pump) shall be started and its speed shall attempt to maintain the wet well level within its control range. If the wet well level begins to drop when only the lead pump is on the line, the pump shall stop at a preset level. If the level continues to rise, the second variable speed pump (the lag pump) shall be started, and the two pumps then on the line shall operate in parallel at the same speed, varying as required to maintain the wet well level within the control range. If the wet well level begins to drop when two pumps are on the line, at a preset point, both pumps shall be stopped. Provide a three-position lead pump selector switch for this purpose. Automatic lead-lag sequencing shall be performed by the PLC after each pumping cycle. Automatic mode shall skip sequence selections involving pumps that are manually or automatically locked-out.
  - b. Wet well liquid level shall normally be controlled via the station's solid-state, liquid level sensing transducer (4-20mA). Should this transducer fail, liquid level control shall automatically switch to management by the wet-well float switches. When the liquid level rises to the high-high level float switch, both pumps shall be started and shall operate in parallel at constant speed to reduce the wet well level. When the liquid level drops below the low level float switch, the pumps shall stop.
  - c. Alarm conditions shall latch in until the alarm source is corrected and the reset button is pushed.
  - d. Programming the PLC shall be accomplished using ladder relay logic. As a minimum, the following programming features shall be provided for

programming the PLC: normally open contacts; normally closed contacts; coils; timers; counters; additions; subtraction; multiplication; division; and sequencing. The number of times each of these features can be used shall be limited only by the amount of memory available.

4. Include the following door-mounted controls:
  - a. PUMP 1 LEAD - ALTERNATE - PUMP 2 LEAD three position selector switch
  - b. ALARM RESET pushbutton
  - c. Level indicator: 4-20ma, 4-digit LED display, 0.54" high numerals, calibrated in feet. Indicator shall have integral 120 volt ac/24 volt DC power supply to power meter and 4-20 ma loop. Pressure Systems Inc. 3019 or approved equal.
  - d. Legend plates for all door-mounted devices.
  
5. Provide PLC inputs for the following:
  - a. Pump 1 Lead
  - b. Automatic Alternate
  - c. Pump 2 Lead
  - d. Pump 1 in Auto
  - e. Pump 2 in Auto
  - f. Pump 1 in Hand (initiate run command to VFC)
  - g. Pump 2 in Hand (initiate run command to VFC)
  - h. Pump 1 Running
  - i. Pump 2 Running
  - j. Pump 1 Flow Failure (Valve Limit Sw 1 fail to open after time delay)
  - k. Pump 2 Flow Failure (Valve Limit Sw 2 fail to open after time delay)
  - l. VFC 1 Fault alarm
  - m. VFC 2 Fault alarm
  - n. Alarm Reset pushbutton
  - o. Wet Well Level High (Float Sw)
  - p. Wet Well Level Low (Float Sw)
  - q. Wet Well Level High-High (Float Sw)
  - r. Wet Well Level Low-Low (Float Sw)
  - s. Wet Well Level 4-20 Ma
  - t. Valve Vault Level High-High (Float Sw)
  - u. Pump 1 VFC FAULT alarm
  - v. Pump 2 VFC FAULT alarm
  - w. Pump 1 OVERTEMPERATURE alarm
  - x. Pump 2 OVERTEMPERATURE alarm
  - y. Pump 1 SEAL FAILURE alarm
  - z. Pump 2 SEAL FAILURE alarm
  - aa. Utility Power Failure alarm
  - bb. Transfer Switch in Normal position status
  - cc. Transfer Switch in Generator position status
  - dd. Generator Run
  - ee. Generator Fail

- ff. Low Fuel
  - gg. Fuel Leak
6. Provide the following PLC outputs:
- a. Pump 1 Run auto command (10 amp relay contact output to VFC)
  - b. Pump 2 Run auto command (10 amp relay contact output to VFC)
  - c. Pump 1 Running status (from VFC, to RTU)
  - d. Pump 2 Running status (From VFC, to RTU)
  - e. Pump 1 Fault alarm (combine all faults for common alarm to RTU)
  - h. Pump 2 Fault alarm (combine all faults for common alarm to RTU)
  - i. PLC Failure alarm (to RTU)
  - j. Wet Well High-High Level alarm (to RTU from float switch via PLC)
  - k. Wet Well Low-Low Level alarm (to RTU from float switch via PLC)
  - l. VFC 1 Speed Signal (4-20 ma to VFC 1)
  - m. VFC 2 Speed Signal (4-20 ma to VFC 2)
  - n. Utility Power Failure alarm (to RTU)
  - o. Valve Vault Flooded alarm (to RTU)
  - p. Pump 1 H-O-A selector not in AUTO alarm (to RTU)
  - q. Pump 2 H-O-A selector not in AUTO alarm (to RTU)
  - r. Wet well level (4-20 mA to RTU)
  - s. Transfer Switch in Normal position status (to RTU)
  - t. Transfer Switch in Generator position status (to RTU)
  - u. Generator Run
  - v. Generator Fail
  - w. Low Fuel
  - x. Fuel Leak
  - y. UPS Power
7. DC Surge Protection
- a. DC surge protector, for 4-20 mA circuits, as recommended by level transducer manufacturer.
8. Intrinsically safe barriers
- a. Intrinsically safe barriers to limit the available voltage and current in the Hazardous (Classified) Areas. The barriers shall interface with non-explosion proof field devices which are mounted in the classified area. The circuits shall be suitable for Class I, Division 1, Group C&D Hazardous (Classified) Locations. Intrinsically safe relays (ISR) for the float switches shall be Square D/Group Schneider NY2 A21, NY2 B31, or approved equal. Intrinsically safe barrier (ISB) for the 4-20 ma level transducer shall be Omega SBG54806, Gems Sensors, or approved equal.
  - b. Provide intrinsically safe barriers for the float switches, discharge check valve limit switches, and level transducer.

G. Enclosure Ventilation

1. Forced air ventilation exhaust fan, air intake vents, and filters to maintain control panel temperature within the operating temperature limits of equipment mounted in the Pump Station Control Panel. Heat gain calculations shall be based on one VFD operating at full load output. Ventilation system shall conform to NEMA 4 requirements.

H. Transient Voltage Surge Suppressor

1. Transient Voltage Surge Suppressor in NEMA 1 enclosure. Modular design with field-replaceable modules and the following features and accessories: Fuses, rated at 200-kA interrupting capacity. Red and green LED indicator lights for power and protection status. Peak Single-Impulse Surge Current Rating: 160 kA per phase.
2. TVSS UPS Protection modes and UL 1449 clamping voltage for 240/120 V, single-phase, 3-wire circuits, shall be as follows: Line to Neutral: 400 V, Line to Ground: 400 V, Neutral to Ground: 400 V.

I. Uninterruptible Power Supply (UPS)

1. Provide a 120 volt 60 Hz uninterruptible power supply for the PLC, sized to operate the PLC and level transducer for a minimum of 60 minutes. The UPS shall be “on-line” type, with output current inverter normally fed from battery DC voltage. Automatic bypass to external 120 VAC supply shall be activated by UPS converter, DC bus, or inverter failure. Battery charger shall be integral to UPS.
2. Mount the UPS inside the Pump Station Control Panel enclosure.

J. Enclosure Lighting

1. Enclosed industrial 120 VAC fluorescent 4-foot fixture with 2 lamps, energized by a door-mounted limit switch.

L. Discharge Check Valve Limit Switches

1. Discharge Check Valve Limit Switches shall be provided on the check valves to shut down each pump in event of a failure to pump condition, to prevent pump damage.
2. Provide heavy-duty limit switches with 10 amp SPDT contacts in NEMA 4X and 7 enclosures. Mount and adjust limit switches in conformance with check valve manufacturer’s instructions.

## PART 3 - EXECUTION

### 3.01 GROUNDING

- A. Grounding shall be in conformance with NFPA 70 and the Drawings.

### 3.02 CONDUCTOR IDENTIFICATION AND TAGGING

- A. Control and signal circuit conductor identification shall be provided within each enclosure.
- B. Control and signal circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.
- C. Conductor coding shall be consistent for each conductor across the control system.

### 3.03 CIRCUIT PROTECTIVE DEVICES

- A. The Contractor shall calibrate, adjust, set and test each new adjustable circuit protective device to ensure that they will function properly prior to the initial energization of the new power system under actual operating conditions.

### 3.04 WIRING

- A. The Contractor shall provide a complete system of power, control, and signal wiring in conduits connecting the various components to the Pump Station Control Panel, in conformance with approved AC 3-line diagrams and control schematics, and based on the equipment actually furnished, conceptual diagrams shown on the Contract Drawings, and specification requirements.

### 3.05 DISCHARGE CHECK VALVE LIMIT SWITCHES

- A. Mount discharge check valve limit switches on check valves and adjust switch actuation angle so that each limit switch is actuated when the flow through each pump is just above the minimum speed flow with two pumps running. Limit switches shall be mounted so that over-travel of the check valve lever does not damage the limit switch. Limit switches shall be wired to intrinsically safe circuits.

### 3.06 PLC PROGRAMMING

- B. The Contractor shall perform all PLC programming required to provide a complete and functional system. Where site specific set-points are needed, the Contractor shall provide a tabulation of all site specific set points. The tabulation shall include set-point description and allowable set-point values. The Owner will select set-points appropriate to the specific installation.

### 3.07 FIELD TESTING

- A. Field testing shall be performed in the presence of the Owner. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspection recommended by the manufacturer unless specifically waived by the Owner. The Contractor shall maintain a written record of all tests which

includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test reports shall be signed and dated by the Contractor.

### 3.08 OPERATING TESTS

- B. After the installation is completed and at such time as the Owner may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. Submit operating test report.

### 3.09 FIELD SERVICE

#### A. Onsite Training

- 1. The Contractor shall conduct a training course for the operating staff as designated by the Owner. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to acceptance. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations.

#### B. Installation Engineer

- 1. After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of equipment, assist in the performance of the onsite tests, oversee initial operations, and instruct personnel as to the operational and maintenance features of the equipment.

### 3.10 ACCEPTANCE

- A. Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected and demonstrated to the Owner.

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Appendix D  
GEOTECHNICAL REPORT



# GEOTECHNICAL ENGINEERING REPORT

**Old Wormley Creek Sanitary Sewer  
Nelson District  
York County, Virginia**

Schnabel Reference # 11633065  
September 9, 2011

Prepared for:







September 9, 2011

Mr. G. Christian Guvernator IV, PE  
O'Brien & Gere  
Reflections I, Suite 305  
2809 South Lynnhaven Road  
Virginia Beach, Virginia 23452

**Subject: Project 11633065, Geotechnical Engineering Report, Old Wormley Creek Sanitary Sewer, Nelson District, York County, Virginia**

Dear Chris:

**SCHNABEL ENGINEERING CONSULTANTS, INC.** (Schnabel) is pleased to submit our geotechnical engineering report for this project. This document includes attached figures, tables, and appendices with relevant data collected for this study. This study was performed in accordance with our revised proposal dated June 22, 2011 as authorized by your Purchase Order No. 11110579EST dated June 29, 2011.

#### **SCOPE**

Our revised proposal dated June 22, 2011, defines the scope of this study. Our services include subsurface exploration, field engineering, soil laboratory testing, and development of geotechnical engineering recommendations. The objective of this study is to evaluate the subsurface conditions and provide recommendations regarding the earthwork considerations for this project.

Services not described in our agreement are not included in this study. We would be happy to provide additional support services to the design team as the project demands.

#### **SITE DESCRIPTION**

This project site is generally north and west of SR 718, Hornsbyville Road, and including Court Road (added for the revised proposal) south of Hornsbyville Road in the Nelson District of York County, Virginia. The proposed alignments are anticipated to fall within the defined roadways of Old Wormley Creek Road to its northern terminus at the Wormley Creek Boat Ramp, Bolivar Drive, Shields Road, Branch Lane, and Court Road. Ground surface elevations range between about El 10 to El 57. The roadways are narrow with light to moderate residential development on either side of each road. The area proposed for the Lift Station is generally open. Site grades were obtained from the site plan Sheets C-6 through C-12 by O'Brien & Gere dated July 2011.

[schnabel-eng.com](http://schnabel-eng.com)

T/ 757-947-1220 F/ 757-947-1225  
300 Ed Wright Lane, Suite I / Newport News, VA / 23606

## PROPOSED CONSTRUCTION

Proposed for construction is approximately 11,000 lf of gravity and force sanitary sewer line, with manholes in the alignments of the above named streets. Manhole inverts are anticipated to be between about 5 ft and 19 ft below existing grades. A lift (pump) station is proposed for construction at the low end of the new gravity sewer line at the northern end of Old Wormley Creek Road along the western side of the cul de sac and west of the boat ramp. The existing grade at the pump station site is about EI 9. We understand that the pump station will consist of a circular precast concrete wet well with an inside diameter of six feet. The top grade for the wet well floor slab is about EI -5. The wet well will be covered with a 12 inch thick concrete slab, measuring approximately 15 ft by 20 ft in plan dimension, with a top of slab of EI 10.1.

Project details were provided by Scott Stamm and Isaiah Holley and from the Lift Station Plan, Sheet C-4 dated July 2011.

## SUBSURFACE CONDITIONS

### Geology

We reviewed existing geologic data and information in our files. Based on this review, the geologic stratigraphy consists of Pleistocene Age soils overlying Miocene Age soils. The Pleistocene Age, Tabb Formation alluvial soils typically consist of a mixture of clay, sands and gravel. At this site, they are primarily clays and silty and clayey sands. These soils typically exhibit low to moderate strength, and low to moderate compressibility. The underlying Miocene Age, Yorktown Formation soils typically consist of sands, silts, and clays containing varying amounts of shells. At this site, they are primarily silty and clayey sands containing shell fragments. The Yorktown Formation soils are known to be sensitive to disturbance. They exhibit higher strength and lower compressibility than would be indicated by their Standard Penetration Test, N values.

### Data Collection Techniques

We performed test borings and soil laboratory testing on samples collected to develop our geotechnical recommendations. Appendix A includes our summary of soil laboratory test results and laboratory test curves. Appendix B includes the logs from our subsurface exploration.

Our geotechnical laboratory conducted tests on selected samples obtained in the borings. This testing aided in the classification of soils encountered in the subsurface exploration, and provided data for use in the development of earthwork recommendations. The logs in Appendix B show the natural moisture content values of selected soil samples. Appendix A presents the results of the remaining laboratory tests.

Fishburne Drilling, Inc. drilled eleven borings at this site under our observation. Appendix B includes specific observations, remarks, and logs for the borings; classification criteria; and sampling protocols. Figure 1 shows the approximate boring locations. We will retain soil samples up to 45 days beyond the issuance of this report, unless you request other disposition.

### **Generalized Subsurface Stratigraphy**

We have characterized the following generalized subsurface soil stratigraphy based on the boring and hand auger data presented in Appendix B:

#### ***Ground Cover:***

Approximately 3.5 inches to 6.5 inches of asphalt and aggregate base course were encountered at the ground surface of Borings B-01 through B-10. Boring B-11 had a 2.5 inch layer of root mat and topsoil at the ground surface.

#### ***Stratum A: Existing Fill***

Existing FILL soils were encountered from below the pavement to depths of about 1.8 ft in Boring B-01 and 0.7 ft in Boring B-05. The fill soils classified as loose density fine to medium grained silty sand. A Standard Penetration Test (SPT), N value of 9 was recorded in the fill soils in Boring B-01. Fill soils were not encountered in any of the other borings.

#### ***Stratum B: Tabb Formation***

Below the ground cover, pavement section and existing fill, the borings encountered the fine and coarse grained soils of the Tabb Formation to depths of 12 to 22 ft, or the maximum depths of penetration in all the borings.

#### ***Stratum B1:***

This stratum consists of fine to medium grained CLAYEY SAND (SC), SILTY SAND (SM), POORLY GRADED SAND (SP), and POORLY GRADED SAND with SILT (SP-SM) with varying amounts of fine gravel. The Standard Penetration test (SPT) N-values ranged from WOH/12" to 30, indicating very loose to medium density soils.

#### ***Stratum B2:***

This stratum consists of LEAN CLAY (CL) and FAT CLAY (CH) with varying amounts of sand. Stratum B2 was interlayered with Stratum B1 in Borings B-01, B-02, B-03, B-05, B-07, and B-09. The Standard Penetration Test (SPT) N-values ranged from 3 to 28, indicating very soft to very stiff consistency soils.

Soil laboratory tests were conducted on five bulk samples obtained from Borings B-01, B-02, B-05, B-07, and B-09, from depths of 0.2 ft to 5.0 ft. This material consisted of a combination of Strata A, B1, and B2 soils. Tests included classification, Standard Proctor, and California Bearing Ratio (CBR) tests. In addition, seven jar samples were tested for classification.

CBR values ranged from 3.1 to 28.5 with swell values ranging from 0 to 0.3 percent. Natural moisture content values varied from about 4.2 percent to 40.8 percent, generally increasing with depth. The fines portions of these soils generally exhibited a slight to medium degree of plasticity having liquid limits between 25 and 38, and plasticity indices of 6 to 18.

### ***Stratum C: Yorktown Formation***

Stratum C consists of fine and coarse grained soils of the Yorktown Formation. These soils were encountered in Borings B-02 and B-04 through B-11 below Stratum B to the maximum depths of penetration, 20 to 40 ft.

#### ***Stratum C1:***

This stratum consists of coarse grained, brown and greenish gray SILTY SAND (SM) and CLAYEY SAND (SC), containing varying amounts of shell fragments. The SPT N-values ranged from 6 to 24, indicating loose to medium density soils.

#### ***Stratum C2:***

This stratum consists of greenish gray SANDY LEAN CLAY (CL), containing shell fragments. These soils were interlayered with Stratum C1 in Boring B-11. The SPT N-value was 6, indicating a medium stiff consistency soil.

### ***Groundwater***

The logs note groundwater level readings obtained in the borings during and after completion. Groundwater was encountered during drilling from depths of about 2 ft to 12 ft. We obtained groundwater level readings in open boreholes ¼ to two hours after completion at depths of 1.9 ft to 13.1 ft, El 7.1 to El 26.7. In addition, our drilling subcontractor installed groundwater observation wells in Borings B-01, B-04, B-08, and B-11. We recorded groundwater levels in the wells at depths of 6.6 ft to 13.4 ft, about El 2.4 to El 26.6, three days after completion of the drilling.

The groundwater levels on the logs show our estimate of the hydrostatic water table at the time of drilling. The final design should anticipate fluctuations in the hydrostatic water table depending on variations in precipitation, surface runoff, pumping, evaporation, leaking utilities, and similar factors.

## **GEOTECHNICAL RECOMMENDATIONS**

We based our geotechnical engineering analysis on the information developed from our subsurface exploration and soil laboratory testing, along with the project development plans and site plans furnished to our office. The following sections of the report provide our detailed recommendations.

### **Earthwork and Grading**

The natural sands of Strata B encountered in test borings B-01, B-02, B-04, B-06, B-08, B-10, and B-11 are typically loose to very loose at and below the water table. These sands may exhibit characteristics of "running sands" when excavated. The contractor should be prepared to work with running sand conditions. This condition may also affect horizontal drilling and bore-and-jack techniques, if used for this project.

Limited undercutting in the new sewer line trenches may be recommended where soft or loose soils are encountered. This may be expected in areas where pipeline construction extends below the water table. Because the depth of undercut needed at any given location may vary from the recommended average,

the Geotechnical Engineer should evaluate the actual undercut depths. The undercut materials may be replaced with crushed stone meeting the gradation requirements of VDOT No. 57 open-graded aggregate. Crushed concrete meeting this gradation may also be used. A geotextile separation fabric such as Mirafi 500X may be required on the subgrades before aggregate placement.

Once the subgrade of the bottom of the trench is prepared, the pipe should be bedded according to manufacturer's specifications. Backfill over top of the pipe should also be placed according to manufacturer's recommendations.

We recommend evaluating undercut volumes by cross sectioning. Other methods of calculating volumes of undercut, such as counting trucks, are less accurate and generally result in additional expense. If truck counts are used, we recommend that the method of payment be in accordance with Section 109 of the Virginia Department of Transportation (VDOT) Road and Bridge Specifications.

Compacted structural backfill should consist of material classifying SC, SM, SP, SW, GC, GM, GP, or GW per ASTM D2487. Most of the non-organic, on-site soils are expected to meet this criterion. If off-site borrow soils are needed, they should classify as SC, SM, SP, SW, GC, CM, GP, or GW per ASTM D2487.

Successful reuse of the excavated, on-site soils as compacted structural fill will depend on their natural moisture contents during excavation. Natural moisture content values of Stratum B soils varied from about 2.0 percent below to about 5.3 percent above optimum for the soil types tested. Therefore, we anticipate scarifying and drying of portions of the on-site soils to achieve the recommended compaction. Drying of these soils would likely result in some delay, and drying may not be possible during late fall, winter, and early spring. Therefore, if on-site soils are used, we recommend that the earthwork be performed during the warmer, drier times of the year from about May to October.

Compacted structural backfill should be placed in maximum eight-inch thick horizontal, loose lifts. It should be compacted to at least 95 percent of maximum dry density per ASTM D698, Standard Proctor. Where applicable, the compacted structural fill should extend laterally at least 5 ft beyond the slab and pavement limits, and then slope as needed to meet existing grades.

### **Pump Station Wet Well Foundation**

A mat foundation is recommended for support of the proposed pump station wet well. Based on our understanding of the proposed project, the pump station subgrade will be about 16 ft below the existing ground surface, about El -6. The mat foundation should be supported on suitable natural materials of Stratum B. The mat foundation may be designed for its distributed contact pressure up to a maximum contact pressure of 1,500 psf. The bearing pressure provides a factor of safety of at least three against general shear failure.

Settlements of the mat foundation supported on suitable natural soils are not expected to exceed about 1/2 inch. Angular distortion across mat foundations is not expected to exceed about 0.005 inches/inch.

A working platform consisting of a 18 inch thick layer of open graded crushed stone or crushed concrete should be placed on approved subgrade to provide a base on which to place reinforcing steel for the mat

slab. The crushed stone or crushed concrete should meet the gradation requirements of VDOT No. 57 crushed stone. The contractor should compact the moisture barrier material in place by at least two passes with suitable vibratory compaction equipment. A geotextile separation fabric such as Mirafi 500X may be required on the subgrades before aggregate placement.

### **Pump Station Slabs on Grade**

The slab on grade portion of the pump station can be supported on the suitable natural soils of Stratum B or compacted structural fill. A six-inch crushed stone, crushed concrete or washed gravel working platform should underlie the floor slabs being constructed below the water table to reduce the potential for disturbance of the subgrade soils during slab construction. The crushed stone or crushed concrete should meet the gradation requirements of VDOT No. 57 crushed stone. The contractor should compact the moisture barrier material in place by at least two passes with suitable vibratory compaction equipment.

### **Pump Station Walls Below Grade**

Walls below grade for the pump station wet well structure should be designed as braced walls. Based on groundwater level readings, the wet well walls below grade will be subject to hydrostatic pressures. The walls should also be designed to resist hydrostatic pressures considering the projected storm surge for this region. These walls should be designed using an angle of internal friction of 30 degrees, and a cohesion of 0 psf. Total and buoyant unit weight of 110 pcf and 47 pcf should be used for the soil backfill above and below the design water table, respectively. Basement walls should be water proofed below permanent groundwater levels.

The mat should be designed to resist hydrostatic uplift pressure with a factor of safety of at least 1.5. The recommended design groundwater level is about EI -1. Resistance to uplift can be provided through the weight of the structure. Additional resistance can be provided by extending the base slab beyond the base of the structure. The structural resistance should consider the buoyant unit weight of the reinforced concrete, 85 pcf. The concrete mat extensions can be evaluated at a weight of the soil above the extended portion of the slab. The resisting forces should be evaluated as shown on Figure 2.

Wall backfill should consist of non-plastic material classifying SP-SM, SW-SM, SP, SW, GW-GM, GP-GM, GP, or GW according to ASTM D2487. This classification includes open-graded crushed stone such as VDOT No. 57. The contractor should place free-draining backfill in maximum eight-inch thick loose lifts, and compact each lift to at least 95 percent of maximum dry density per ASTM D698, Standard Proctor or to 60 percent Relative Density per ASTM D 4253 and D 4254. Open graded crushed stone may be placed in 24 inch thick lifts and tamped with a backhoe bucket.

Only light hand-operated equipment should be used to compact backfill against walls. The Structural Engineer of Record should approve the size of the compaction equipment.

### Wet Well Sheeting

We anticipate wet well excavation will require excavation sheeting or benching of the soil. Recommended soil parameters for design of a temporary braced excavation are provided below. These parameters have been estimated from the test boring and soil laboratory test data obtained for this study.

Table 1: Recommended Soil Parameters for Design of Temporary Sheeting

Stratum	Depth, ft	Classification	Total Unit Weight, pcf	Friction Angle, degrees	Cohesion, psf
B1	0-22	SM	110	30	0
C1/C2	22-40	SC/SM/CL	115	35	0

### Manhole Base Slabs

Suitable natural soils of Stratum B or compacted structural fill may be used to support the manhole base slabs. The contractor should recompact the subgrades immediately before placing moisture barrier materials to repair any disturbance that may occur due to construction operations. A six-inch crushed stone, crushed concrete or washed gravel working platform should underlie manhole base slabs being constructed below the water table to reduce the potential for disturbance of the subgrade soils during slab construction.

Base subgrades needing undercut should be backfilled to the original design subgrade elevation with an open-graded crushed stone such as No. 57 aggregate. Crushed stone should extend at least 6 inches laterally beyond

### Pavements

The contractor should prepare pavement subgrades and place compacted structural fill for pavement support as previously described in the Earthwork and Grading Section of this report. Dense-graded aggregate placed as pavement base course should be compacted to at least 95 percent of maximum dry density per ASTM D698, Standard Proctor. Dense-graded aggregate should be placed in maximum eight-inch thick loose lifts.

Based on the CBR values obtained from our testing program, we recommend that a design CBR of 3.5 be used for pavements in the vicinity of Borings B-01 through B-06 and 16.5 be used for pavements in the vicinity of Borings B-07 through B-11. This design CBR represents two-thirds of the average laboratory CBR values in the respective areas.

Adequate control of surface drainage will be a very important consideration for the overall performance of this pavement design. The area surrounding pavements should be graded to direct surface water away from paved areas. Utility excavations within pavement areas should be backfilled with compacted structural fill.

## **CONSTRUCTION CONSIDERATIONS**

### **Earthwork**

We expect the subgrade soils in sections of the pipe line excavations to be wet and easily disturbed. The contractor may need crushed stone and stabilization geotextile working platforms to provide a base on which to place the pipeline and compacted structural backfill. The Geotechnical Engineer can make recommendations for working platforms in the field, based on observation of subgrade conditions.

### **Construction Dewatering**

We anticipate that the contractor will encounter ground water during excavation for the proposed utilities, manhole structures, and the pump station wet well. Pumping from sumps will likely adequately control this ground water in the shallower excavations. Sumps should extend at least 3 ft below the base of the excavation. The contractor may use a well point system to dewater the deeper excavation for the pump station wet well, if needed. Project specifications should make the contractor responsible for dewatering methods.

A specialty contractor should prepare the design of the dewatering system. The design should be based on groundwater conditions at the time of construction and the required depth of groundwater lowering. We recommend that the project specifications require that groundwater levels be maintained at least 3 ft below excavation subgrade elevations.

### **Excavation Support**

Where sheeting is used, the excavation contractor should prepare drawings indicating details of the excavation sheeting. A licensed Professional Engineer should prepare the drawings and should submit the drawings to the Structural Engineer and to our office for review.

We recommend that the contract require the excavation sheeting and shoring contractor to furnish bodily injury and property damage liability insurance to adequately protect the Owner and consulting engineers on the project from claims arising from the work. The builder's risk policy should also name the Engineer and Schnabel Engineering Consultants, Inc. as co-insured for claims arising from the construction.

A specialty contractor, who has had at least 5 years experience in performance of the specialized work, should perform the excavation sheeting, including preparation of plans.

### **Manhole Base Slabs**

The contractor should exercise care during excavation for manhole base slabs so that as little disturbance as possible occurs at the slab level. The contractor should carefully clean loose or soft soils from the bottom of the excavation before placing concrete.

Base subgrades needing undercut should be backfilled to the original design subgrade elevation with an open-graded crushed stone such as No. 57 aggregate. Crushed stone should extend at least six inches laterally beyond the base in all directions. Concreting should take place the same day as excavation of footings.

### Engineering Services During Construction

The engineering recommendations provided in this report are based on the information obtained from the subsurface exploration and laboratory testing. However, conditions on the site may vary between the discrete locations observed at the time of our subsurface exploration. The nature and extent of variations between borings may not become evident until during construction.

To account for this variability, we should provide professional observation and testing of actual subsurface conditions revealed during construction as an extension of our engineering services. These services will also help in evaluating the contractor's conformance with the plans and specifications. Because of our unique position to understand the intent of the geotechnical engineering recommendations, retaining Schnabel for these services will allow us to provide consistent service throughout the project construction.

### General Specification Recommendations

An allowance should be established to account for possible additional costs that may be required to construct earthwork and foundations as recommended in this report. Additional costs may be incurred for a variety of reasons including variation of soil between borings, greater than anticipated unsuitable soils, need for borrow fill material, wet on-site soils, running sands, obstructions, temporary dewatering, etc.

We recommend that the construction contract include unit prices for scarifying and drying wet and/or loose subgrade soils, and provide an allowance for this work. In addition, the construction contract should include an allowance for undercutting soft or loose, pipe or manhole base subgrade soils, and replacement with compacted structural fill. Add/deduct unit prices should also be established in the contract so adjustments can be made for the actual volume of materials handled.

The project specifications should indicate the contractor's responsibility for providing adequate site drainage during construction. Inadequate drainage will most likely lead to disturbance of soils by construction traffic and increased volume of undercut.

This report may be made available to prospective bidders for informational purposes. We recommend that the project specifications contain the following statement:

*Schnabel has prepared this geotechnical engineering report for this project. This report is for informational purposes only and is not part of the contract documents. The opinions expressed represent the Geotechnical Engineer's interpretation of the subsurface conditions, tests, and the results of analyses conducted. Should the data contained in this report not be adequate for the Contractor's purposes, the Contractor may make, before bidding, independent exploration, tests and analyses. This report may be examined by bidders at the office of the Owner, or copies may be obtained from the Owner at nominal charge.*

The contract documents should include the boring and hand auger data provided in Appendix B.

Additional data and reports prepared by others that could have an impact upon the contractor's bid should also be made available to prospective bidders for informational purposes.

## LIMITATIONS

We based the analyses and recommendations submitted in this report on the information revealed by our exploration. We attempted to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction.

We prepared this report to aid in the evaluation of this site and to assist in the design of the project. We intend it for use concerning this specific project. We based our recommendations on information on the site and proposed construction as described in this report. Substantial changes in locations or grades should be brought to our attention so we can modify our recommendations as needed. We would appreciate an opportunity to review the plans and specifications as they pertain to the recommendations contained in this report, and to submit our comments to you based on this review.

We have endeavored to complete the services identified herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project. No other representation, express or implied, is included or intended, and no warranty or guarantee is included or intended in this report, or any other instrument of service.

We appreciate the opportunity to be of service for this project. Please call us if you have any questions regarding this report.

Sincerely,

**SCHNABEL ENGINEERING CONSULTANTS, INC.**



Frank J. Romano, EIT  
Senior Staff Engineer



Gilbert T. Seese, PE  
Principal



FJR:GTS:dah

## Figures

- Appendix A: Soil Laboratory Test Data
- Appendix B: Subsurface Exploration Data

**O'Brien & Gere**

**Old Wormley Creek Sanitary Sewer, Nelson District, York County, VA**

Distribution:

O'Brien and Gere (e-mail only)

Attn: Christian Guvernator, PE

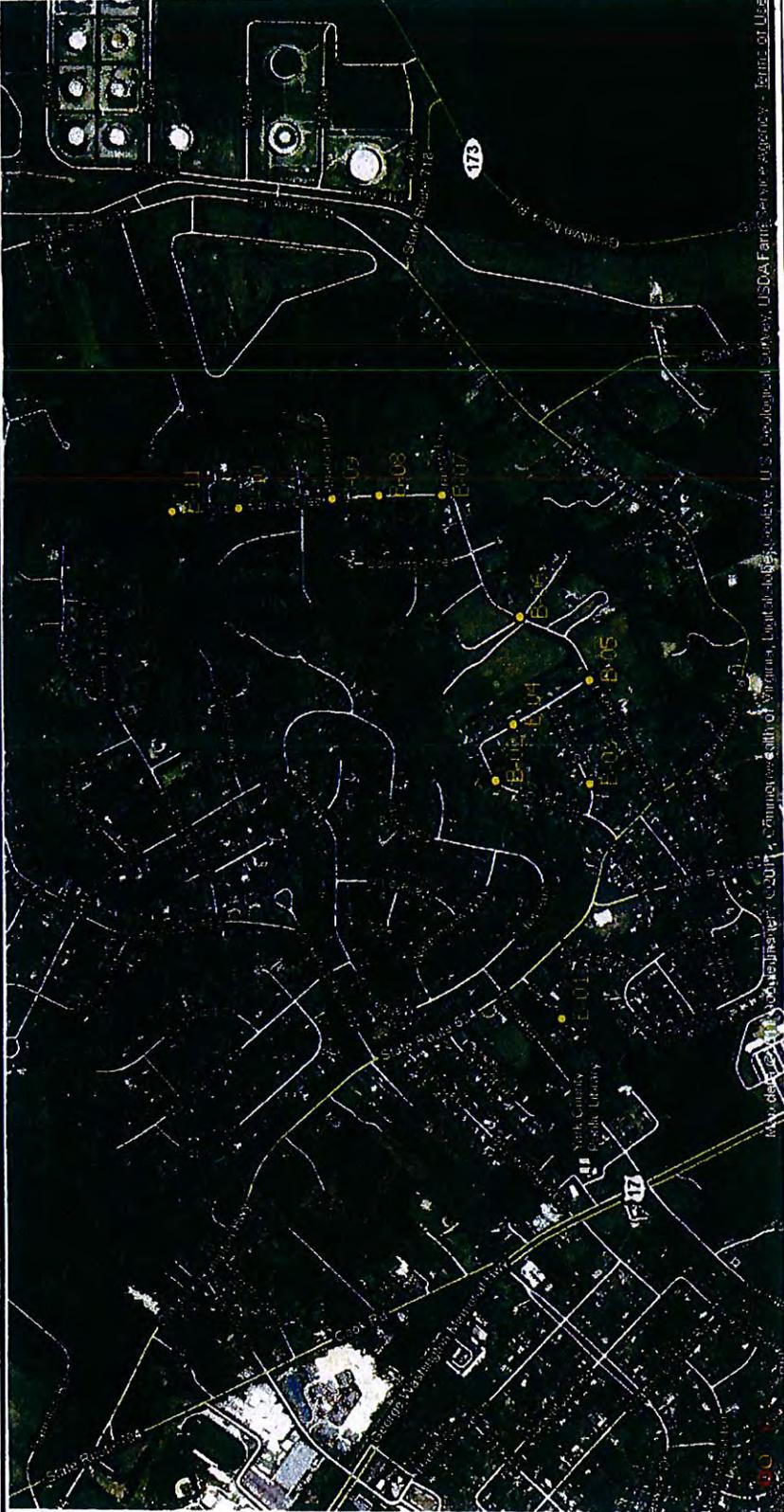
O'Brien and Gere (e-mail only)

Attn: Scott Stamm, PE

# FIGURES

Figure 1: Soil Boring Location Plan

Figure 2: Uplift Resistance Recommendations



**LEGEND:**

- APPROXIMATE TEST BORING LOCATION
- B-11

**NOTES:** COORDINATES FOR TEST BORING ARE SHOWN ON BORING LOGS  
 AERIAL PHOTOGRAPHY FOR PLAN PROVIDED BE GOOGLE IMAGERY



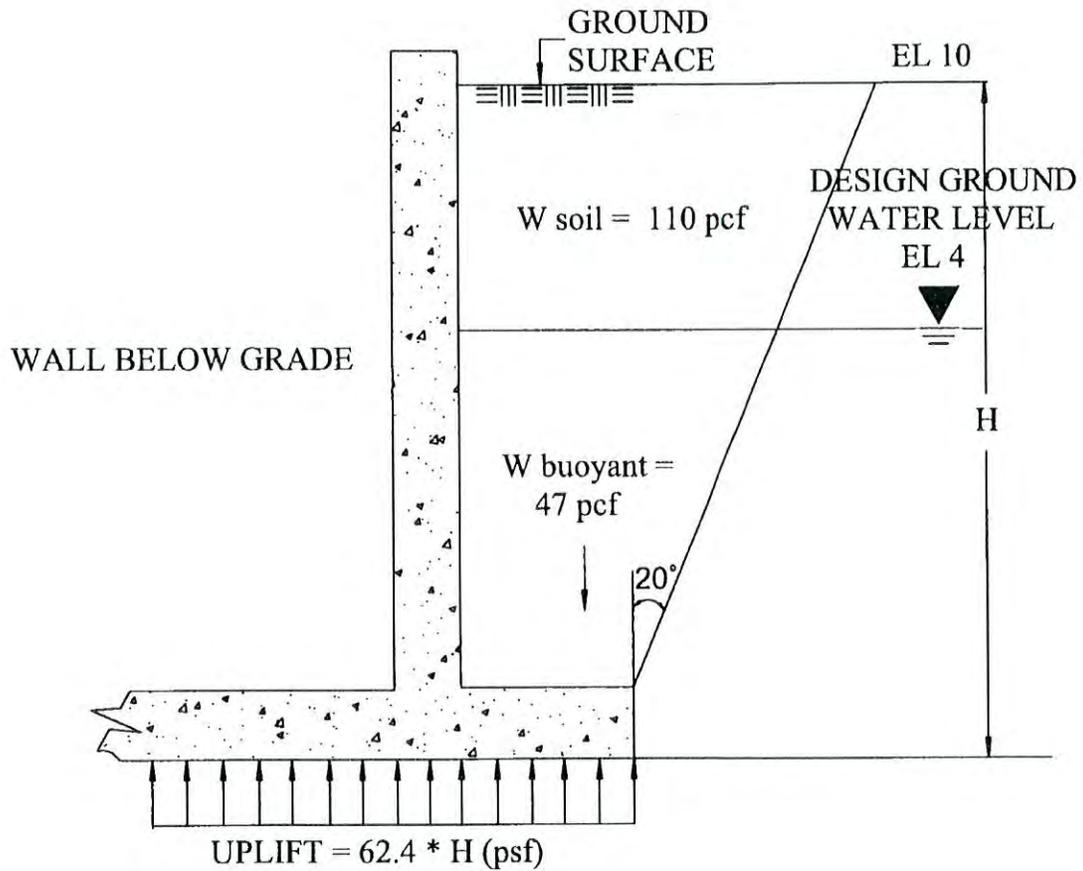
**OLD WORMLEY CREEK SANITARY SEWER**

YORK COUNTY, VIRGINIA

TEST BORING LOCATION PLAN	SCALE:	DATE:	PROJECT NO:
	NO SCALE	9/11	11033005
	DRAWN BY:	CHECK BY:	FIGURE
	RR	GS	1

**UPLIFT RESISTANCE RECOMMENDATIONS FOR PROPOSED PUMP STATION**  
**Old Wormly Creek Sanitary Sewer, York County, VA**  
**Schnabel Engineering Project # 11633065**

NOT TO SCALE



	<b>OLD WORMLY CREEK          SANITARY SEWER - PUMP          STATION          YORK COUNTY, VA</b>	Figure Name: UPLIFT RESISTANCE DETAIL	Done: FJR	Figure Number: 2
		Project Number: 11633065	Reviewed: GTS	Date: SEPT 2011

## APPENDIX A

# SOIL LABORATORY TEST DATA

Summary of Soil Laboratory Tests (2 Sheets)

Gradation Curve (2 Sheets)

Moisture Density Relationship (5 Sheets)

California Bearing Ratio (5 Sheets)

# Summary Of Laboratory Tests

Appendix  
Sheet 1 of 2  
Project Number: 11633065

Boring No.	Sample Depth ft		Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 40 Sieve	% Passing No. 200 Sieve	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	CBR Dry Density At Compaction (pcf)	CBR Moisture Content (%)	CBR Percent Swell	CBR Value
	Elevation ft																
B-01	0.3 - 5.0		Bulk	SANDY LEAN CLAY (CL), trace crushed stone, gray	A/B2	13.1	25	13	12	87.3	51.6	119.7	12.0	119.7	12.3	0.3	3.1
	49.7 - 45.0																
B-02	0.5 - 5.0		Bulk	CLAYEY SAND (SC), fine to medium grained, trace crushed stone, orange-brown	B1	12.7	28	15	13	90.0	44.9	113.6	13.6	113.6	12.6	0.3	9.4
	49.3 - 44.8																
B-03	2.0 - 4.0		Jar	CLAYEY SAND (SC), fine to coarse grained, contains mica, gray-brown	B1	14.3	32	15	17	--	46.5	--	--	--	--	--	--
	52.7 - 50.7																
B-04	2.0 - 4.0		Jar	SILTY SAND (SM), fine to coarse grained, red-brown	B1	10.0	NP	NP	NP	--	13.5	--	--	--	--	--	--
	37.8 - 35.8																
B-05	0.2 - 5.0		Bulk	CLAYEY SAND (SC), fine to coarse grained, trace crushed stone, brown	B1	13.5	28	18	10	65.1	45.6	120.2	11.5	120.2	11.1	0.3	3.4
	33.6 - 28.8																
B-06	6.0 - 8.0		Jar	POORLY GRADED SAND (SP), fine to coarse grained, orange-brown	B1	12.6	NP	NP	NP	--	3.1	--	--	--	--	--	--
	23.6 - 21.6																
B-07	0.5 - 5.0		Bulk	SILTY SAND (SM), fine to medium grained, trace gravel, brown	B1	6.3	NP	NP	NP	63.0	12.8	114.9	10.6	114.9	10.7	0.0	28.5
	26.7 - 22.2																

- Notes:
- Soil tests in general accordance with ASTM standards.
  - Soil classifications are in general accordance with ASTM D2487 (as applicable), based on testing indicated and visual classification.
  - Key to abbreviations: NP=Non-Plastic; -- indicates no test performed



**Schnabel**  
ENGINEERING

**Project:** Old Wormley Creek Sanitary Sewer  
York County, VA

# Summary Of Laboratory Tests

Appendix  
Sheet 2 of 2  
Project Number: 11633065

Boring No.	Sample Depth ft		Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing No. 40 Sieve	% Passing No. 200 Sieve	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	CBR Dry Density At Compaction (pcf)	CBR Moisture Content (%)	CBR Percent Swell	CBR Value
	Elevation ft																
B-07	13.0 - 15.0		Jar	CLAYEY SAND (SC), fine grained, contains mica, dark gray	B1	40.8	38	20	18	--	36.7	--	--	--	--	--	--
	14.2 - 12.2																
B-08	18.0 - 20.0		Jar	SILTY SAND (SM), fine grained, contains shell fragments and mica, gray	C1	29.4	NP	NP	NP	--	14.2	--	--	--	--	--	--
	11.2 - 9.2																
B-09	0.5 - 5.0		Bulk	WELL GRADED SAND WITH SILT (SW-SM), fine to coarse grained, contains asphalt, trace gravel and crushed stone, orange-brown	B1	4.2	NP	NP	NP	55.0	11.8	121.3	9.5	120.1	9.5	0.0	21.0
	26.2 - 21.7																
B-10	13.0 - 15.0		Jar	SILTY SAND (SM), fine grained, contains mica, orange-brown	B1	38.9	37	26	11	--	26.2	--	--	--	--	--	--
	4.3 - 2.3																
B-11	18.0 - 20.0		Jar	SILTY SAND (SM), fine grained, contains mica, brown	B1	40.5	34	28	6	--	27.2	--	--	--	--	--	--
	-9.0 - -11.0																

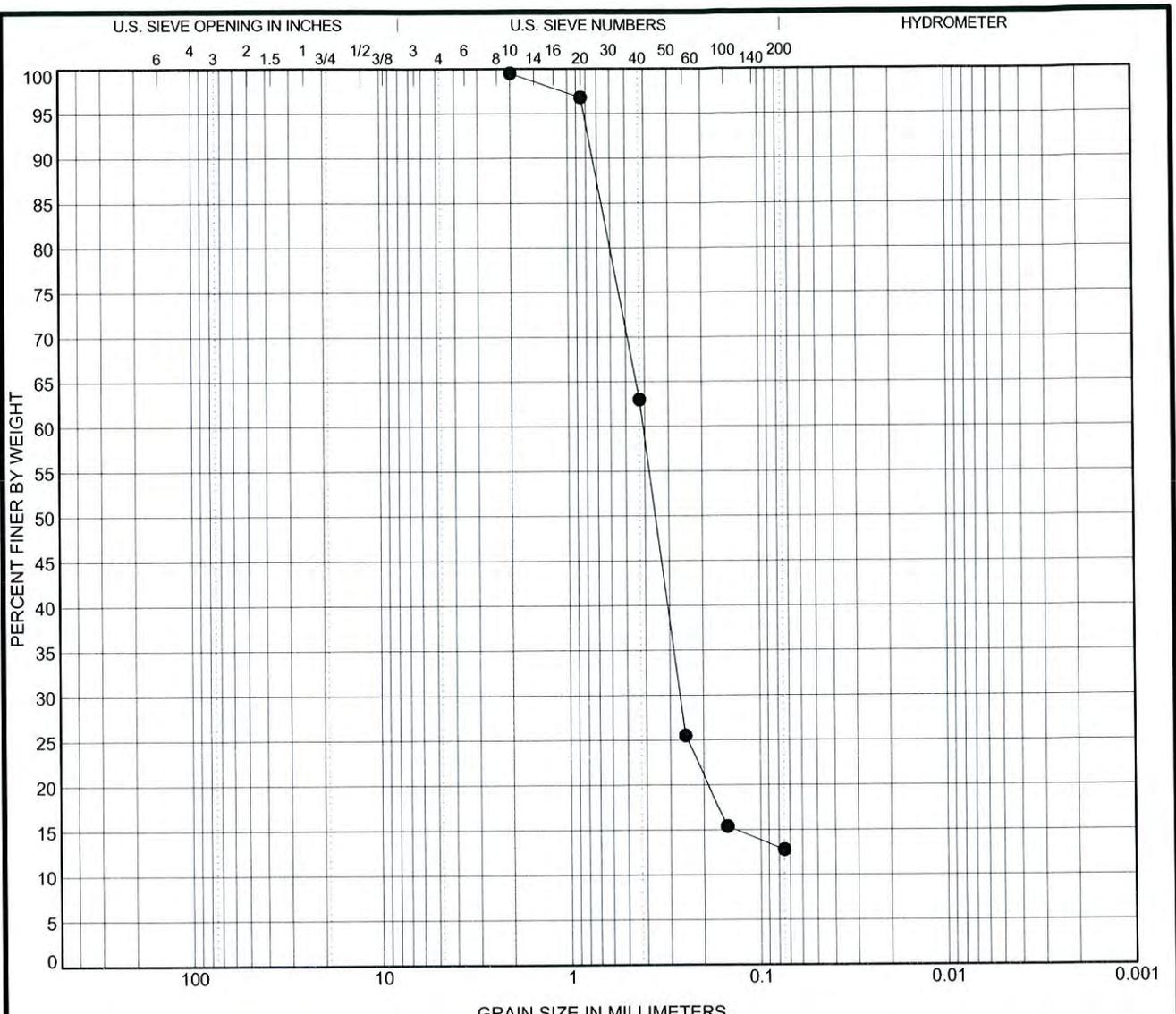
Notes:  
 1. Soil tests in general accordance with ASTM standards.  
 2. Soil classifications are in general accordance with ASTM D2487 (as applicable), based on testing indicated and visual classification.  
 3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed



**Schnabel**  
ENGINEERING

**Project:** Old Wormley Creek Sanitary Sewer  
York County, VA

SIEVE 1/SHEET 11633065 DRAFT LOGS.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 8/31/11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen	Sample Description					LL	PL	PI		
B-07	0.5 ft	SILTY SAND (SM), fine to medium grained, trace gravel, brown					NP	NP	NP	
Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay		
ASTM D422	2	0.407	0.266					12.8		

Percent Finer						
Sieve Size	No. 200	No. 100	No. 60	No. 40	No. 20	No. 10
% Finer	12.8	15.4	25.5	63.0	96.8	99.5



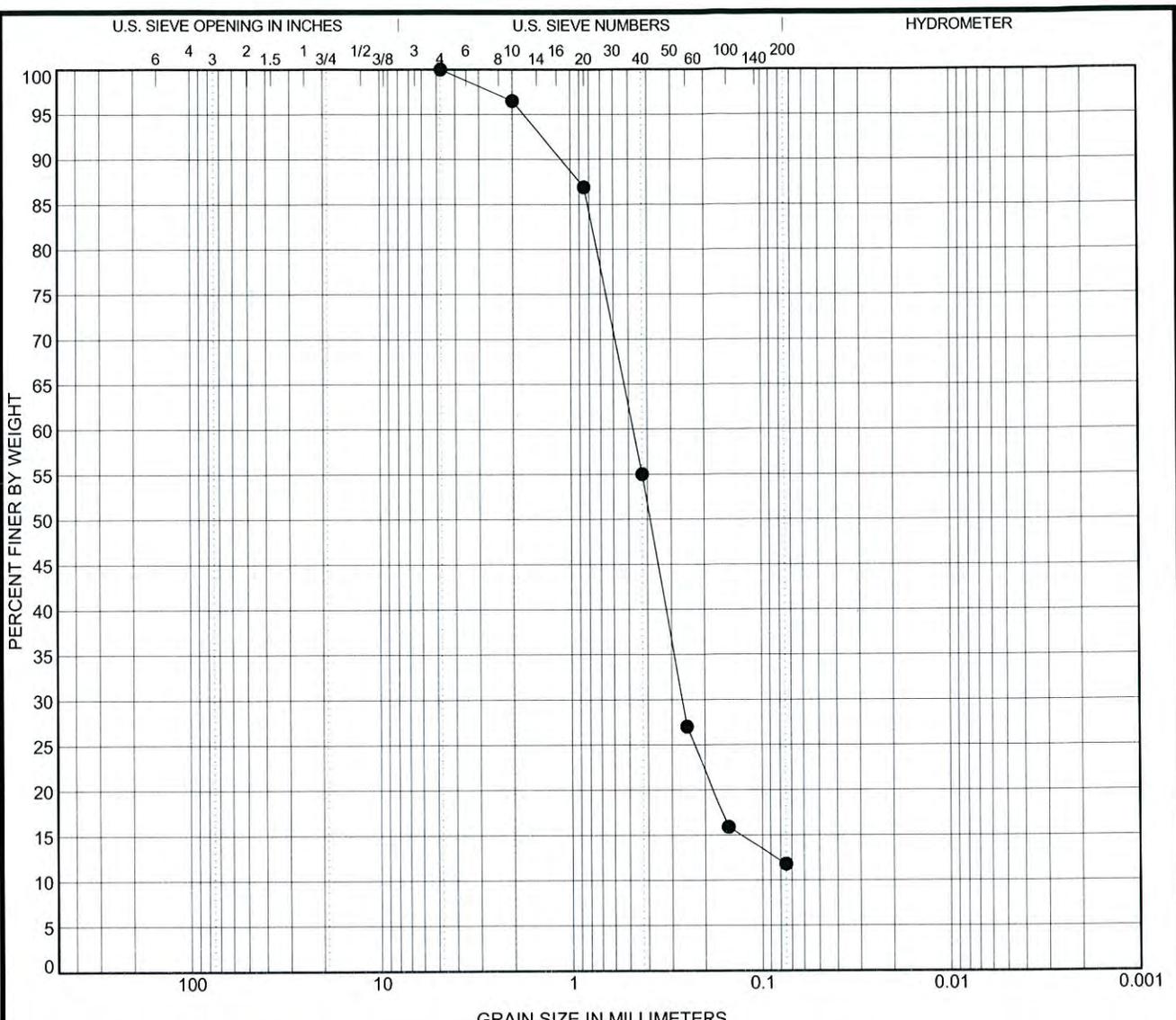
**GRADATION CURVE**

**Project:** Old Wormley Creek Sanitary Sewer

York County, VA

**Contract:** 11633065

SIEVE 1/SHEET - 11633065 DRAFT LOGS.GPJ - SCHNABEL DATA TEMPLATE 2008.04.22.GDT - 8/31/11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

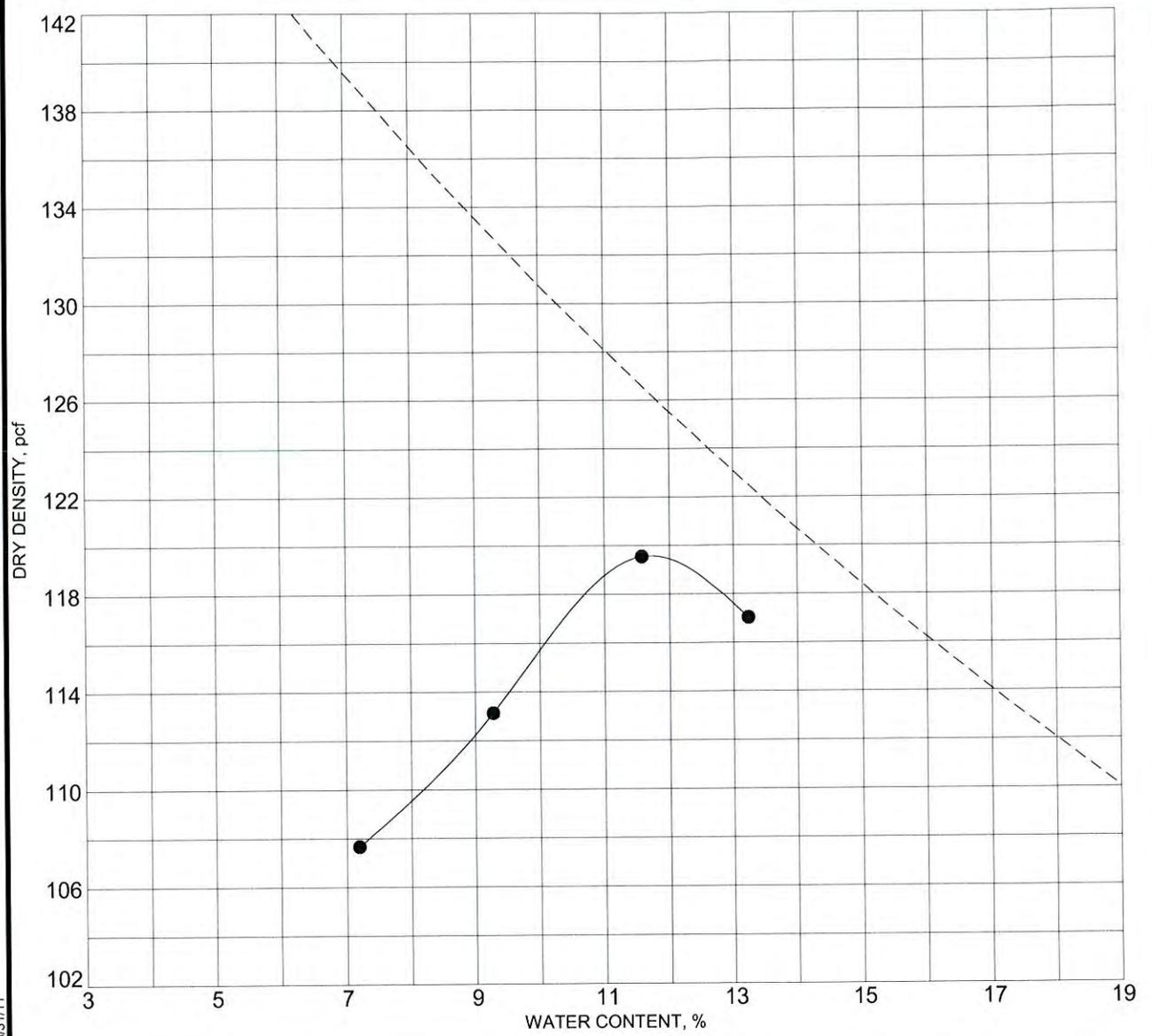
Specimen	Sample Description	LL	PL	PI	Cc	Cu		
B-09	0.5 ft WELL GRADED SAND WITH SILT (SW-SM), fine to coarse grained, contains asphalt, trace gravel and crushed stone, orange-brown	NP	NP	NP	2.67	8.56		
Test Method	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
ASTM D422	4.75	0.474	0.265		0.0	88.2		11.8

Percent Finer							
Sieve Size	No. 200	No. 100	No. 60	No. 40	No. 20	No. 10	No. 4
% Finer	11.8	15.9	27.0	55.0	86.9	96.5	100.0



**GRADATION CURVE**  
**Project:** Old Wormley Creek Sanitary Sewer  
 York County, VA  
**Contract:** 11633065

COMPACTION 11633065 DRAFT LOGS.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 8/31/11



Sample Description: SANDY LEAN CLAY (CL), trace crushed stone, gray

Sample Source: B-01, 0.3 ft

Test Methods: ASTM D698 Method A

Assumed Specific Gravity: 2.65

Max. Dry Density (pcf): 119.7

Opt. Moisture (%): 12.0

Liquid Limit (LL): 25

Plasticity Index (PI): 12

% Retained #4 Sieve:

% Passing # 200 Sieve: 51.6

Comments:



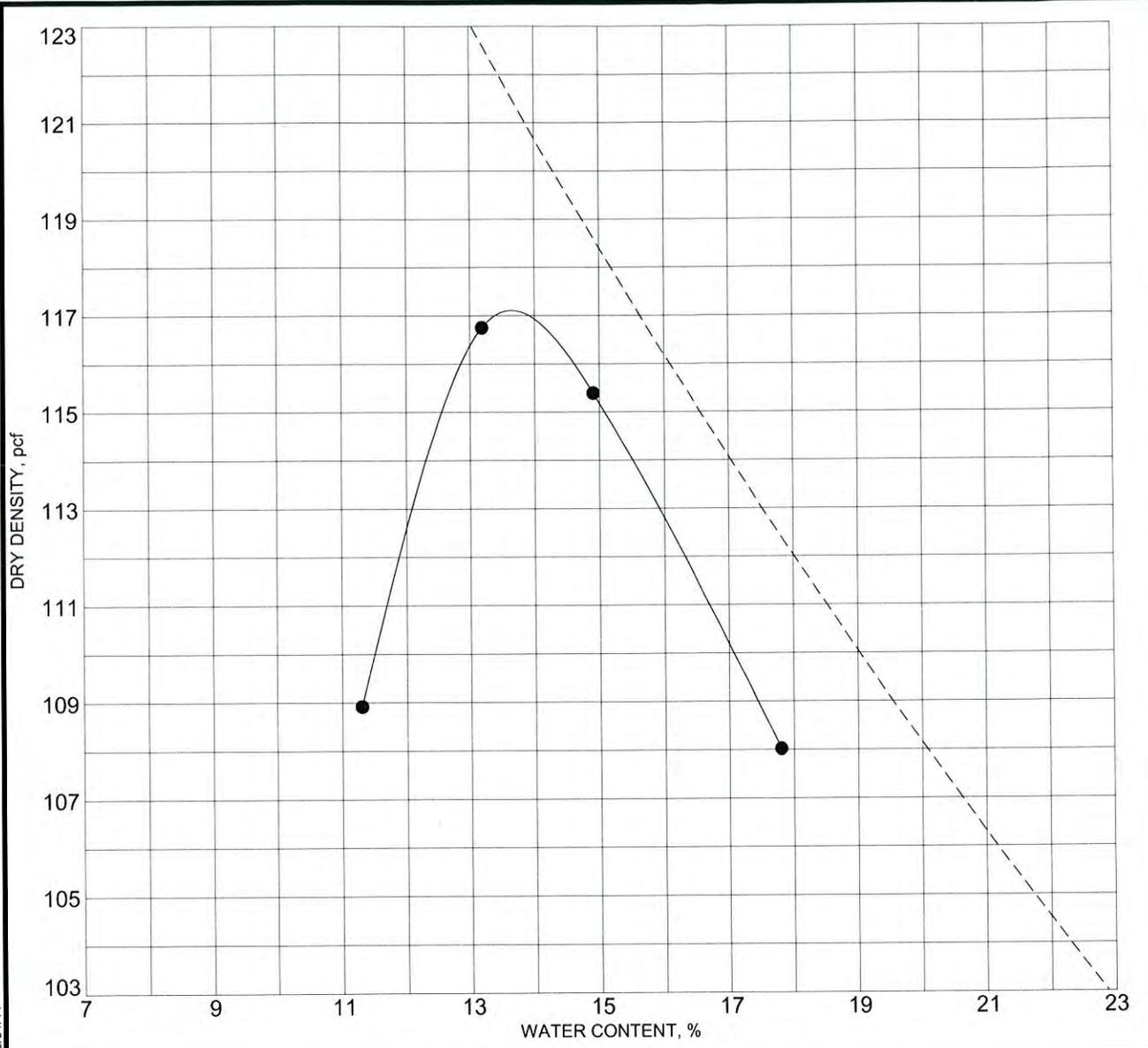
**MOISTURE DENSITY RELATIONSHIP**

**Project:** Old Wormley Creek Sanitary Sewer

York County, VA

**Contract:** 11633065

COMPACTION: 11633065 DRAFT LOGS.GPJ SCHNABEL DATA TEMPLATE 2008\_04\_22.GDT 8/31/11



Sample Description: CLAYEY SAND (SC), fine to medium grained, trace crushed stone, orange-brown

Sample Source: B-02, 0.5 ft

Test Methods: ASTM D698 Method A

Assumed Specific Gravity: 2.65

Max. Dry Density (pcf): 117.0

Opt. Moisture (%): 13.6

Liquid Limit (LL): 28

Plasticity Index (PI): 13

% Retained #4 Sieve:

% Passing # 200 Sieve: 44.9

Comments:

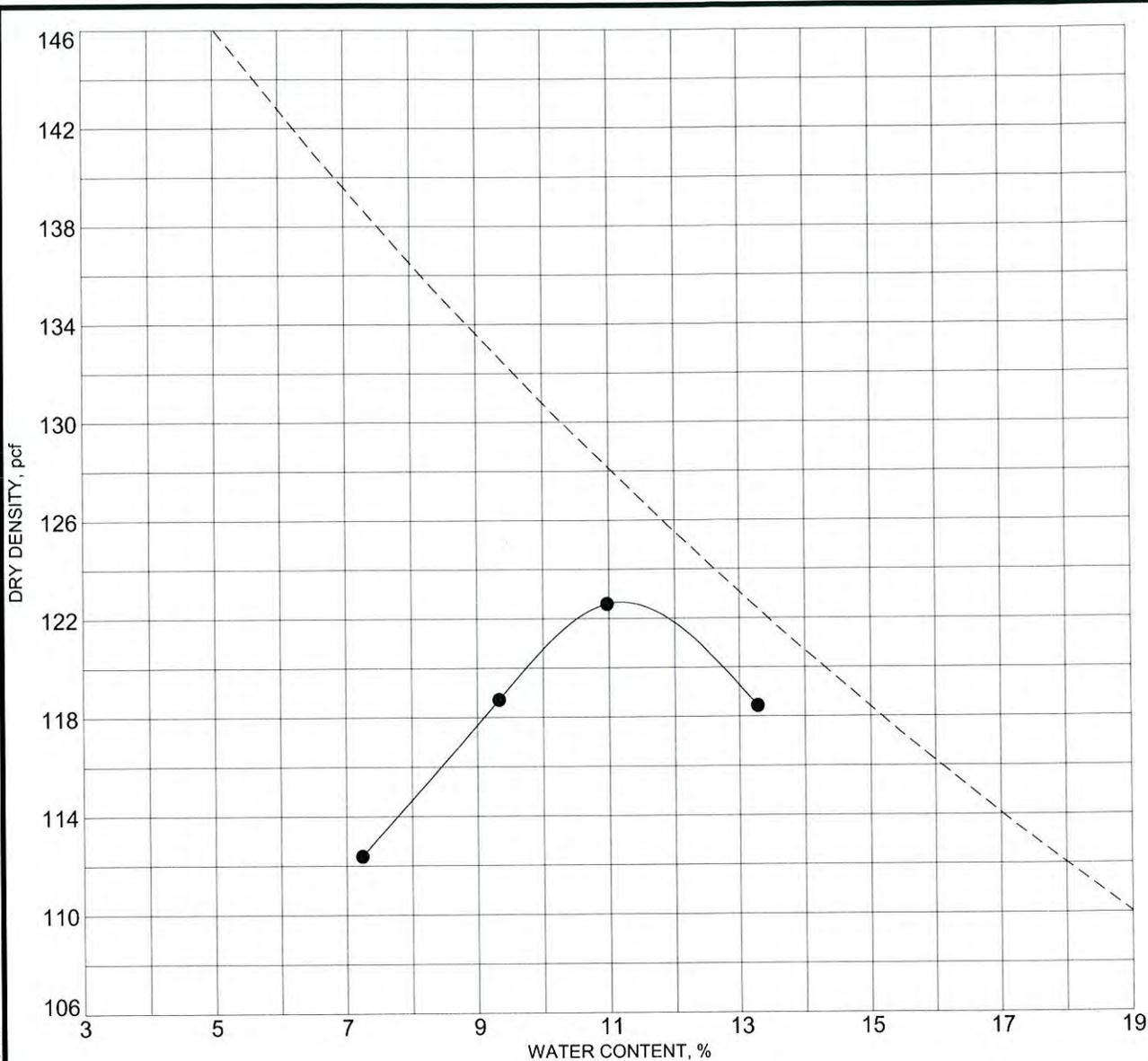


**MOISTURE DENSITY RELATIONSHIP**

Project: Old Wormley Creek Sanitary Sewer

York County, VA

Contract: 11633065



COMPACTION 11633065 DRAFT LOGS.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 8/31/11

Sample Description: CLAYEY SAND (SC), fine to coarse grained, trace crushed stone, brown

Sample Source: B-05, 0.2 ft

Test Methods: ASTM D698 Method A

Assumed Specific Gravity: 2.65

Max. Dry Density (pcf): 122.9

Opt. Moisture (%): 11.5

Liquid Limit (LL): 28

Plasticity Index (PI): 10

% Retained #4 Sieve:

% Passing # 200 Sieve: 45.6

Comments:



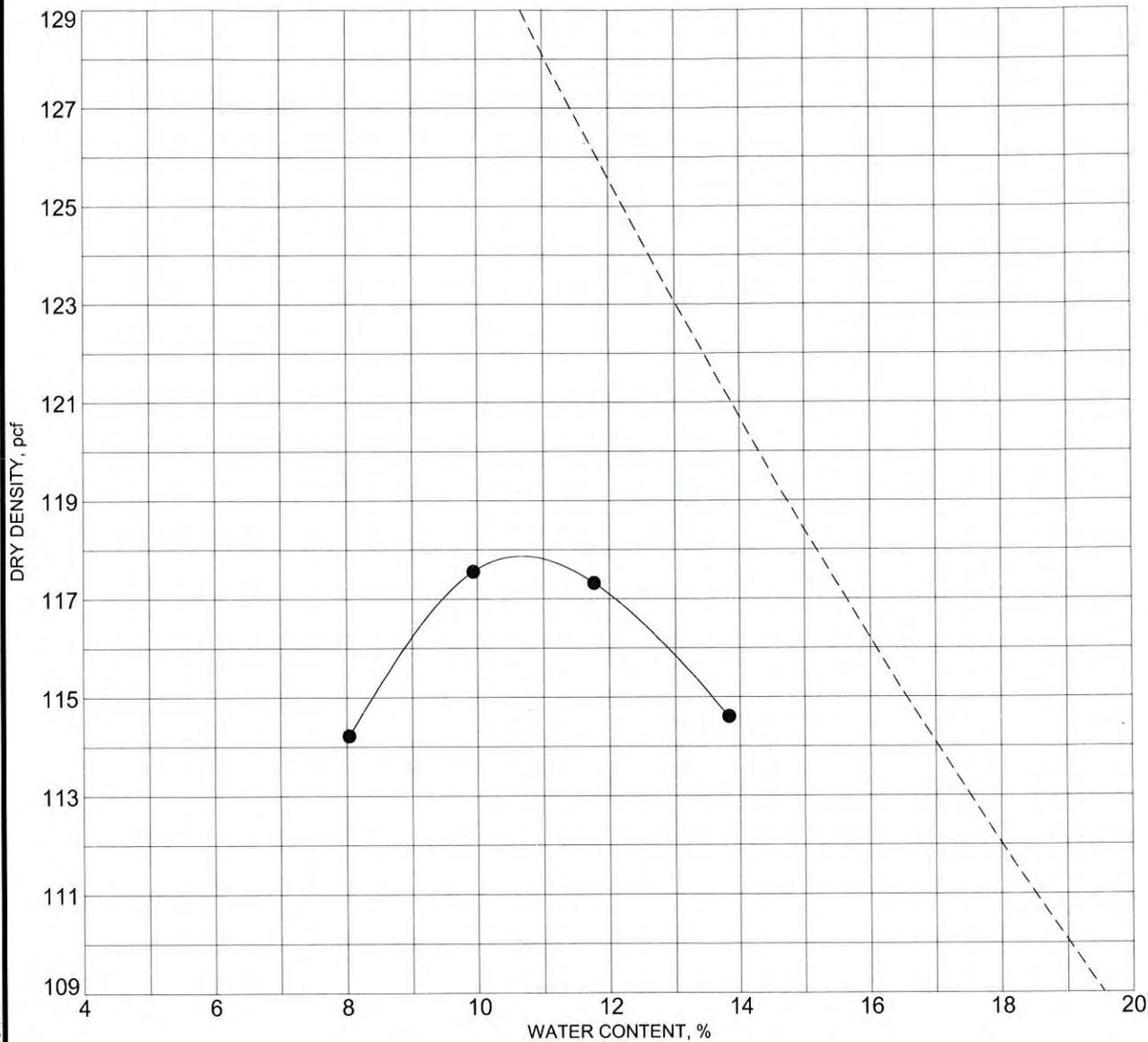
**MOISTURE DENSITY RELATIONSHIP**

Project: Old Wormley Creek Sanitary Sewer

York County, VA

Contract: 11633065

COMPACTION 11633065 DRAFT LOGS.GPJ SCHNABEL DATA TEMPLATE 2008.04 22.GDT 8/31/11



Sample Description: SILTY SAND (SM), fine to medium grained, trace gravel, brown

Sample Source: B-07, 0.5 ft

Test Methods: ASTM D698 Method A

Assumed Specific Gravity: 2.65

Max. Dry Density (pcf): 117.8

Opt. Moisture (%): 10.6

Liquid Limit (LL): NP

Plasticity Index (PI): NP

% Retained #4 Sieve:

% Passing # 200 Sieve: 12.8

Comments:

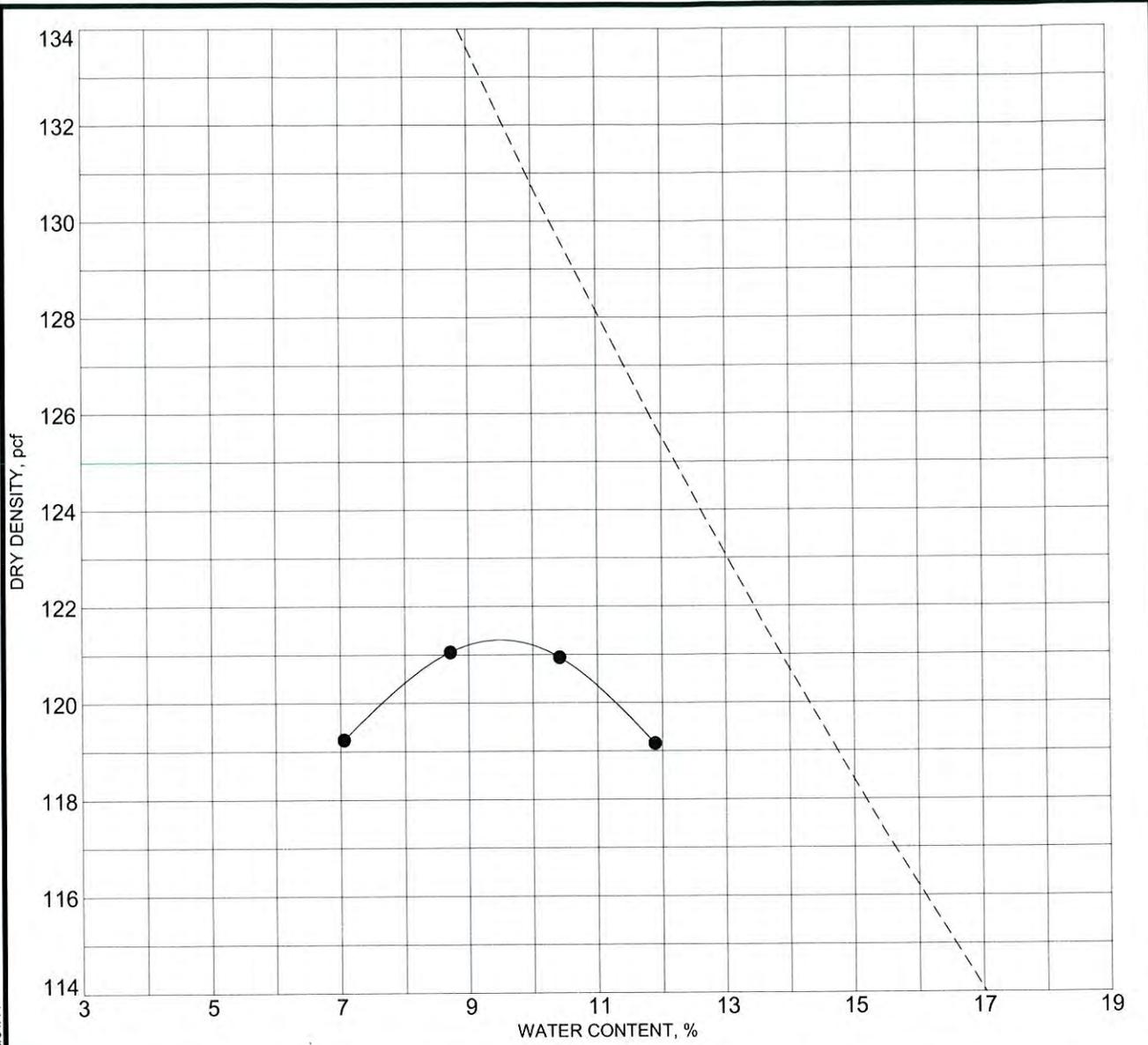


**MOISTURE DENSITY RELATIONSHIP**

Project: Old Wormley Creek Sanitary Sewer

York County, VA

Contract: 11633065



COMPACTION - 11633065 DRAFT LOGS.GPJ SCHNABEL DATA TEMPLATE 2008\_04\_22.GDT 8/31/11

Sample Description: WELL GRADED SAND WITH SILT (SW-SM), fine to coarse grained, contains asphalt, trace gravel and crushed stone, orange-brown

Sample Source: B-09, 0.5 ft

Test Methods: ASTM D698 Method A

Assumed Specific Gravity: 2.65

Max. Dry Density (pcf): 121.3

Opt. Moisture (%): 9.5

Liquid Limit (LL): NP

Plasticity Index (PI): NP

% Retained #4 Sieve: 0.0

% Passing # 200 Sieve: 11.8

Comments:

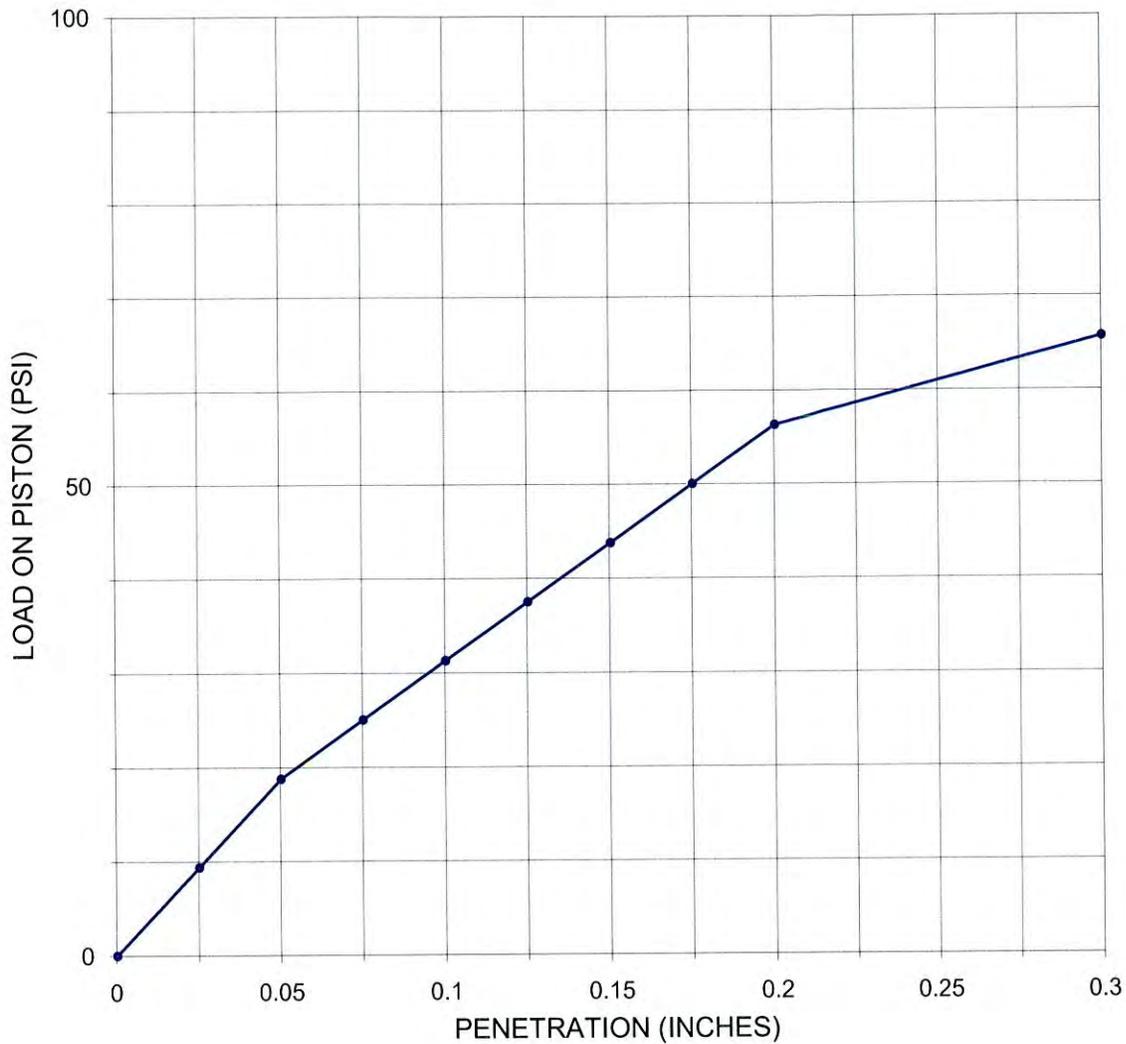


**MOISTURE DENSITY RELATIONSHIP**

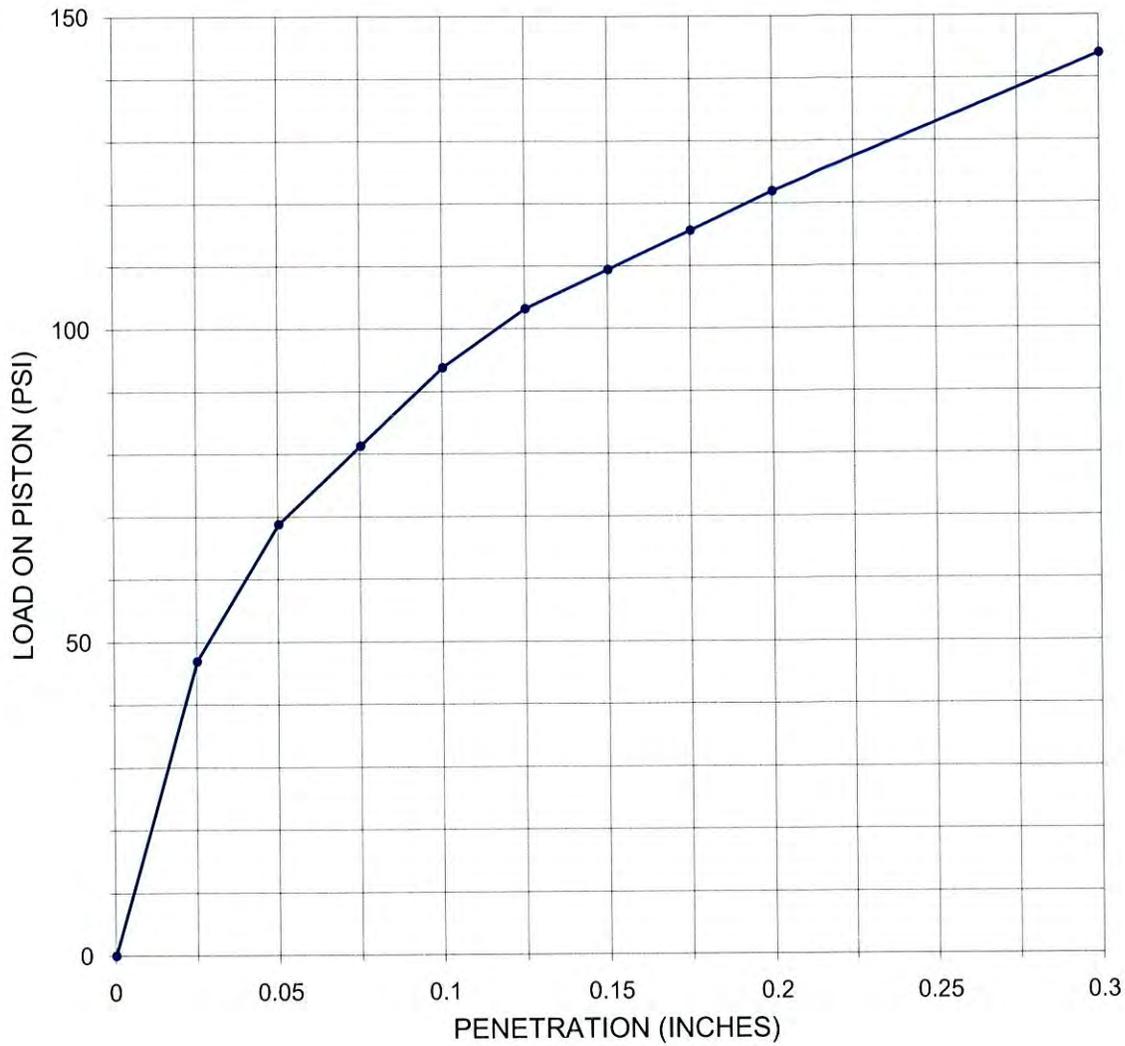
Project: Old Wormley Creek Sanitary Sewer

York County, VA

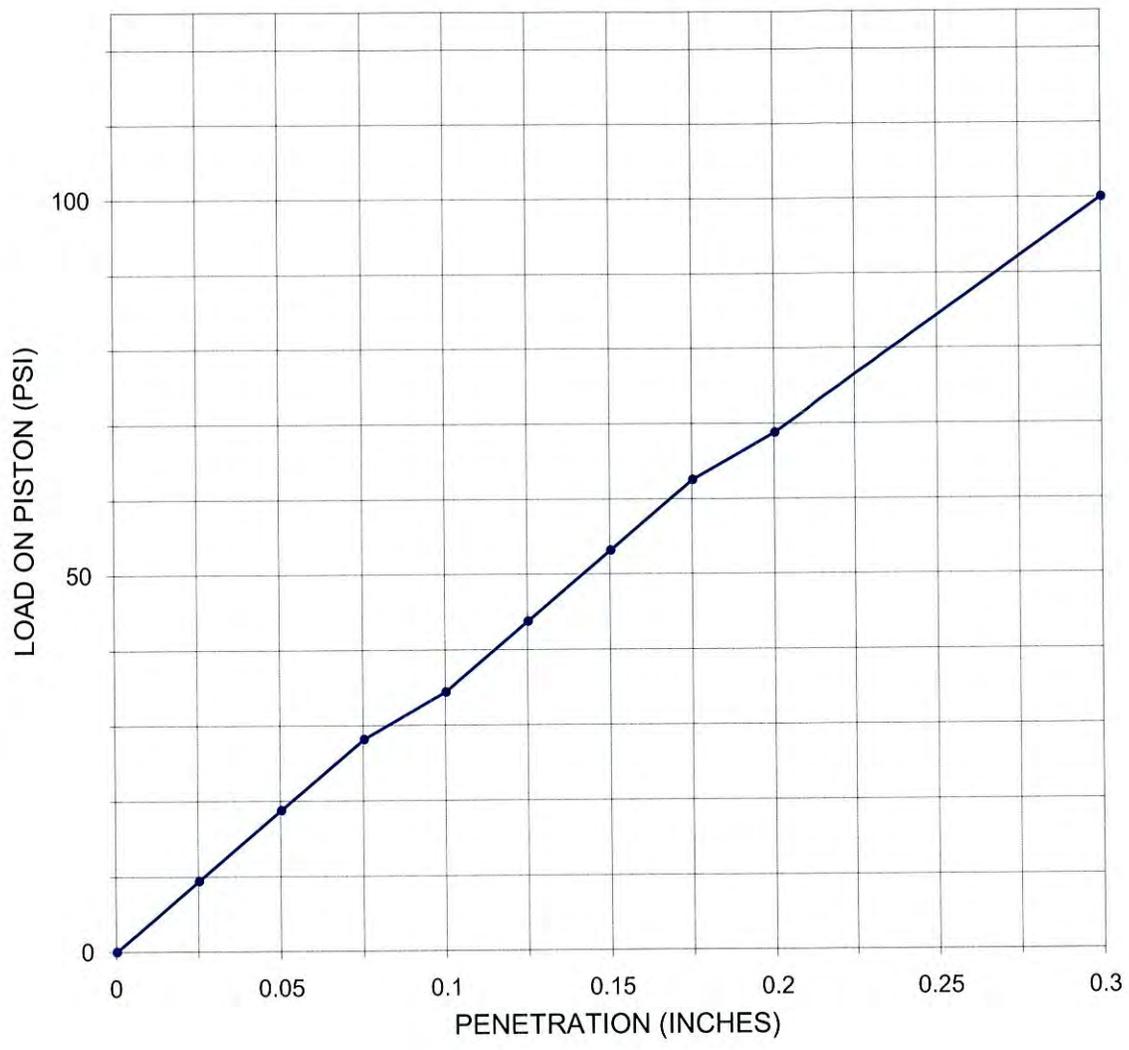
Contract: 11633065



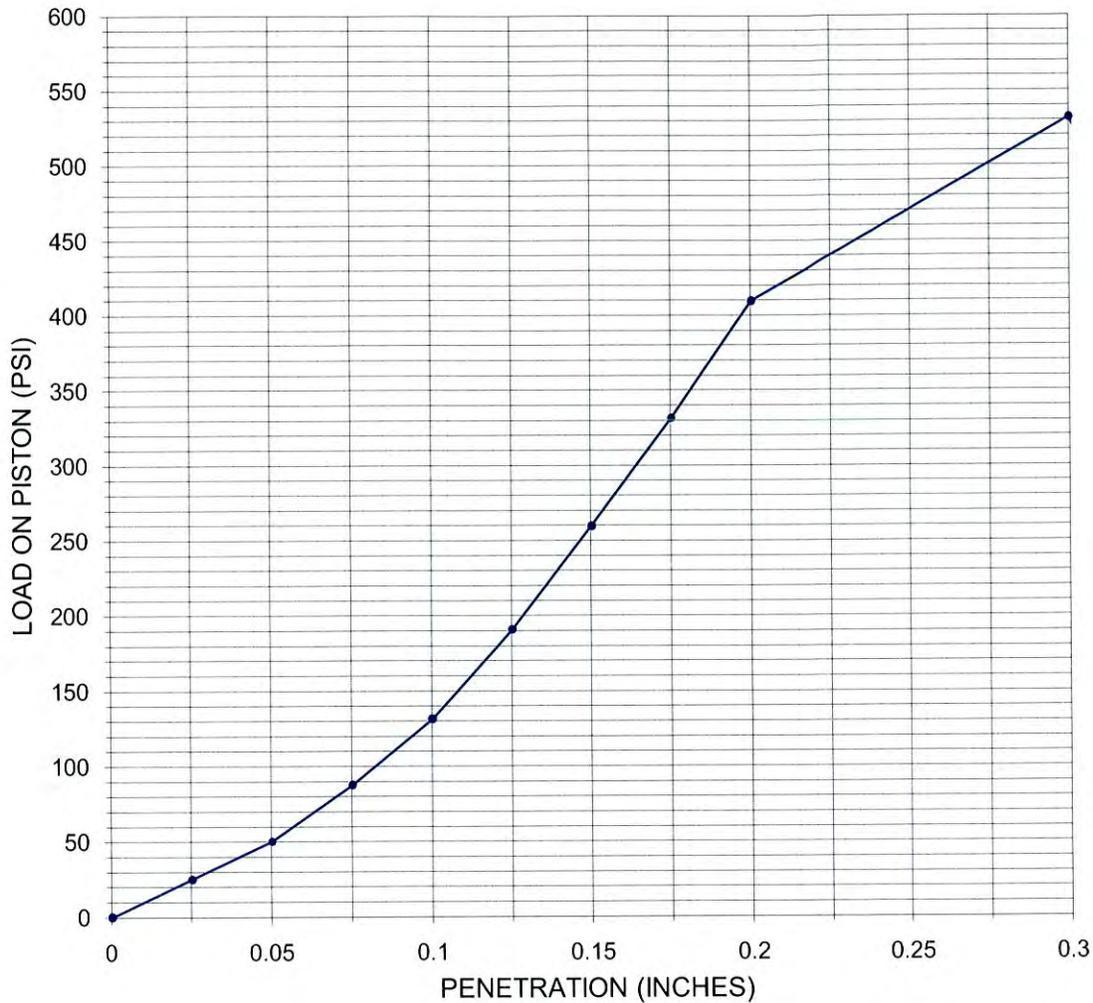
Sample No.: B1	SOURCE: ON SITE	SPECIFICATION: ASTM D 1883
DESCRIPTION OF SAMPLE: SANDY LEAN CLAY (CL), trace crushed stone, gray		<b>SCHNABEL ENGINEERING</b>  <b>CALIFORNIA BEARING RATIO TEST</b>
CBR (SOAKED): 3.1	SWELL: 0.30%	
DRY DENSITY, PCF BEFORE SOAKING: 119.7	MOISTURE CONTENT, % BEFORE SOAKING: 12.3%	PROJECT: Old Wormley Creek Sanitary Sewer York County, Virginia
MAX DRY DENSITY: 119.7	OPT. MOISTURE: 12.0%	DATE: 08/29/11   CONTRACT NO. 11633065



Sample No.: B2	SOURCE: ON SITE	SPECIFICATION: ASTM D 1883
DESCRIPTION OF SAMPLE: CLAYEY SAND (SC), fine to medium grained, trace crushed stone, orange-brown		<b>SCHNABEL ENGINEERING</b>
CBR (SOAKED): 9.4	SWELL: 0.30%	
DRY DENSITY, PCF BEFORE SOAKING: 113.6	MOISTURE CONTENT, % BEFORE SOAKING: 12.6%	PROJECT: Old Wormley Creek Sanitary Sewer York County, Virginia
MAX DRY DENSITY: 117.0	OPT. MOISTURE: 13.6%	DATE: 08/29/11   CONTRACT NO. 11633065

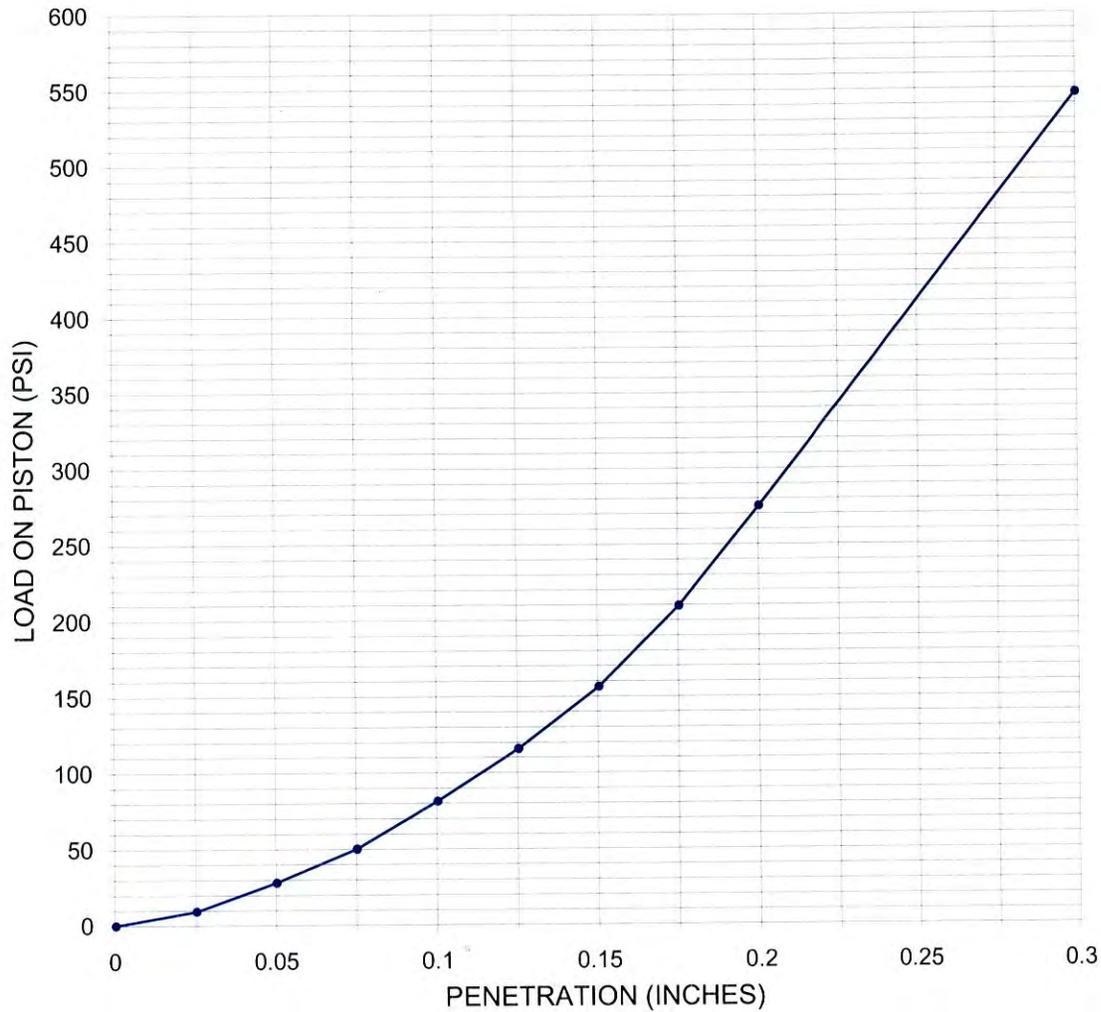


Sample No.: B5	SOURCE: ON SITE	SPECIFICATION: ASTM D 1883
DESCRIPTION OF SAMPLE: CLAYEY SAND (SC), fine to coarse grained, trace crushed stone, brown		<b>SCHNABEL ENGINEERING</b>
CBR (SOAKED): 3.4	SWELL: 0.30%	
DRY DENSITY, PCF BEFORE SOAKING: 120.2	MOISTURE CONTENT, % BEFORE SOAKING: 11.1%	PROJECT: Old Wormley Creek Sanitary Sewer York County, Virginia
MAX DRY DENSITY: 122.9	OPT. MOISTURE: 11.5%	DATE: 08/29/11   CONTRACT NO. 11633065



Sample No.: B7	SOURCE: ON SITE	SPECIFICATION: ASTM D 1883
DESCRIPTION OF SAMPLE: SILTY SAND (SM), fine to medium grained, trace gravel, brown		<b>SCHNABEL ENGINEERING</b>
CBR (SOAKED): 28.5**	SWELL: 0.00%	<b>CALIFORNIA BEARING RATIO TEST</b>
DRY DENSITY, PCF BEFORE SOAKING: 114.9	MOISTURE CONTENT, % BEFORE SOAKING: 10.7%	PROJECT: Old Wormley Creek Sanitary Sewer York County, Virginia
MAX DRY DENSITY: 117.8	OPT. MOISTURE: 10.6%	DATE: 08/29/11   CONTRACT NO. 11633065

Note - \*\* Corrected per ASTM D1883



Sample No.: B9	SOURCE: ON SITE	SPECIFICATION: ASTM D 1883
DESCRIPTION OF SAMPLE: WELL GRADED SAND WITH SILT (SW-SM), fine to coarse grained, contains asphalt, trace gravel and crushed stone, orange-brown		<b>SCHNABEL ENGINEERING</b>
CBR (SOAKED): 21.0**	SWELL: 0.00%	
DRY DENSITY, PCF BEFORE SOAKING: 120.1	MOISTURE CONTENT, % BEFORE SOAKING: 9.5%	PROJECT: Old Wormley Creek Sanitary Sewer York County, Virginia
MAX DRY DENSITY: 121.3	OPT. MOISTURE: 9.5%	DATE: 08/29/11   CONTRACT NO. 11633065

Note - \*\* Corrected per ASTM D1883

## **APPENDIX B**

# **SUBSURFACE EXPLORATION DATA**

Subsurface Exploration Procedures  
General Notes for Subsurface Exploration Logs  
Identification of Soils  
Test Boring Logs (B-01 through B-11)

## **SUBSURFACE EXPLORATION PROCEDURES**

### **Boring Procedures**

Drillers advanced the borings using mud rotary drilling. With mud rotary drilling techniques, driller's mud is used to maintain an open borehole. The hole is advanced by using a nominal 3-inch O.D. tri-cone roller bit. At the designated depth, drillers removed the roller bit and perform the Standard Penetration Test. Water level data indicated on the logs may not be indicative of actual groundwater levels because of the presence of drilling fluid in the borehole. The logs indicate water level data.

### **Standard Penetration Test Results**

The numbers in the Sampling Data column of the boring logs represent Standard Penetration Test (SPT) results. Each number represents the blows needed to drive a two-inch O.D., 1 $\frac{3}{8}$  inch I.D. split-spoon sampler six inches, using a 140-pound hammer falling 30 inches. The sampler is typically driven a total of 18 or 24 inches. The first six inch interval usually represents a seating interval. The total of the number of blows for the second and third six-inch intervals is the SPT "N value." When the blow count reaches 100 before the full driving distance, we determine the SPT N value based on extrapolation of the blows recorded. The SPT is conducted according to ASTM D1586.

### **Soil Classification Criteria**

The group symbols on the logs represent the Unified Soil Classification System Group Symbols (ASTM D2487) based on visual observation and limited laboratory testing of the samples. Criteria for visual identification of soil samples are included in this appendix. Some variation may be expected between samples visually classified and samples classified in the laboratory.

### **Pocket Penetrometer Results**

The values following "PP=" in the Sampling Data column of the logs represent pocket penetrometer readings. Pocket penetrometer readings provide an estimate of the unconfined compressive strength of fine-grained soils.

### **Water Observation Wells**

Our drilling subcontractor installed temporary water observation wells in Borings B-01, B-04, B-08 and B-11 by inserting a hand-slotted, 1 $\frac{1}{4}$ -inch PVC pipe in each of these borings. Each pipe was capped, and the area surrounding the pipe was backfilled with cuttings from the boring.

### **Boring Locations and Elevations**

The borings locations were staked in the field with handheld GPS equipment prior to drilling. Figure 1 shows the approximate boring locations. Ground surface elevations at the boring locations with the exception of Boring B-01 were provided by O'Brien and Gere. The ground surface elevation at Boring B-01 was not available at the time this report was prepared. Project planning should consider these locations and elevations no more accurate than the methods and plans used to obtain them.

# GENERAL NOTES FOR SUBSURFACE EXPLORATION LOGS

1. Numbers in sampling data column next to Standard Penetration Test (SPT) symbols indicate blows required to drive a 2-inch O.D., 1 $\frac{1}{8}$ -inch I.D. sampling spoon 6 inches using a 140 pound hammer falling 30 inches. The Standard Penetration Test (SPT) N value is the number of blows required to drive the sampler 12 inches, after a 6-inch seating interval. The Standard Penetration Test is performed in general accordance with ASTM D1586.
2. Visual classification of soil is in accordance with terminology set forth in "Identification of Soil." The ASTM D2487 group symbols (e.g., CL) shown in the classification column are based on visual observations.
3. Estimated water levels indicated on the logs are only estimates from available data and may vary with precipitation, porosity of the soil, site topography, and other factors.
4. Refusal at the surface of rock, boulder, or other obstruction is defined as an SPT resistance of 100 blows for 2 inches or less of penetration.
5. The logs and related information depict subsurface conditions only at the specific locations and at the particular time when drilled or excavated. Soil conditions at other locations may differ from conditions occurring at these locations. Also, the passage of time may result in a change in the subsurface soil and water level conditions at the subsurface exploration location.
6. The stratification lines represent the approximate boundary between soil and rock types as obtained from the subsurface exploration. Some variation may also be expected vertically between samples taken. The soil profile, water level observations and penetration resistances presented on these logs have been made with reasonable care and accuracy and must be considered only an approximate representation of subsurface conditions to be encountered at the particular location.
7. Key to symbols and abbreviations:



S-1, SPT  
5+10+1

Sample No., Standard Penetration Test  
Number of blows in each 6-inch increment



UD-1, UNDIST  
Rec=24", 100%

Sample No., 2" or 3" Undisturbed Tube Sample  
Recovery in inches, Percent Recovery



C-1, CORE  
Run = 5.0 ft  
REC = 60", 100%  
RQD = 60", 100%  
MC  
PP  
FD  
PD  
GP  
LL  
PL  
TPH

Core No., Rock Core  
Run length in feet  
Recovery in inches, Percent Recovery  
RQD in inches, Percent RQD  
Moisture Content  
Pocket Penetrometer Reading (tsf)  
Flame Ionization Detector Reading (ppm)  
Photoionization Detector Reading (ppm)  
Geostick Penetration Reading (inches)  
Liquid Limit  
Plastic Limit  
Total Petroleum Hydrocarbons

# IDENTIFICATION OF SOIL

## I. DEFINITION OF SOIL GROUP NAMES (ASTM D2487)

		SYMBOL	GROUP NAME
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels – More than 50% of coarse fraction retained on No. 4 sieve Coarse, ¾" to 3" Fine, No. 4 to ¾"	Clean Gravels Less than 5% fines	GW WELL GRADED GRAVEL
			GP POORLY GRADED GRAVEL
		Gravels with fines More than 12% fines	GM SILTY GRAVEL
			GC CLAYEY GRAVEL
	Sands – 50% or more of coarse Fraction passes No. 4 sieve Coarse, No. 10 to No. 4 Medium, No. 40 to No. 10 Fine, No. 200 to No. 40	Clean Sands Less than 5% fines	SW WELL GRADED SAND
			SP POORLY GRADED SAND
		Sands with fines More than 12% fines	SM SILTY SAND
			SC CLAYEY SAND
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays – Liquid Limit less than 50 Low to medium plasticity	Inorganic	CL LEAN CLAY
			ML SILT
		Organic	OL ORGANIC CLAY ORGANIC SILT
	Silts and Clays – Liquid Limit 50 or more Medium to high plasticity	Inorganic	CH FAT CLAY
			MH ELASTIC SILT
		Organic	OH ORGANIC CLAY ORGANIC SILT
Highly Organic Soils	Primarily organic matter, dark in color and organic odor	PT	PEAT

## II. DEFINITION OF SOIL COMPONENT PROPORTIONS (ASTM D2487)

		Examples
Adjective Form	GRAVELLY SANDY	>30% to <50% coarse grained component in a fine-grained soil
	CLAYEY SILTY	>12% to <50% fine grained component in a coarse-grained soil
"With"	WITH GRAVEL WITH SAND	>15% to <30% coarse grained component in a fine-grained soil
	WITH GRAVEL WITH SAND	>15% to <50% coarse grained component in a coarse-grained soil
	WITH SILT WITH CLAY	>5% to <12% fine grained component in a coarse-grained soil
		GRAVELLY LEAN CLAY
		SILTY SAND
		FAT CLAY WITH GRAVEL
		POORLY GRADED GRAVEL WITH SAND
		POORLY GRADED SAND WITH SILT

## III. GLOSSARY OF MISCELLANEOUS TERMS

<b>SYMBOLS</b> .....	Unified Soil Classification Symbols are shown above as group symbols. A dual symbol "-" indicates the soil belongs to two groups. A borderline symbol "/" indicates the soil belongs to two possible groups.
<b>FILL</b> .....	Man-made deposit containing soil, rock and often foreign matter.
<b>PROBABLE FILL</b> .....	Soils which contain no visually detected foreign matter but which are suspect with regard to origin.
<b>DISINTEGRATED ROCK (DR)</b> .....	Residual materials with a standard penetration resistance (SPT) between 60 blows per foot and refusal. Refusal is defined as a SPT of 100 blows for 2" or less penetration.
<b>PARTIALLY WEATHERED ROCK (PWR)</b> .....	Residual materials with a standard penetration resistance (SPT) between 100 blows per foot and refusal. Refusal is defined as a SPT of 100 blows for 2" or less penetration.
<b>BOULDERS &amp; COBBLES</b> .....	Boulders are considered rounded pieces of rock larger than 12 inches, while cobbles range from 3 to 12 inch size.
<b>LENSES</b> .....	0 to ½ inch seam within a material in a test pit.
<b>LAYERS</b> .....	½ to 12 inch seam within a material in a test pit.
<b>POCKET</b> .....	Discontinuous body within a material in a test pit.
<b>MOISTURE CONDITIONS</b> .....	Wet, moist or dry to indicate visual appearance of specimen.
<b>COLOR</b> .....	Overall color, with modifiers such as light to dark or variation in coloration.



Project: Old Wormley Creek Sanitary Sewer  
York County, Virginia

Boring Number: **B-01**  
Contract Number: 11633065  
Sheet: 1 of 1

Contractor: Fishburne Drilling, Inc.  
Chesapeake, Virginia  
Contractor Foreman: J. Rassio  
Schnabel Representative: R. Rountree  
Equipment: CME-75  
Method: 2-15/16" O.D. Tri-cone Roller Bit

**Groundwater Observations**

	Date	Time	Depth	Casing	Caved
Encountered	7/15	1:21 PM	2.0'	---	---
After Drilling	7/15	1:50 PM	3.7'	---	19.2'
Temporary Well	7/18	9:35 AM	6.9'	---	---

Hammer Type: Safety Hammer (140 lb)  
Dates Started: 7/15/11 Finished: 7/15/11  
X: 12069634.651 ft Y: 3601293.969 ft

Ground Surface Elevation: Total Depth: 20.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.3	Asphalt	FILL		A		S-1 5+5+4+3 REC=16", 67%	LL = 25 PL = 13 MC = 13.1% % Passing #200 = 51.6 PP = 1.75 tsf PP = 0.50 tsf	FILL
1.8	FILL, sampled as silty sand, fine to medium grained sand; moist, brown, estimated 5 - 10% shells	CL		B2		S-2 1+1+2+2 REC=22", 92%		TABB FORMATION
4.0	SANDY LEAN CLAY; moist, brown Change: wet	CH		B2	5	S-3 2+2+6+8 REC=24", 100%	MC = 13.9% PP = 4.25 tsf	Bulk sample collected from 0.3 to 5 ft.
6.0	SANDY FAT CLAY; moist, mottled orangish brown	SC		B1		S-4 8+11+11+10 REC=20", 83%		
8.0	CLAYEY SAND, fine to coarse grained sand; wet, light brown, estimated <5% fine gravel	CL		B2	10	S-5 4+6+6+7 REC=20", 83%	PP = 1.00 tsf	
12.0	SANDY LEAN CLAY; wet, light brown	SM		B1	15	S-6 3+4+4+4 REC=18", 75%		
17.0	SILTY SAND, fine to medium grained sand; wet, light brown, contains lean clay layers	SP				S-7 3+5+8+8 REC=20", 83%		
20.0	POORLY GRADED SAND, fine to medium grained sand; wet, light brown, estimated <5% silt				20			

Bottom of Boring at 20.0 ft.  
Piezometer installed upon completion.  
Ground Surface Elevation not available.

TEST BORING LOG 11633065.GPJ SCHNABEL DATA TEMPLATE 2008\_07\_06.GDT 9/9/11



Project: Old Wormley Creek Sanitary Sewer  
York County, Virginia

Boring Number: **B-02**  
Contract Number: 11633065  
Sheet: 1 of 1

Contractor: Fishburne Drilling, Inc.  
Chesapeake, Virginia  
Contractor Foreman: J. Rassio  
Schnabel Representative: R. Rountree  
Equipment: CME-75  
Method: 2-15/16" O.D. Tri-cone Roller Bit  
  
Hammer Type: Safety Hammer (140 lb)  
Dates Started: 7/15/11 Finished: 7/15/11  
X: 12071586.419 ft Y: 3601890.604 ft  
  
Ground Surface Elevation: 50± (ft) Total Depth: 20.0 ft

Groundwater Observations						
	Date	Time	Depth	Casing	Caved	
Encountered	7/15	11:22 AM	12.0'	---	---	
After Drilling	7/15	11:36 AM	5.6'	---	19.5'	

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.5	Asphalt; 1 1/2 - inches asphalt and 4 - inches base course	CL	49.3			S-1 12+5+6+7 REC=16", 67%	PP = 1.50 tsf LL = 28 PL = 15 MC = 12.7% % Passing #200 = 44.9 MC = 14.3% PP = 2.50 tsf	TABB FORMATION
2.0	SANDY LEAN CLAY; moist, mottled orangish brown	CH	47.8	B2	5	S-2 5+7+6+9 REC=24", 100%	PP = 3.25 tsf	Bulk sample collected from 0.5 to 5 ft.
	SANDY FAT CLAY; moist, mottled orangish brown					S-3 6+6+9+10 REC=24", 100%		
6.0	SILTY SAND, fine to medium grained sand; moist, orangish brown	SM	43.8	B1		S-4 9+11+11+10 REC=22", 92%	PP = 1.25 tsf	YORKTOWN FORMATION
8.0	FAT CLAY WITH SAND; moist, mottled orangish brown, contains silty sand layers, ironite	CH	41.8	B2	10	S-5 9+9+6+10 REC=20", 83%		
12.0	CLAYEY SAND, fine to medium grained sand; wet, orangish brown, contains ironite	SC	37.8	B1		S-6 2+1+1+1 REC=22", 92%		
14.9	SILTY SAND, fine to coarse grained sand; wet, orangish brown, estimated 15 - 25% shells	SM	34.9	C1	15	S-7 8+13+16+7 REC=18", 75%		
	Change: estimated 5 - 10% shells, estimated 15 - 25% fine gravel							
20.0	Bottom of Boring at 20.0 ft. Boring backfilled with cuttings upon completion.							

TEST BORING LOG 11633065.GPJ SCHNABEL DATA TEMPLATE 2008\_07\_06.GDT 9/9/11



Project: Old Wormley Creek Sanitary Sewer  
York County, Virginia

Boring Number: **B-03**  
Contract Number: 11633065  
Sheet: 1 of 1

Contractor: Fishburne Drilling, Inc.  
Chesapeake, Virginia  
Contractor Foreman: J. Rassio  
Schnabel Representative: R. Rountree  
Equipment: CME-75  
Method: 2-15/16" O.D. Tri-cone Roller Bit

**Groundwater Observations**

	Date	Time	Depth	Casing	Caved
After Drilling	7/15	12:36 PM	3.4'	---	14.2'

Hammer Type: Safety Hammer (140 lb)  
Dates Started: 7/15/11 Finished: 7/15/11  
X: 12071583.252 ft Y: 3601093.44 ft

Ground Surface Elevation: 55± (ft) Total Depth: 15.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.4	Asphalt; 3/4 - inches asphalt and 4 1/2 - inches base course	CH	54.3	B2		S-1 14+6+7+9 REC=20", 83%	PP =4.25 tsf	TABB FORMATION
2.0	FAT CLAY WITH SAND; moist, mottled orangish gray	SC	52.7			S-2 8+12+16+18 REC=24", 100%		
	CLAYEY SAND, fine to coarse grained sand; moist, grayish brown				5	S-3 14+12+18+14 REC=24", 100%	LL = 32 PL = 15 MC = 14.3% % Passing #200 = 46.5 PP = 3.75 tsf PP =3.75 tsf	
5.0	Change: SANDY	SP-SM	49.7		S-4 9+12+13+14 REC=24", 100%			
6.0	POORLY GRADED SAND WITH SILT, fine to medium grained sand; moist, brown	SC	48.7	B1		S-5 8+10+13+12 REC=22", 92%		
	CLAYEY SAND, fine to medium grained sand; moist, mottled orangish brown					10		
12.0	SILTY SAND, fine to medium grained sand; moist, mottled orangish brown	SM	42.7			S-6 9+7+10+10 REC=22", 92%		
15.0			39.7		15			

Bottom of Boring at 15.0 ft.  
Boring backfilled with cuttings upon completion.

TEST BORING LOG 11633065.GPJ SCHNABEL DATA TEMPLATE 2008\_07\_06.GDT 9/9/11



Project: Old Wormley Creek Sanitary Sewer  
York County, Virginia

Boring Number: **B-04**  
Contract Number: 11633065  
Sheet: 1 of 1

Contractor: Fishburne Drilling, Inc.  
Chesapeake, Virginia  
Contractor Foreman: J. Rassio  
Schnabel Representative: R. Rountree  
Equipment: CME-75  
Method: 2-15/16" O.D. Tri-cone Roller Bit

**Groundwater Observations**

	Date	Time	Depth	Casing	Caved
Encountered	7/15	10:15 AM	12.0'	---	---
After Drilling	7/15	10:20 AM	13.1'	---	19.6'
Temporary Well	7/18	9:17 AM	13.4'	---	---

Hammer Type: Safety Hammer (140 lb)  
Dates Started: 7/15/11 Finished: 7/15/11  
X: 12072069.258 ft Y: 3601745.618 ft

Ground Surface Elevation: 40± (ft) Total Depth: 20.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRA TUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.4	Asphalt; 1/2 - inch asphalt and 4 - inches base course SILTY SAND, fine to coarse grained sand; moist, brown Change: orangish brown	SM	39.4			S-1 11+10+10+8 REC=20", 83%	LL = NP MC = 10.0% % Passing #200 = 13.5	TABB FORMATION
					5	S-2 6+5+6+5 REC=24", 100%		
						S-3 6+5+5+4 REC=24", 100%		
6.0	POORLY GRADED SAND, fine to medium grained sand; moist, orangish brown, estimated <5% silt Change: SAND, fine to coarse grained sand	SP	33.8	B1		S-4 4+4+4+4 REC=22", 92%		
					10	S-5 3+4+5+7 REC=20", 83%		
12.0	CLAYEY SAND, fine to coarse grained sand; wet, orangish brown	SC	27.8			S-6 2+4+3+1 REC=24", 100%	YORKTOWN FORMATION	
14.0	SILTY SAND, fine to medium grained sand; wet, orangish brown, estimated 5 - 10% shells Change: SAND, fine to coarse grained sand; light orangish brown, estimated 15 - 25% shells	SM	25.8	C1		S-7 5+4+5+3 REC=22", 92%		
					15			
20.0	Bottom of Boring at 20.0 ft. Piezometer installed upon completion.		19.8		20			

TEST BORING LOG 11633065.GPJ SCHNABEL DATA TEMPLATE 2008\_07\_06.GDT 9/9/11



**Schnabel TEST BORING LOG**  
ENGINEERING

Project: Old Wormley Creek Sanitary Sewer  
York County, Virginia

Boring Number: **B-05**  
Contract Number: 11633065  
Sheet: 1 of 1

Contractor: Fishburne Drilling, Inc.  
Chesapeake, Virginia  
Contractor Foreman: J. Rasio  
Schnabel Representative: R. Rountree  
Equipment: CME-75  
Method: 2-15/16" O.D. Tri-cone Roller Bit  
  
Hammer Type: Safety Hammer (140 lb)  
Dates Started: 7/15/11 Finished: 7/15/11  
X: 12072460.118 ft Y: 3601108.173 ft  
  
Ground Surface Elevation: 34± (ft) Total Depth: 15.0 ft

Groundwater Observations						
	Date	Time	Depth	Casing	Caved	
Encountered	7/15	9:01 AM	6.0'	---	---	
After Drilling	7/15	9:18 AM	3.9'	---	13.6'	

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.5	Asphalt; 1 3/4 - inches asphalt and 3 - inches base course	FILL	33.3	A			LL = 28 PL = 18 MC = 13.5% % Passing #200 = 45.6 PP = 1.25 tsf PP = 0.75 tsf	FILL TABB FORMATION  Bulk sample collected from 0.5 to 5 ft.
0.7	FILL, sampled as lean clay with sand; moist, dark grayish brown, contains wood, burnt wood	CL	33.1	B2	S-1 6+5+4 REC=16", 89%			
2.0	LEAN CLAY WITH SAND; moist, mottled orangish brown	SC	31.8		S-2 5+5+5+5 REC=18", 75%			
	CLAYEY SAND, fine to medium grained sand; moist, brown			5	S-3 4+5+6+7 REC=20", 83%			
6.0	POORLY GRADED SAND, fine to coarse grained sand; wet, orangish brown, estimated <5% silt		27.8	B1	S-4 7+7+6+9 REC=24", 100%			
	Change: SAND, fine to coarse grained sand	SP		10	S-5 3+4+5+6 REC=20", 83%			
12.0	SILTY SAND, fine to coarse grained sand; wet, banded orangish gray, estimated 5 - 10% shells	SM	21.8				YORKTOWN FORMATION	
15.0			18.8	C1	S-6 12+15+14+11 REC=20", 83%			

Bottom of Boring at 15.0 ft.  
Boring backfilled with cuttings upon completion.

TEST BORING LOG 11633065.GPJ SCHNABEL DATA TEMPLATE 2008\_07\_06.GDT 9/9/11



**TEST BORING LOG**

Project: Old Wormley Creek Sanitary Sewer  
York County, Virginia

Boring Number: **B-06**  
Contract Number: 11633065  
Sheet: 1 of 1

Contractor: Fishburne Drilling, Inc.  
Chesapeake, Virginia  
Contractor Foreman: J. Rasio  
Schnabel Representative: R. Rountree  
Equipment: CME-75  
Method: 2-15/16" O.D. Tri-cone Roller Bit  
  
Hammer Type: Safety Hammer (140 lb)  
Dates Started: 7/14/11 Finished: 7/14/11  
X: 12072963.449 ft Y: 3601709.305 ft  
  
Ground Surface Elevation: 30± (ft) Total Depth: 20.0 ft

Groundwater Observations						
	Date	Time	Depth	Casing	Caved	
Encountered	7/14	3:11 PM	12.0'	---	---	
After Drilling	7/14	3:23 PM	5.6'	---	12.9'	

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.3	Asphalt		29.3					TABB FORMATION
2.0	POORLY GRADED SAND, fine to medium grained sand; moist, brown, estimated <5% silt	SP	27.6			S-1 6+8+8 REC=16", 89%		
4.0	POORLY GRADED SAND WITH SILT, fine to medium grained sand; moist, brown	SP-SM	25.6			S-2 2+3+4+4 REC=24", 100%		
	POORLY GRADED SAND, fine to coarse grained sand; moist, light brown, estimated <5% silt			5		S-3 3+4+3+4 REC=24", 100%		
	Change: orangish gray, estimated <5% fine gravel	SP		B1		S-4 3+3+4+5 REC=24", 100%	LL = NP MC = 12.6% % Passing #200 = 3.1	
12.0	POORLY GRADED SAND WITH SILT, fine to medium grained sand; wet, orangish brown, estimated 15 - 25% shells	SP-SM	17.6			S-5 4+5+7+10 REC=24", 100%		YORKTOWN FORMATION
17.0	SILTY SAND, fine to medium grained sand; wet, greenish gray, estimated 5 - 10% shells	SM	12.6			S-6 6+5+1+1 REC=5", 21%		
20.0			9.6			S-7 7+11+10+11 REC=24", 100%		

Bottom of Boring at 20.0 ft.  
Boring backfilled with cuttings upon completion.

TEST BORING LOG 11633065.GPJ SCHNABEL DATA TEMPLATE 2008.07.06.GDT 9/9/11



**Schnabel** TEST BORING LOG  
ENGINEERING

Project: Old Wormley Creek Sanitary Sewer  
York County, Virginia

Boring Number: **B-07**  
Contract Number: 11633065  
Sheet: 1 of 1

Contractor: Fishburne Drilling, Inc.  
Chesapeake, Virginia  
Contractor Foreman: J. Rasio  
Schnabel Representative: R. Rountree  
Equipment: CME-75  
Method: 2-15/16" O.D. Tri-cone Roller Bit

Hammer Type: Safety Hammer (140 lb)  
Dates Started: 7/14/11 Finished: 7/14/11  
X: 12073964.671 ft Y: 3602365.491 ft

Ground Surface Elevation: 27± (ft) Total Depth: 20.0 ft

**Groundwater Observations**

	Date	Time	Depth	Casing	Caved
Encountered	7/14	2:00 PM	12.0'	---	---
After Drilling	7/14	2:18 PM	4.6'	---	5.1'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.3	Asphalt, 4 1/2 - inches asphalt		26.9					
	POORLY GRADED SAND, fine to medium grained sand; moist, brown, estimated <5% silt Change: orangish brown	SP		B1	5	S-1 13+10+9 REC=18", 100% S-2 5+6+5+6 REC=24", 100% S-3 5+7+9+10 REC=24", 100% S-4 5+5+7+7 REC=24", 100% S-5 2+3+7+10 REC=24", 100%	LL = NP MC = 6.3% % Passing #200 = 12.8	TABB FORMATION  Bulk sample collected from 0.3 to 5 ft.
9.0	FAT CLAY WITH SAND; moist, mottled orangish brown	CH	18.2	B2	10		MC = 31.5% PP = 0.75 tsf	
12.0	CLAYEY SAND, fine grained sand; wet, gray	SC	15.2	B1	15	S-6 WOH+11/12"+1 REC=4", 17%	LL = 38 PL = 20 MC = 40.8% % Passing #200 = 36.7	
17.0	SILTY SAND, fine to medium grained sand; wet, greenish gray, estimated <5% shells	SM	10.2	C1		S-7 4+5+9+11 REC=24", 100%		YORKTOWN FORMATION
20.0			7.2		20			

Bottom of Boring at 20.0 ft.  
Boring backfilled with cuttings upon completion.

TEST BORING LOG 11633065.GPJ, SCHNABEL DATA TEMPLATE 2008\_07\_06.GDT 9/9/11



**TEST BORING LOG**

Project: Old Wormley Creek Sanitary Sewer  
York County, Virginia

Boring Number: **B-08**  
Contract Number: 11633065  
Sheet: 1 of 2

Contractor: Fishburne Drilling, Inc.  
Chesapeake, Virginia  
Contractor Foreman: J. Rassio  
Schnabel Representative: R. Rountree  
Equipment: CME-75  
Method: 2-15/16" O.D. Tri-cone Roller Bit

Hammer Type: Safety Hammer (140 lb)  
Dates Started: 7/14/11 Finished: 7/14/11  
X: 12073951.079 ft Y: 3602902.884 ft

**Groundwater Observations**

	Date	Time	Depth	Casing	Caved
Encountered	7/14	12:10 PM	12.0'	---	---
After Drilling	7/14	1:30 PM	6.2'	---	23.4'
Temporary Well	7/15	7:18 AM	6.6'	---	---
Temporary Well	7/18	9:00 AM	6.7'	---	---

Ground Surface Elevation: 29± (ft) Total Depth: 25.0 ft

TEST BORING LOG 11633065.GPJ SCHNABEL DATA TEMPLATE 2008\_07\_06.GDT 9/9/11

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.3	Asphalt; 4 - inches asphalt		28.9					TABB FORMATION
2.0	POORLY GRADED SAND, fine to medium grained sand; moist, brown, estimated <5% silt	SP	27.2			S-1 13+9+5 REC=16", 89%		
	SILTY SAND, fine to medium grained sand; moist, orangish brown	SM				S-2 2+2+3+2 REC=24", 100%		
4.0	POORLY GRADED SAND, fine to medium grained sand; moist, orangish brown, estimated <5% silt		25.2		5	S-3 5+3+4+3 REC=24", 100%		
				B1		S-4 3+3+4+4 REC=24", 100%		
					10	S-5 3+3+4+4 REC=24", 100%		
12.0	POORLY GRADED SAND WITH SILT, fine to medium grained sand; wet, orangish brown	SP	17.2			S-6 5+4+3+3 REC=24", 100%		
		SP-SM			15			
17.0	SILTY SAND, fine grained sand; wet, greenish gray, estimated <5% shells		12.2			S-7 4+5+9+14 REC=24", 100%	LL = NP MC = 29.4% % Passing #200 = 14.2	YORKTOWN FORMATION
		SM		C1	20	S-8 4+7+11+14 REC=24", 100%		

(continued)



**Schnabel** TEST  
ENGINEERING BORING  
LOG

Project: Old Wormley Creek Sanitary Sewer  
York County, Virginia

Boring Number: **B-08**  
Contract Number: 11633065  
Sheet: 2 of 2

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRA TUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
25.0	Bottom of Boring at 25.0 ft. Piezometer installed upon completion.		4.2					



**Schnabel** TEST BORING LOG  
ENGINEERING

Project: Old Wormley Creek Sanitary Sewer  
York County, Virginia

Boring Number: **B-09**  
Contract Number: 11633065  
Sheet: 1 of 1

Contractor: Fishburne Drilling, Inc.  
Chesapeake, Virginia  
Contractor Foreman: J. Rassio  
Schnabel Representative: R. Rountree  
Equipment: CME-75  
Method: 2-15/16" O.D. Tri-cone Roller Bit

Hammer Type: Safety Hammer (140 lb)  
Dates Started: 7/14/11 Finished: 7/14/11  
X: 12073915.576 ft Y: 3603305.669 ft

**Groundwater Observations**

	Date	Time	Depth	Casing	Caved
Encountered	7/14	12:02 PM	8.0'	---	---
After Drilling	7/14	12:20 PM	4.7'	---	18.8'

Ground Surface Elevation: 27± (ft) Total Depth: 20.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.3	Asphalt; 4 - inches asphalt		26.4					TABB FORMATION  Bulk sample collected from 0.3 to 5 ft.
	POORLY GRADED SAND, fine to medium grained sand; moist, brown, estimated <5% silt	SP				S-1 8+6+5 REC=18", 100%	LL = NP MC = 4.2% % Passing #200 = 11.8 MC = 7.8%	
4.0	POORLY GRADED SAND WITH SILT, fine to coarse grained sand; moist, orangish brown, estimated 5 - 10% fine gravel	SP-SM	22.7		5	S-2 4+4+4+4 REC=24", 100%		
6.0	POORLY GRADED SAND, fine to medium grained sand; moist, light brown, estimated <5% silt	SP	20.7	B1		S-3 9+10+11+11 REC=24", 100%	MC = 11.2%	
8.0	POORLY GRADED SAND WITH SILT, fine to medium grained sand; wet, light brown	SP-SM	18.7		10	S-4 5+6+7+8 REC=24", 100%		
12.0	LEAN CLAY WITH SAND; wet, gray	CL	14.7	B2		S-5 6+7+7+8 REC=24", 100%	PP = 0.25 tsf	YORKTOWN FORMATION
17.0	SILTY SAND, fine to medium grained sand; wet, greenish gray, estimated 5 - 10% shells	SM	9.7	C1		S-6 1+1+2+1 REC=24", 100%		
20.0			6.7		20	S-7 3+5+9+12 REC=24", 100%		

Bottom of Boring at 20.0 ft.  
Boring backfilled with cuttings upon completion.

TEST BORING LOG 11633065.GPJ, SCHNABEL DATA TEMPLATE 2008\_07\_06.GDT 9/9/11



**Schnabel** TEST BORING LOG  
ENGINEERING

Project: Old Wormley Creek Sanitary Sewer  
York County, Virginia

Boring Number: **B-10**  
Contract Number: 11633065  
Sheet: 1 of 1

Contractor: Fishburne Drilling, Inc.  
Chesapeake, Virginia  
Contractor Foreman: J. Rassio  
Schnabel Representative: R. Rountree  
Equipment: CME-75  
Method: 2-15/16" O.D. Tri-cone Roller Bit

Hammer Type: Safety Hammer (140 lb)  
Dates Started: 7/14/11 Finished: 7/14/11  
X: 12073833.564 ft Y: 3604102.549 ft

**Groundwater Observations**

	Date	Time	Depth	Casing	Caved
Encountered	7/14	10:12 AM	12.0'	---	---
After Drilling	7/14	11:34 AM	6.7'	---	19.9'

Ground Surface Elevation: 17± (ft) Total Depth: 20.0 ft

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.5	Asphalt; 6 1/2 - inches asphalt		16.8					TABB FORMATION
2.0	POORLY GRADED SAND WITH SILT, fine to medium grained sand; moist, brown	SP-SM	15.3			S-1 11+8+9 REC=18", 100%		
	SILTY SAND, fine to medium grained sand; moist, brown	SM				S-2 14+11+11+8 REC=20", 83%		
4.0	CLAYEY SAND, fine to coarse grained sand; moist, orangish brown	SC	13.3		5	S-3 7+7+7+6 REC=22", 92%	MC = 11.5%	
6.0	SILTY SAND, fine to medium grained sand; moist, yellowish brown	SM	11.3			S-4 5+6+7+6 REC=24", 100%		
	Change: brown			B1		S-5 2+4+4+5 REC=24", 100%		
	Change: wet, orangish brown				10			
						S-6 2+1+1+2 REC=24", 100%	LL = 37 PL = 26 MC = 38.9% % Passing #200 = 26.2	
					15			
17.0	SILTY SAND, fine to medium grained sand; wet, greenish gray, estimated <5% shells	SM	0.3			S-7 4+6+8+11 REC=24", 100%		YORKTOWN FORMATION
20.0			-2.7	C1	20			

Bottom of Boring at 20.0 ft.  
Boring backfilled with cuttings upon completion.

TEST BORING LOG 11633065.GPJ SCHNABEL DATA TEMPLATE 2008\_07\_06.GDT 9/9/11



**Schnabel** TEST BORING LOG  
ENGINEERING

Project: Old Wormley Creek Sanitary Sewer  
York County, Virginia

Boring Number: **B-11**  
Contract Number: 11633065  
Sheet: 1 of 2

Contractor: Fishburne Drilling, Inc.  
Chesapeake, Virginia  
Contractor Foreman: J. Rasio  
Schnabel Representative: R. Rountree  
Equipment: CME-75  
Method: 2-15/16" O.D. Tri-cone Roller Bit  
Hammer Type: Safety Hammer (140 lb)  
Dates Started: 7/14/11 Finished: 7/14/11  
X: 12073789.786 ft Y: 3604651.305 ft  
Ground Surface Elevation: 9± (ft) Total Depth: 40.0 ft

Groundwater Observations						
	Date	Time	Depth	Casing	Caved	
Encountered	7/14	9:40 AM	6.0'	---	---	
After Drilling	7/14	10:28 AM	1.9'	---	36.8'	
Temporary Well	7/15	7:18 AM	6.6'	---	---	
Temporary Well	7/18	8:44 AM	6.6'	---	---	

TEST BORING LOG 11633065.GPJ SCHNABEL DATA TEMPLATE 2008\_07\_06.GDT 9/9/11

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRA TUM	SAMPLING		TESTS	REMARKS
					DEPTH	DATA		
0.2	Rootmat and topsoil		8.8			S-1 4+9+9+11 REC=2", 8%		TABB FORMATION Crushed stone in vicinity of boring.
	SILTY SAND, fine to medium grained sand; moist, orangish brown					S-2 8+6+7+5 REC=22", 92%		
					5	S-3 4+4+4+3 REC=24", 100%		
	Change: wet					S-4 2+3+3+2 REC=24", 100%		
					10	S-5 1+1+1+2 REC=24", 100%		
	Change: brown					S-6 1+1/12"+1 REC=24", 100%		
		SM		B1		S-7 1+1+1+1 REC=24", 100%	LL = 34 PL = 28 MC = 40.5% % Passing #200 = 27.2	
					15			
22.0	CLAYEY SAND, fine to medium grained sand; wet, brown, estimated 5 - 10% shells		-13.0			S-8 2+2+4+6 REC=24", 100%		YORKTOWN FORMATION
	Change: greenish gray	SC		C1				

(continued)



**Schnabel** TEST BORING LOG  
ENGINEERING

Project: Old Wormley Creek Sanitary Sewer  
York County, Virginia

Boring Number: **B-11**  
Contract Number: 11633065  
Sheet: 2 of 2

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DATA		TESTS	REMARKS
					DEPTH	DATA		
27.0	CLAYEY SAND, fine to medium grained sand; wet, brown, estimated 5 - 10% shells (continued)	SC	-18.0	C1			PP = 2.00 tsf	YORKTOWN FORMATION
	SANDY LEAN CLAY; wet, greenish gray, estimated 15 - 25% shells	CL		C2	30	S-9 3+3+3+6 REC=24", 100%		
32.0	CLAYEY SAND, fine to medium grained sand; wet, greenish gray, estimated 15 - 25% shells	SC	-23.0		35	S-10 4+5+6+9 REC=24", 100%		
37.0	SILTY SAND, fine to medium grained sand; wet, greenish gray, estimated <5% shells	SM	-28.0	C1		S-11 5+5+5+6 REC=24", 100%		
40.0			-31.0		40			

Bottom of Boring at 40.0 ft.  
Piezometer installed upon completion.

TEST BORING LOG 11633065.GPJ SCHNABEL DATA TEMPLATE 2008\_07\_06.GDT 9/9/11