Project Manual
for
Queens Lake Sanitary Sewer Project
Contract 3 – Pump Station

December 2009

IFB No. 1731

York County
VIRGINIA
America's Future Since 1781

These Bid Documents refer to the Hampton Roads Planning District Commission's Regional Construction Standards, Fourth Edition, October 2006, including Publication Updates #1, #2, and #3.

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REGIONAL CONSTRUCTION STANDARDS
Fourth Edition

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PREFACE

THE *REGIONAL CONSTRUCTION STANDARDS*

The Cities and Counties that make up the Region of Hampton Roads, Virginia have recognized the need to develop uniform construction standards for improvements in public rights of way. The initial direction is to address "horizontal" improvements and those involving the major elements of roadways, drainage and utilities (water distribution and wastewater collection). With a limited budget and a strong sense of urgency, the intent was to develop standards that would accommodate most of the "typical" construction projects in the region. Therefore, these documents are intended to support the majority of issues the communities face in building minor roads and utilities. Additional specifications and standard details, along with improvements to earlier versions, will be an ongoing effort.

The *Regional Construction Standards* are a reference document comprised of Technical Specifications, Standard Details and "Front-End" documents (the legal framework and administrative provisions for construction contracts). The user should normally prepare Construction Drawings and Special Provisions for individual projects. The Special Provisions are tied to the *Regional Construction Standards* by reference (Section 110) and should address any particular administrative, procedural, legal, or technical requirement of the project and/or the locality; supplemental or modified specifications and standard details; along with the appropriate completed bidding documentation. **The vast majority of the Standards (Technical Specifications and Standards Details) should NOT be reproduced when projects are bid for construction. Municipalities typically reproduce only the Front-End Documents, which include the Special Provisions (Section 110).**

These Standards were developed under the auspices of the Hampton Roads Planning District Commission (HRPDC) and represent a collaborated effort of the 16 communities that constitute the HRPDC, the Hampton Roads Sanitation District (HRSD), and the Hampton Roads Utility and Heavy Contractors Association (HRUHCA). Many municipal, HRSD and HRUHCA representatives have spent countless hours serving on committees that guided, edited, refined, and established these *Regional Construction Standards*. Designers, material suppliers, contractors, attorneys, purchasing agents and consulting engineers have provided timely and insightful comments, along with the Virginia Department of Transportation and the Virginia Department of Health.

While diligent effort has been made to provide reliable, accurate, and up-to-date information, neither the communities of Hampton Roads, HRPDC, or its consultants, can place a guarantee on the correctness of the data or information contained in this document. The authors and editors do hereby disclaim any responsibility or liability in connection with the use of these *Regional Construction Standards* or of any data or other information contained therein.

This document may be obtained electronically at www.hrpdc.org. or by purchasing a CD at the offices of the HRPDC. The front end documents are available in Microsoft Word software, while the technical specifications and standard details are available in Acrobat Reader (.pdf) format. The user must acknowledge all modifications to the *Regional Construction Standards* and should illustrate changes in the Front End documents using ~~strikethroughs~~ and **bold** for deletions and additions, respectively. The user is entirely responsible and completely liable for misrepresentations to this document.

Hampton Roads Planning District Commission

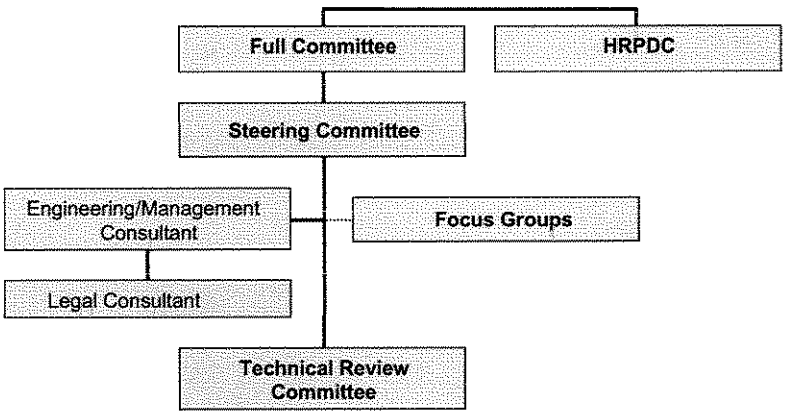
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PREFACE

ADMINISTRATIVE STRUCTURE

The Organizational Structure for the development and implementation of HRPDC's *Regional Construction Standards* is illustrated in the accompanying figure and briefly described below. A consultant has been used for technical, management and legal advice.



Program Administration
HRPDC is responsible for the administration of the financial and contractual issues for the continued implementation of the *Regional Construction Standards* program.

Full Committee
The Full Committee is the governing body for the project, which consists of one voting representative from each of the 16 cities and counties in the Hampton Roads Planning District. The Hampton Roads Sanitation District (HRSD), the Hampton Roads Utility and Heavy Contractors Association (HRUHCA), and Newport News Waterworks have also provided financial and technical support. The Virginia Department of Health - Division of Water Programs and the Virginia Department of Transportation (VDOT) participate in Full Committee meetings and provide comments. The Full Committee Chairman is a municipal public works or utilities representative who typically calls for meetings on an annual basis.

Municipalities are allowed to send as many individuals as they wish to Full Committee meetings. However, only the voting member designated by the City Manager or County Administrator, as appropriate, could represent the desires of the municipality on official voting issues.

Steering Committee
The Steering Committee consists of municipal representatives, inclusive of HRSD, Newport News Waterworks and HRUHCA who provide general direction on on-going activities and new initiatives for research and implementation by the Technical Review Committee. This committee typically meets on a semi-annual basis.

PREFACE

Technical Review Committee

Technical Review Committees (TRCs) were established by the Full Committee to provide technical reviews of the *Regional Construction Standards*. During the development of the First Edition, which was published in January 2000, three Technical Review Committees were formed and met on a regular basis. After the publication of the First Edition, only one TRC was needed to oversee technical issues associated with the entire document. In general, the TRC consists of municipal engineers from city Public Works and Public Utilities Departments; county utility agencies; HRSD; contractors; consultants; and, suppliers.

The TRC updates and edits the document and prepares new technical specification sections and standard details. The TRC collects information from jurisdictions with an emphasis on reviewing Special Provisions to determine common elements that could be incorporated into the future editions. The more comprehensive the *Regional Construction Standards* become, the fewer Special Provisions will be required for future projects. Typically, the TRC meets on a quarterly basis, but more frequently when the development of a new edition is forthcoming.

Focus Groups

At key stages of development, Focus Groups are convened to provide critical input. One group is comprised of City and County Attorneys and Purchasing Agents whose task was to review the front-end portion of the document. The second group has included consulting engineers, contractors, and suppliers who reviewed the entire First Edition document, with emphasis on the technical specifications and the standard details.

Want to get involved?

If you would like to help provide quality construction practices and simplify the bidding and construction administration process throughout the Hampton Roads region, HRPDC would like you to join one of the above described functions. Please e-mail DFarmer@ HRPDC.org or call 757-420-8300.

PREFACE

IMPORTANT NOTICES!

The *Regional Construction Standards* have reached a very usable level of maturity and future updated editions are anticipated approximately every three years. The time interval allows the users to become more familiar with the document, while the need for updating Special Provisions in each locality is greatly reduced to keep up with newer versions. When major edits are required, "Amendments" are considered for adoption and, once adopted, posted on the HRPDC Web Site. Notification of a recently adopted Amendment is e-mailed to the jurisdictions, which is responsible for including them in the Special Provisions of the Contract Documents for the particular project being constructed. Other users wishing to be notified via e-mail should contact HRPDC for inclusion on an e-mail tree. Continuing workshops and training sessions are also anticipated with construction inspectors, contractors and designers to facilitate the implementation of the document.

USE OF PROFESSIONAL ENGINEER'S SEAL

In Virginia, a professional engineer may only affix his seal to plans and specifications that he has either directly prepared or were prepared under his direct supervision. The seal indicates that the professional engineer has had complete control and direction over, and accepts responsibility for, the sealed work. (See *18 Va. C10-20-760*). Since the *Regional Construction Standards* were developed by consensus of committees comprised of experienced individuals representing various industry groups rather than under the complete direction and control of a professional engineer, the *Regional Construction Standards* are not sealed, nor would it be appropriate for the *Regional Construction Standards* to be sealed without reference to the application of the *Regional Construction Standards* to a specific project.

When a professional engineer prepares design documents for a specific project and incorporates the *Regional Construction Standards* into that design by reference, the professional engineer's seal of the particular plans, specifications and drawings for that project represents his approval of the *Regional Construction Standards* as incorporated by reference into such particular plans, specifications and drawings for such project. In other words, the professional engineer who stamps or seals any plans, specifications, reports or other documents incorporating the *Regional Construction Standards* by reference is responsible for assuring that such plans, and the *Regional Construction Standards* as incorporated into such plans by reference, are adequate and appropriate for the particular project. Although it is encouraged that the *Regional Construction Standards* be used as appropriate and applicable to public right of way projects in Hampton Roads, the ultimate decision about what goes into such plans, specifications, reports, or other documents for a specific project must be that of the professional engineer who signs and seals them.

York County Modifications to Regional Construction Standards

The Hampton Roads Planning District Commission (HRPDC) Regional Construction Standards, fourth edition has been modified to meet the needs of York County for the **"Queens Lake Sanitary Sewer Project, Contract 3 – Pump Station"** 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.

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.

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.

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. ***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.***

1.44 *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 (IFB No. 1731)

1. Long Form

PROJECT: ***Queens Lake Sanitary Sewer Project, Contract 3 – Pump Station***
LOCATION: ***County of York, Virginia***
DATE: **December *18, 2009***

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*** until ***2:00 p.m.*** local time on ***February 16, 2010***, 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.

This project involves construction of a sanitary sewer pumping station, sanitary sewer gravity mains, and sanitary sewer force main in the Queens Lake Subdivision of York County, Virginia. Services provided by the contractor shall include, but not be limited to, the furnishing of all materials, equipment, labor, tools, excavation, clearing, grading, restoration, and testing necessary to complete the sewer system in accordance with the Bidding and Contract Documents.

The Work under this Project consists of the ***installation of a precast wet well submersible pump station, approximately 377 linear feet of gravity sewer, 550 linear feet of 8-inch diameter force main, a concrete retaining wall, an asphalt access drive, and all appurtenances thereto required for complete operation of the pump station.***

Bid Documents may be examined at the offices of ***York County Department of Environmental and Development Services***, located at ***105 Service Drive, Yorktown, Virginia, 23692*** and have been provided to the following plan room services:

Peninsula Builder's Exchange
615 Dresden Drive.
Newport News, Va. 23601

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

McGraw Hill Construction Dodge
5540 Falmouth Street Suite 101
Richmond, Va. 23230

Bid Documents may be obtained from the office of ***Central Purchasing*** upon a non-refundable payment of $***75.00*** for each set of documents. 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 ***$100.00***. Checks shall be made payable to ***Treasurer, County of York***.

The Hampton Roads Planning District Commission's *Regional Construction Standards, Fourth Edition,* October 2006, 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 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).

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 italics 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 **NON-MANDATORY** PRE-BID CONFERENCE will be held on ***February 2, 2010***, at ***10:00 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 errors 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, Virginia*** 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

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 ***URS Corporation*** and are dated **December, *2009***. 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 ***URS Corporation*** and dated ***December 18, 2009, and consisting of 24 sheets*** are defined as follows:

County of York, Virginia
Queens Lake Area Sanitary Sewer Project, Contract 3 – Pump Station
Advertisement for Bid
IFB No. 1731

Sheet No.		*Sheet Title*
T-1	*1 of 24*	*Cover Sheet*
G-2	*2 of 24*	*General Notes and Details*
G-3	*3 of 24*	*Site Details*
G-4	*4 of 24*	*Erosion and Sediment Control Notes and Details*
C-1	*5 of 24*	*Overall Site Plan*
C-2	*6 of 24*	*Pump Station Site Plan*
C-3	*7 of 24*	*Pump Station Site Profiles*
C-4	*8 of 24*	*Pump Station Plan and Sections*
S-1	*9 of 24*	*Structural Plan*
S-2	*10 of 24*	*Structural Floor Plan*
S-3	*11 of 24*	*Structural Building Elevations*
S-4	*12 of 24*	*Structural Wall Sections*
S-5	*13 of 24*	*Foundation Plan*
S-6	*14 of 24*	*Sections and Details*
S-7	*15 of 24*	*Roof Plan*
S-8	*16 of 24*	*Structure Section*
S-9	*17 of 24*	*Structure Section*
S-10	*18 of 24*	*Retaining Wall Elevations*
S-11	*19 of 24*	*Retaining Wall Elevations*
S-12	*20 of 24*	*Structural Details*
S-13	*21 of 24*	*Structural Floor Plan*
ME-01	*22 of 24*	*Electrical Legend, Abbreviations, Diagrams, Schedules, and Notes*
ME-02	*23 of 24*	*Mechanical/Electrical Plans and Details*
P-01	*24 of 24*	*Plumbing Plans, Schedules, Risers, and 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 ***seven*** (7) days prior to the date for opening of Bids.

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 _____ of the Code of the City/County of _____, Virginia, as amended,~~ ***section 3-8 of the York County Purchasing Policy,*** 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 its manager, ***if any, or by a member if a member-managed 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.

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.

10. Alternate Bids.

10.1. If alternate Bids are requested for a portion of all of the Work due to the character of the improvement and uncertainties which may be encountered during construction, Bidders shall submit alternate Bids on all items as shown on the Bid Form. Alternate Bids shall be considered in the order listed in the Bid Form and in accordance with criteria defined in the Special Provisions.

10.2. Award shall be based on the lowest responsive and responsible Bid for base Bid plus alternatives selected.

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 and 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, 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."

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 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.

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 alternates 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)~~ ***The County of York Purchasing Policy, procurement code section 3-15*** ~~of the Code of the City/County of Virginia, as amended,~~ 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 ~~and~~ ***but not*** 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 non-substantive errors 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.

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.

III BID FORM

Bids to be opened:	Time **2:00 p.m.**, ***Tuesday, February 16, 2010***
Work to be Completed in:	Substantial Completion ***240*** Days Final Completion ***270*** Days
Liquidated Damages:	***$300.00*** per calendar day after time for Substantial Completion has expired. ***$500.00*** per calendar day after time for Final Completion has expired.
Performance Bond:	100%
Payment Bond:	100%
Bid Security:	*5* %

To: ***County of York, Virginia***
105 Service Drive
Yorktown, Virginia, 23690
Queens Lake Sanitary Sewer Project, Contract 3 – Pump Station
Advertisement for Bid
IFB No. 1731

A. BID PRICE

OPTION A - LUMP SUM BID *(Unused)*

OPTION B - COMBINATION LUMP SUM AND UNIT PRICE BID

OPTION C - UNIT PRICE BID *(Unused)*

In compliance with the Bid Documents, titled ***Project Manual for the Queens Lake Sanitary Sewer Project, Contract 3 – Pump Station***, and 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:

BASE BID

NO.	ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
1	Mobilization, Complete (up to 5% of total price of all other base bid items)	LS	1		
2	Pump Station – Installed Complete-in-Place	LS	1		
3	Select Material, Type II – Sand as Directed by Owner	Ton	1,000		

NO.	ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
4	Select Material, Type II – Stone as Directed by Owner	Ton	1,000		
5	Miscellaneous Unclassified Excavation as Directed by Owner	CY	500		
6	Undercut Excavation with Bedding Backfill as Directed by Owner	CY	500		
7	Wire Reinforced Silt Fence	LF	1,600		
8	Construction Entrance	Each	1		
9	Tree Protection	LF	850		
10	Clearing and Grading	AC	1		
11	Asphalt Drive, Installed Complete-in-Place	SY	1,880		
12	Concrete Retaining Wall, Installed Complete-in-Place	LF	172		
13	Timber Pedestrian Guard, Installed Complete-in-Place	LF	172		
14	Concrete Slab on Grade, Installed Complete-in-Place	CY	4		
15	Diesel Engine Generator, Installed Complete-in-Place	Each	1		
16	Generator Canopy, Installed Complete-in-Place	Each	1		
17	48" Diameter Pre-cast Concrete Manhole, Installed Complete-in-Place	Each	1		
18	48" Diameter Shallow Pre-cast Concrete Manhole, Installed Complete-in-Place	Each	1		
19	60" Diameter Pre-cast Concrete Manhole with Type B Coating, Installed Complete-in-Place	Each	2		
20	Interior Drop Manhole Connection, Installed Complete-in-Place	VF	24		
21	Watertight Manhole Frame and Cover, Installed Complete-in-Place	Each	4		
22	Yard Drain, Installed Complete-in-Place	Each	2		
23	12" Drain Basin, Installed Complete-in-Place	Each	5		
24	12" C900 Class 150 Gravity Sewer Main, Installed Complete-in-Place	LF	77		

NO.	ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL PRICE
25	4" PVC SDR 26 Gravity Sewer Lateral, Installed Complete-in-Place	LF	300		
26	4" PVC SDR 26 Gravity Sewer Lateral Cleanout Assembly, Installed Complete-in-Place	Each	2		
27	12" C900 Class 150 Storm Drain, Installed Complete-in-Place	LF	19		
28	8" HDPE Storm Drain, Installed Complete-in-Place	LF	269		
29	8" Ductile Iron Force Main, Installed Complete-in-Place	LF	52		
30	8" PVC C900 Force Main, Installed Complete-in-Place	LF	460		
31	Emergency Pump Connection, Installed Complete-in-Place	Each	1		
32	8" Gate Valve, Installed Complete-in-Place	Each	2		
33	2" PVC SCH 80 Water Service, Installed Complete-in-Place	LF	1,030		
34	Tracer Wire Box, Installed Complete-in-Place	Each	1		
35	Aggregate Stone Retaining Wall Backfill, Installed Complete-in-Place	Ton	152		
TOTAL OF ALL BASE BID PRICES					

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 $ ***5% of Bid***, 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 ***270*** 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. CONTRACTOR'S REGISTRATION AND SIGNATURE

Registered Virginia Contractor Class and No._____

(NOTE: FAILURE TO INCLUDE CONTRACTOR'S REGISTRATION NUMBER IS 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 NUMBER OF BIDDER:

_____

_____

_____

_____

(_____)_____[Telephone]

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.

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

J. NON COLLUSION AFFIDAVIT

County of York, Virginia project: **provision of all labor, materials, equipment and other items necessary and incidental for the *construction of a sanitary sewer pumping station, sanitary sewer gravity mains, and sanitary sewer force main in the Queens Lake Subdivision of York County, Virginia .***

Queens Lake Sanitary Sewer Project, Contract 3 – Pump Station Bid Date: ***February 16, 2010***

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 (IFB No. 1731)

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):

Contract	Type of Work	Amount	Percentage Completed

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

Name	Years of Experience	Dates of Employment with Bidder

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:

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).

_____

_____

_____

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:

_____

_____

_____

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:

_____

_____

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

_____

_____

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

_____

_____

_____

_____

_____

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

_____

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

VII. 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
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	Undercut Excavation (regular)	Earthwork	CY
303	Select Material (min. CBR)	Earthwork	CY
303	Select Bedding (regular)	Earthwork	CY
303	Suitable Fill (regular)	Earthwork	CY
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	Check dam (log or rock)	Earthwork	EA
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

Section	Bid Item	Category	Unit
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	Slope drain	Earthwork	EA
303	Sediment basin excavation	Earthwork	CY
303	Siltation control excavation	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
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	TONS
315/ 315A	Edge clipping of shoulders	Asphalt Concrete Pavement	LF
317	Pavement Patch	Pavement Patching	LF
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	Grouted riprap	Riprap	SY or TON
414	Stone riprap for foundation protection (depth)	Riprap	SY or TON
414	Dumped riprap	Riprap	SY or TON
414	Mortared riprap	Riprap	SY
414	Concrete riprap in bags	Riprap	CY
414	Erosion control rip rap	Riprap	SY or TON
501	Underdrain and combination underdrain	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
502	Paved flume	Concrete Items	SY
502	Street Connection pavement	Concrete Items	SY
502	Bridge drainage aprons and chutes	Concrete Items	SY
502	Energy Dissipators	Concrete Items	EA
502	Sign island	Concrete Items	EA or SY
502	Median barriers (including delineators)	Concrete Items	LF

Section	Bid Item	Category	Unit
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)	Concrete Items	CY
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	Reuse guardrail (Standard)	Guardrail and Steel Median Barriers	LF
505	Radial guardrail (Standard)	Guardrail and Steel Median Barriers	LF
505	Guardrail terminal (Standard and type)	Guardrail and Steel Median Barriers	LF or EA
505	Intermediate anchorage assembly	Guardrail and Steel Median Barriers	EA
505	Median barrier (Standard)	Guardrail and Steel Median Barriers	LF
505	Radial median barrier (Standard)	Guardrail and Steel Median Barriers	LF
505	Median barrier terminal (Standard and type)	Guardrail and Steel Median Barriers	EA
505	Cable barricade (Standard)	Guardrail and Steel Median Barriers	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	Reuse guardrail terminal (Standard and type)	Guardrail and Steel Median Barriers	LF
505	Guardrail terminal site preparation (Standard)	Guardrail and Steel Median Barriers	EA
505	Bull nose barrier	Guardrail and Steel Median Barriers	EA
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	PDMS (Type)	Maintaining Traffic	DAY,WEEK or MONTH
512	TMA	Maintaining Traffic	HR, DAY, WEEK or MONTH
512	Electronic Arrow	Maintaining Traffic	HR, DAY, WEEK or MONTH

Section	Bid Item	Category	Unit
512	Warning Light	Maintaining Traffic	DAY, WEEK or MONTH
512	Group 2 Channelizing Devices	Maintaining Traffic	DAY, WEEK or MONTH
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	Eradication of existing pavement marking (per 6-inch width)	Maintaining Traffic	LF
512	Temporary Pavement marker ([ ]-way)	Maintaining Traffic	EA
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	EA/DAY or SF
513	Mobilization (3 payments)	Mobilization & Demobilization	LS
515	Milling Pavement	Milling Pavement	SY
521	Pavers	Pavers	SF
521	Spare Pavers	Pavers	SF
530	Abandon Laterals and Cleanouts (on Abandoned Mains)	Abandonment of Existing Pipelines and Structures	LF or EA
530	Abandon Pipe, (diameter) < larger than 2-inch>	Abandonment of Existing Pipelines and Structures	LF
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	EA
530	Abandon Manholes	Abandonment of Existing Pipelines	EA
530	Abandon Drainage Structures	Abandonment of Existing Pipelines and Structures	EA
530	Abandon Meter/Valve Vaults/Boxes	Abandonment of Existing Pipelines and Structures	EA
530	Abandon Metallic Structures	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

Section	Bid Item	Category	Unit
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
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	Ductile iron water main (diameter)	Water Distribution Systems	LF
801	PVC water main (diameter)	Water Distribution Systems	LF
801	PVCO (diameter)	Water Distribution Systems	LF
801	HDPE (diameter)	Water Distribution Systems	LF
801	Fire hydrant assembly	Water Distribution Systems	EA
801	Water sampling stations	Water Distribution Systems	EA
801	Gate valves (diameter)	Water Distribution Systems	EA
801	Butterfly Valves (diameter)	Water Distribution Systems	EA
801	Water Meter Box	Water Distribution Systems	EA
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)	Water Distribution Systems	LF or EA
801	Type K copper service lines (open cut)	Water Distribution Systems	LF or EA
801	Type K copper dual service lines (jack and pull)	Water Distribution Systems	LF or EA
801	Type K copper dual service lines (open cut)	Water Distribution Systems	LF or 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,	Sanitary Gravity Sewer Systems	LF

Section	Bid Item	Category	Unit
	8-10,10-12,12-14,14-16,16-18,18-20, >20')		
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	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	Ductile iron force main (diameter)	Sanitary Force Main Systems	LF
803	HDPE force main (diameter)	Sanitary Force Main Systems	LF
803	PVC force main (diameter)	Sanitary Force Main Systems	LF
803	Manual air vent assembly	Sanitary Force Main Systems	EA
803	Gate valves (diameter)	Sanitary Force Main Systems	EA
803	Tapping sleeve/valve (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
804	Bore and jack casing (diameter)	Boring and Jacking	LF
806	Horizontal Directional Drill	Horizontal Directional Drilling	LS
	Sanitary Sewer Rehabilitation	**(Sections 810-822)**	
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

Section	Bid Item	Category	Unit
816	Sewer Joint Testing (diameter)	Sewer Joint Testing	EA
817	Chemical Joint Sealing / Grouting	Chemical Grouting	GAL
818	Sewer Point Repair (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 0-3 Foot Section Length (diameter)	Insitu Structural Point Repair	EA
819	Insitu Structural Point Repair / Wall Thickness = ____ mm 3-6 Foot Section Length (diameter)	Insitu Structural Point Repair	EA
819	Insitu Structural Point Repair / Wall Thickness = ____ mm 6-9 Foot Section Length (diameter)	Insitu Structural Point Repair	EA
819	Insitu Structural Point Repair / Wall Thickness = ____ mm 9-12 Foot Section Length (diameter)	Insitu Structural Point Repair	EA
819	Insitu Structural Point Repair / Wall Thickness = ____ mm 12-15 Foot Section Length (diameter)	Insitu Structural Point Repair	EA
820	Insitu Point Repair by Sectional Lining / Wall Thickness = ___mm 6-9 Foot Section Length (diameter)	Insitu Point Repair By Sectional Lining	EA
820	Insitu Point Repair by Sectional Lining / Wall Thickness = ___mm 9-12 Foot Section Length (diameter)	Insitu Point Repair By Sectional Lining	EA
820	Insitu Point Repair by Sectional Lining / Wall Thickness = ___mm 12-15 Foot Section Length (diameter)	Insitu Point Repair By Sectional Lining	EA
821	Service Laterals (diameter and material)	Sanitary Sewer Service Reconnection	LF
822	Manhole Cementitious Coating, 0-6' depth (4- or 5-ft diameter)	Manhole Rehabilitation	EA
822	Manhole Cementitious Coating extra depth (4- or 5-ft diameter)	Manhole Rehabilitation	VF
822	Manhole Fiberglass Insert Liner, 0-6' depth (4- or 5-ft diameter)	Manhole Rehabilitation	EA
822	Manhole Fiberglass Insert Liner extra depth (4- or 5-ft diameter)	Manhole Rehabilitation	VF
822	Manhole Epoxy Coating, 0-6' depth (4- or 5-ft diameter)	Manhole Rehabilitation	EA
822	Manhole Epoxy Coating extra depth (4- or 5-ft diameter)	Manhole Rehabilitation	VF
822	Manhole Frame Seals	Manhole Rehabilitation	EA

End of Section

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 informality or technical defects, 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. ~~At the time of the issuance of the Notice of Award, the Owner shall publicly post an announcement of the award on/at the~~ ***Bid results are posted on the County of York web page at*** 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 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 (IFB No. 1731)

TO: _____
_____
_____
_____

PROJECT TITLE: _____
_____
_____
_____

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

By_____

Title _____

III AGREEMENT (IFB No. 1731)

This AGREEMENT, dated this _____ day of _____, 20___, by and between _____ hereinafter called the Owner; and _____
(a corporation or an unincorporated 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 ***Queens Lake Sanitary Sewer Project, Contract 3 – Pump Station (IFB 1731)***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 ***URS Corporation*** 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.

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*, Fourth Edition, as referenced in Section I. below and as specifically revised for this Project.

F. Time

The undersigned Contractor agrees to commence Work within __ Days after the date of Notice to Proceed and further agrees to substantially complete all Work under this Agreement within ___Days from the date of the Notice to Proceed and to reach Final Completion of all Work under this Agreement within _____ 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

_____
Owner

By: _____
Name

Title: _____

Attest: _____

Address: _____

_____

_____

_____

CONTRACTOR

_____
Contractor

By: _____
Name

Title: _____

Attest: _____

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 $_____per Day for failure of the Contractor to substantially complete the Work by the date for Substantial Completion and $_____ 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 CONTRACTOR'S COMPLETED PROJECT EVALUATION REPORT (OPTIONAL)

(This form [two pages] may be used by the Contractor following the completion of the Project to provide feedback and suggestions for improvements to the Regional Construction Standards.)

Date: _____

Contractor: _____

Project Title: _____

Project Location: _____

_____

Owner: _____

Owner's Project Number: _____

Design Engineer: _____

Construction Engineer: _____

Contract Amount: _____ Date of Award: _____

Change Orders Amount: _____ Number of Change Orders: _____

Total Completed Contract Amount: _____

Original Completion Time: _____ Days

Actual Completion Time: _____ Days

Difference (+/-): _____ Days

Days Lost To Weather: _____ Days Allowed: _____

Days Lost To Conflicts: _____ Days Allowed: _____

cc: ***HRPDC***
County of York Virginia

Summation of Problems with Regional Construction Standards

Section(s)

Division 1 - General Provisions _____

Division 2 - Products and Materials _____

Division 3 - Roadway Construction _____

Division 4 - Miscellaneous _____

Division 5 - Incidental Construction _____

Division 6 - Landscaping _____

Division 7 - Traffic Control Devices _____

Division 8 - Water and Wastewater Utilities _____

Sheet No./ Detail Number

Standard Details _____

_____

Describe the problem in detail, proposed resolution, actual resolution, recommended changes, etc.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Use additional pages if necessary)

End of Section

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.

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) 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 in Section 104-7.5.1**A** 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 ~~are~~ required ***in 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.***

1. ***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.***

2. ***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) 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 14 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):

(Owner's Name)

(Project Name)

Shop Drawing No.: _____

Specification Section: _____

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.

_____ *No variation from Contract Documents*

_____ *Variation from Contract Documents as shown*

(Contractor's Name and Address)

By: _____

Date: _____

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 fittings 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 ¾"), 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.

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 ***7:00 a.m.*** to ***5:00 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. ***There will be no work on Sundays, except for emergency situations.*** 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~~ ***Saturdays*** and/or Holidays without cause.

Holidays are as listed below:

New Years Day	1st day of January
Martin Luther King's Birthday	3rd Monday in January
President's Day	3rd Monday in February
Memorial Day	Last Monday in May
Independence Day	4th day in July
Labor Day	1st Monday in September
Yorktown Day	***19th day of October***
Veteran's Day	11th day of November
Thanksgiving Day	4th Thursday in November
Friday after 4th Thursday in November	4th Friday in November
Christmas Eve	24th day of December
Christmas Day	25th day of December
New Year's Eve	***31st day of December***

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 (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, not-withstanding 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 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 Claims, disputes, and other matters relating to the acceptability of the Work or the interpretation of the requirements of the Contract Documents pertaining to the performance and furnishing of the Work and claims in respect to changes in the Contract Price or Contract times will be referred initially to the Engineer in writing with a request for a formal decision in accordance with this paragraph. 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 Engineer allows an additional period of time 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 ten (10) days after receipt of the Contractor's last submittal (unless the Engineer allows additional time).

The Engineer shall render a written decision within twenty (20) days of receipt of the Owner's response. The Engineer's written decision on such claim, dispute, or other matter shall be final and binding upon the Owner and Contractor unless, within twenty (20) days after issuance of the Engineer's written decision, either party appeals the decision by giving the other party and the Engineer written notice of a request for negotiation.

Within ten (10) days of the delivery of said Notice, 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 attempt to resolve the dispute. The Owner's representative will participate in good faith during the negotiation and will have authority to approve changes in the Contract Time and Price.

In the event a mutually acceptable decision cannot be reached through negotiation within twenty (20) days of the appealing party's Notice, (or mutually agreeable longer period), or if the party receiving such Notice will not meet within ten (10) days, the Owner or Contractor may declare, by written Notice, delivered to the other party and to the Engineer, that the negotiation was unsuccessful and may initiate further appeal.

Any further appeal shall be initiated by written Notice of the appeal by the Owner or Contractor to the Engineer and non-appealing party within twenty (20) calendar days of receipt of the Notice of unsuccessful negotiation. Failure to issue a Notice of appeal within said period will result in the Engineer's decision being final and binding to the fullest extent allowed by law. If a written Notice of appeal is issued, the claim or dispute may be submitted for non-binding mediation at the discretion of Owner. 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

If the Owner requests mediation upon issuance of the Notice of appeal, 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. The dispute resolution process shall then proceed in accordance with paragraph 16.4.

16.4. A formal proceeding may then be instituted by the appealing party in a forum of competent jurisdiction within the Owner's locality, to exercise such rights or remedies as the appealing party may have with respect to such claim, dispute or other matter in accordance with applicable state and city laws and regulations.

In the event of any litigation between the parties arising out of this Agreement, the prevailing party will be entitled to recover its attorneys' fees and expert fees, as well as all other costs and expenses of such litigation.

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.

XVIII NOTICE TO COMPLY ORDER

See page 105-15.

XIX STOP WORK ORDER

See page 105-16.

End of Section

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)

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)

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 form 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 ***not less than 3*** calendar 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.

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.

5.2. 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.

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 stopped 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 stopped, 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.

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 weather or 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 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 accounting, legal, clerical and other expenses reasonably necessary for the termination and settlement of subcontracts or orders thereunder, together with 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.

End of Section

SECTION 109

MEASUREMENT AND PAYMENT

I. PAYMENT PROCEDURES

1.1. 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. ***Connection to existing and newly constructed mains and force main***
23. ***Operation and Maintenance Manuals***
24. ***Record Drawings***
25. ***Administrative items of any nature***

1.2 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.

1.3 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.

1.4 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. ***Payment for such material and equipment shall be in the amount of the lesser of the invoice price paid for of the materials or 60% of the value specified on the approved Schedule of Values.*** The Owner, at its sole discretion, may not pay for stored materials without prejudice and without cause.

1.5 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.

1.6 Retained Funds

A. The Owner shall retain ***five*** percent (*5* %) 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.

B. 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.

1. 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.

2. 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.

3. 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.

4. 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.

1.7 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, or 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.

1.8 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.

1.9 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.

1.10 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.

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 and 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) calendar 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) calendar 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: _____ By: _____ By: _____
ENGINEER(Authorized Signature) OWNER(Authorized Signature) 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: $_____
Less Amount 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 (IFB No._____)

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 and _____ (Surety), provides:

5.1. The Owner and the Contractor have entered into an Agreement 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. Unites States Treasury Bonds, United States Treasury Notes, Unites 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 installations. 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 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

X. MANHOLE/STRUCTURE PROTECTIVE COATING POST INSTALLATION CERTIFICATION

(Submit prior to Substantial Completion)

Project Name _____

Owner _____

Contractor _____

Agreement No. _____

Applicator _____

Company Name: _____

Address: _____

_____

Telephone: _____

I certify that the coating system identified below was installed in conformance with the manufacturer's recommendations at the conditions listed below.

_____ _____

Applicator Date

This applicator is certified by _____, Coatings Manufacturer, located at

_____

(Address)

and approved in the proper application of the specified coating system. The materials and workmanship for Type B (80 mil) coatings systems are warranted for a period of five (5) years from the date of Substantial Completion of the project.

_____ _____

Coatings Manufacturer Authorized Representative/Title Date

Coating System: _____

(Use Separate Form For Each Coating System Applied)

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

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

End of Section

SECTION 110

SPECIAL PROVISIONS

I. CONSTRUCTION DRAWINGS

Drawings 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

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

The following modifications, additions, or deletions to the HRPDC *Regional Construction Standards* are hereby incorporated into the Contract Documents.

III. SUPPLEMENTAL INFORMATION

3.1 SUBSURFACE EXPLORATION

A. Appendix A of the Supplemental Technical Specifications includes subsurface boring data. The Contractor shall be responsible for conducting any further subsurface investigations that he deems necessary.

B. Geotechnical Exploration and Analysis Information included, in whole or in part, in these Bidding Documents give the physical data on sub-surface conditions as obtained for the Owner only, and in no event is this information to be considered as part of the Contract. It is expressly understood that neither the Owner nor the Engineer will be responsible for any interpretation or conclusions drawn therefrom by the Contractor.

C. Bidders are cautioned that the subsurface boring data was used for general design purposes only and may be inadequate for the purposes of bidding of the Contract items. It is strongly recommended that the Contractor perform their own subsurface investigation(s) to the extent necessary to satisfy themselves as to the sub-surface conditions. It is the Contractor's responsibility to thoroughly investigate the site and under no circumstance is the Contractor to rely on the sub-surface information that was obtained for the information of the Owner.

3.2 STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

A. Appendix B of the Supplemental Technical Specifications includes the SWPPP. The Contractor shall be responsible for following the requirements of the SWPPP.

3.3 SUPPLEMENTARY TECHNICAL SPECIFICATIONS

A. Additional technical specifications are provided to supplement the Hampton Roads Regional Construction Standards for this project. These Supplementary Technical Specifications supercede the Hampton Roads Regional Construction Standards where applicable. These Supplementary Technical Specifications include the following sections:

Section 01151	Measurement and Payment	1-13
Section 01650	System Start Up and Acceptance Testing	1-5
Section 01781	Operation and Maintenance Data/Manual	1-7
Section 02010	Subsurface Exploration	1-2
Section 02151	Shoring	1-2
Section 02200	Earthwork	1-12
Section 02270	Slope Protection and Erosion Control	1-5
Section 02724	Interior Piping	1-6
Section 03100	Structural Concrete Formwork	1-4
Section 03200	Concrete Reinforcement	1-3
Section 03250	Waterstops	1-4
Section 03300	Cast-in-Place Structural Concrete	1-30
Section 03410	Precast Concrete Wet Well	1-3
Section 03931	Concrete Protective Liner	1-5
Section 04200	Masonry	1-24
Section 05500	Miscellaneous Metal	1-8
Section 06100	Rough Carpentry	1-8
Section 06200	Finish Carpentry	1-4
Section 07150	Exterior Waterproofing	1-3
Section 07311	Roofing, Strip Shingles	1-4
Section 07920	Joint Sealants	1-6
Section 08120	Fiberglass Reinforced Plastic Doors and Frames	1-5
Section 08700	Builder's Hardware	1-6
Section 09900	Painting	1-12
Section 14534	Trolley and Manual Hoist	1-4
Section 15100	Submersible Pumping Equipment	1-13
Section 15400	Plumbing Systems	1-7
Section 16010	Electrical Basic Requirements	1-8
Section 16020	Utility Service and Service Entrance	1-1
Section 16035	Electrical Testing and Placing in Service	1-3
Section 16110	Raceways	1-5
Section 16120	Wire and Cables	1-6
Section 16130	Electrical Boxes and Fittings	1-5
Section 16135	Wiring Devices	1-4
Section 16190	Supporting Devices	1-4

Section 16195	Electrical Identification	1-2
Section 16231	Packaged Engine Generator System	1-9
Section 16425	Pump Control System	1-25
Section 16450	Secondary Grounding	1-3
Section 16470	Panelboards	1-4
Section 16482	Motor Starters	1-4
Section 16510	Lighting Fixtures	1-4
Section 16900	Remote Terminal Unit	1-5

3.4 STANDARD DETAILS

A. The Details listed below and either shown on the Drawings (those for which a sheet number is given) or incorporated by reference from the York County Sanitary Sewer Standards & Specifications (those for which a York County Standard Detail number is given), replace applicable Standard Details found in the Regional Construction Standards (RCS):

Applicable Replacement Detail Title (location in Contract Documents)	RCS Detail No.
Trench Width Detail for Payment of Contingent Items (Sheet G-3)	EW_03
Sanitary Sewer Interior Drop Manhole (Sheet G-3)	SS_04
Manhole Invert Shaping Detail (York County Standard Detail S1008)	SS_07
Watertight Manhole Frame and Cover (York County Standard Detail S1002)	SS_09
Watertight Manhole Frame and Cover (York County Standard Detail S1002)	SS_10
Sanitary Cleanout Frame and Cover (York County Standard Detail S1012)	SS_11
Standard Valve Box Frame and Cover (York County Standard Detail S2005)	WS_01

B. Detail Revisions

1. Delete Note 3 of York County detail S1008 and replace with the following:

"3. Bench and inverts shall be coated with an acid resistant coating per specification section 200.5.11.E and shall be Type B coating."

3.5 MEASUREMENT AND PAYMENT

A. Measurement and Payment will be in accordance with supplemental specification Section 01151.

B. Delete the ***Measurement For Payment*** Sections established under ***Part III*** of the following Sections of the Regional Construction Standards:

Division	Section	Description
3	301	Clearing and Grubbing
3	302	Drainage Structures
3	303	Earthwork
3	305	Subgrade and Shoulders
3	309	Aggregate Base Course
3	310	Tack and Prime Coat
3	313	Asphalt Surface Treatment
3	315	Asphalt Concrete Pavement (NON SUPERPAVE)
3	315A	Asphalt Concrete Pavement (SUPERPAVE)
3	317	Pavement Patching
4	406	Reinforcing Steel
4	414	Riprap
5	501	Underdrains
5	502	Concrete Items
5	505	Guardrail and Steel Median Barriers
5	507	Fences
5	510	Relocating or Modifying Existing Miscellaneous Items
5	511	Allaying Dust
5	512	Maintaining Traffic
5	513	Mobilization
5	515	Milling Pavement
5	521	Pavers
5	530	Abandonment of Existing Pipelines and Structures
6	602	Topsoil
6	603	Seeding
6	604	Sodding
6	605	Planting
6	608	Mowing
7	700	Traffic Control Devices
7	704	Pavement Markings and Markers
8	801	Water Distribution Systems
8	802	Sanitary Gravity Sewer Systems
8	803	Sanitary Force Main Systems
8	804	Boring and Jacking
8	805	Separation of Water Mains and Sewers
8	806	Horizontal Directional Drilling
8	810	Sewer Line Cleaning
8	811	Television Inspection

8	812	Bypass Pumping
8	813	Pipe Rehabilitation by Cured-in-Place Method
8	814	Pipe Rehabilitation by Fold-and-Form Method
8	816	Sewer Pipe Joint Testing
8	817	Chemical Grouting
8	818	Point Repair by Excavation
8	819	Insitu Structural Point Repair
8	820	Insitu Point Repair by Sectional Lining
8	821	Sanitary Sewer Service Reconnections
8	822	Manhole Rehabilitation

MODIFICATIONS TO REGIONAL CONSTRUCTION STANDARDS				
Section	Title	Page	Subsection	Modification
101	General Definitions	101-3	1.28	References to "Owner" shall mean County of York Department of Environmental and Development Services.
105	Control of Work	105-6	5.3	Add: "*K. Record drawings shall include the northing and easting for each manhole and valve.*"
107	Legal Relations and Responsibility to the Public	107-1	1.1	Add: "*The owner shall obtain the VA LDA permit.*"
200	Products and Materials	200-7	5.1.B.	Add: "*Select Material, Type II – Sand shall be defined as those complying with ASTM D2487 United Soil Classification System (USCS) groups SW and SP. Select Material, Type II – Stone shall be defined as those complying with ASTM D2487 United Soil Classification System (USCS) groups GW, GP, and GM.*"
200	Products and Materials	200-53	5.11.B.	Add: "*8. PVC Pipe conforming to the requirements of AWWA C900 – Class 150 (DR-18) shall be used.*"
200	Products and Materials	200-54	5.11.D.	Delete paragraph 5. in its entirety and replace with the following paragraph: "*5. Manhole steps shall not be installed.*"
303	Earthwork	303-11	2.2.F.	Add the following sentence: "*The area in the wetlands disturbed by construction activity shall be seeded with a wetlands seed mix.*"
802	Sanitary Gravity Sewer Systems	802-10	2.4.B.1.d.	Delete this paragraph in its entirety and replace with the following paragraph: "*d. Remote Camera/TV Inspection* *Upon successful completion of the visual testing, deflection testing, and leakage testing the Contractor shall clean the gravity sewer lines for televising to be performed by the Owner. Sewer line cleaning shall be performed in accordance with Section 810. The Owner will*

				perform initial television inspections for all new gravity sewer mains in accordance with Section 811. If the television inspection of the pipe reveals unclean conditions, poor alignment, displaced or cracked pipe, improper joints or slipped gaskets, or other defect(s), the Contractor shall correct the defect(s) and the pipe line shall be completely retested in accordance with Section 802 and cleaned and re-televised by the Contractor in accordance with this paragraph and Sections 810 and 811. All additional television inspections performed to verify defect repair shall be performed at the Contractor's expense. A DVD of inspected gravity sewer mains shall be provided to the Owner upon completion of the inspections."
811	Television Inspection	811-4	2.2.D.	Post installation television inspection clarification: The Owner will perform one television inspection of all new gravity sewer lines installed as part of this project. Upon satisfactory completion of the gravity sewer installation, cleaning and testing, the Contractor shall request television inspection from the Owner. The television inspection will be performed under the following conditions: 1. The Contractor shall provide the Owner a written request for television inspection. Contractor shall provide the Owner a minimum of five working days notice after which the Owner will commence the video inspection. 2. Post installation television inspection will not be performed until all Work including mainline and manhole visual, pressure, deflection, and leakage testing and cleaning is completed and accepted. Deflection testing shall be performed in accordance with Section 802, part 2.4.B. Cleaning shall be performed in accordance with Section 810. 3. Preliminary record drawings shall be submitted by the Contractor to the Owner and approved by the Owner prior to submission of a request for television inspection. The required five working day notice will start only upon approval of the preliminary record drawings. 4. If the television inspection performed by the Owner results in the discovery of defective or improperly installed gravity sewer, the Contractor shall repair all defects or improper installations at no additional cost to the Owner. Once the Contractor completes the necessary repairs, the Contractor shall, in the presence of the Owner, provide additional television inspection(s) in accordance with the conditions listed in this Special Provision

				and the Contract Documents. 5. The Contractor shall re-clean the lines in accordance with Section 810 prior to performing each additional television inspection. After cleaning and immediately prior to performing television inspection, the Contractor shall flood each terminal manhole or cleanout (the last access structure on any gravity sewer branch) with at least 1,000 gallons of potable water. The Contractor shall make all provisions to collect and dispose of this excess water at no additional cost to the Owner. 6. Contractor shall provide to the Owner a DVD(s) of all video inspection(s) performed by the Contractor. 7. All television inspections performed by the Contractor shall be at no cost to the Owner and no extension of time shall be granted for video inspection(s) performed by the Owner or the Contractor. 8. No separate measurement or payment will be made for post construction television inspection.

SECTION 01151

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.

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.

C. Structure measurements shall be in accordance with the Contract Plans except as approved by the Owner.

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.

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 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.

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: Pump Station, Installed complete and in place. The pump station will be measured and paid for based on the unit and unit price indicated on the Bid Form and shall include all work necessary and incidental within the limits of the structure including, but not limited to the following:

1. Excavation for the wet well including any required sheeting and bracing.
2. Disposal of surplus material.
3. Compaction of subgrade and aggregate base under the wet well and building.
4. Pre-cast concrete wet well.
5. Backfill of the wet well excavation with select material.
6. Structural concrete for the valve vault, top slab, and floor including formwork and bracing, reinforcement, furnishing, hauling, placing and consolidating the concrete material, and any required concrete testing.
7. All architectural items noted on the plans including, masonry walls, framing, sheathing, shingles, siding, trim, doors, and louvers.
8. All structural items noted on the plans including ladders, grating, access hatches, and structural supports.
9. All mechanical items noted on the plans including pumps, interior piping, interior valves, plumbing fixtures, and HVAC equipment.
10. All electrical items noted on the plans including equipment and all associated conduit and wiring.

6. Structural concrete for the valve vault, top slab, and floor including formwork and bracing, reinforcement, furnishing, hauling, placing and consolidating the concrete material, and any required concrete testing.
7. All architectural items noted on the plans including, masonry walls, framing, sheathing, shingles, siding, trim, doors, louvers, and painting.
8. All structural items noted on the plans including ladders, grating, access hatches, and structural supports.
9. All mechanical items noted on the plans including pumps, interior piping, interior valves, plumbing fixtures, and HVAC equipment.
10. All electrical items noted on the plans including equipment and all associated conduit and wiring.

C. Bid Item No. 3 and 4: Select Material, Type II – Sand and Type II – Stone as directed by Owner. Select Material Type II – Sand and Type II – Stone shall be in accordance with Section 200 and Section 110. When directed and authorized by the Owner in accordance with Section 303 2.2.E.3, 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 (Sheet G-3)

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 Type II – sand and Type II – stone in accordance with the Contract Documents.

D. Bid Item No. 5: Miscellaneous Unclassified Excavation as Directed by the Owner. When directed and authorized by the Owner to excavate beyond plan dimension, 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 (Sheet G-3)

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 No. 6: Wire Reinforced Silt Fence installed, complete in place. Temporary Silt Fence will be measured and paid for based on the unit and unit price indicated on the Bid Form. Payment shall include installation as shown in the Silt Fence detail and Wire Backed Silt Fence detail on Sheet G-4. The cost 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 required as a result of erosion and sediment control shall be considered incidental to erosion and sediment control.

F. Bid Item No. 7: Construction entrance installed, complete in place. The construction entrance will be measured and paid for based on the unit and unit price indicated on the Bid Form. Payment shall include installation as shown in the Construction Entrance detail on Sheet G4 and complete removal. Surface restoration required as a result of erosion and sediment control shall be considered incidental to erosion and sediment control.

G. Bid Item No. 8: Tree Protection installed, complete in place. The Drawings address where tree protection is to be provided. Actual placement shall be as approved by the Owner. Payment will be made at the unit price 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.

H. Bid Item No. 9: Clearing and Grading, complete in place. Clearing and grading will be measured and paid for based on the unit and unit price indicated on the Bid Form and shall include all work necessary and incidental to clearing and grading including, but not limited to the following:

1. Tree clearing in accordance with note 25 on sheet G-2.
2. Grubbing.
3. Any earthwork required to achieve the lines and grades indicated on the plans including importation of select material.
4. Disposal of surplus material.
5. Protective cover installation in accordance with VDOT EC-2 detail on sheet G-4.
6. Temporary seeding.

I. Bid Item No. 10: Asphalt drive installed, complete in place. Asphalt drive shall be measured and paid for based on the unit and unit price indicated on the Bid Form. Payment shall include all work necessary and incidental to installation of the asphalt drive in accordance with the Asphalt Drive details on Sheet G-2 including, but not limited to the following:

1. Removal of existing subgrade to accommodate aggregate base.
2. Disposal of surplus material.
3. Compaction of subgrade.
4. Geogrid.
5. Aggregate base course.
6. Asphalt testing.
7. Hauling, placing, compacting, and asphalt pavement material.

J. Bid Item No. 11: Concrete retaining wall installed, complete in place. Retaining wall installation will be measured along the centerline of the top of the wall and paid for based on the unit price indicated on the Bid Form. Payment shall include all work necessary and incidental to retaining wall installation in accordance with the plans including, but not limited to the following:

1. Aggregate base.
2. Formwork and bracing.
3. Steel reinforcement.
4. Concrete footing.
5. Concrete testing.
6. Furnishing, hauling, placing and consolidating the concrete material.

K. Bid Item No. 12: Timber pedestrian guard installed, complete in place. Timber pedestrian guard installation will be measured along the centerline of the top of the guard and paid for based on the unit price indicated on the Bid Form. Payment shall include all work necessary and incidental to timber pedestrian guard installation in accordance with the plans including posts, balusters, caps, rails, and associated fasteners and hardware.

L. Bid Item No. 13: Concrete slab on grade installed, complete in place. Concrete slab installation will be measured and paid for based on the unit and unit price indicated on the Bid Form. Payment shall include all work necessary and incidental to slab on grade installation including compaction of subgrade, aggregate base, furnishing, hauling, placing, manipulating and vibrating the concrete material, concrete testing, construction joint, reinforcement, formwork, surface treatments and protection.

M. Bid Item No. 14: Diesel engine generator installed, complete in place. Diesel generator will be measured and paid for based on the unit and unit price indicated on the Bid Form. Payment shall include all materials, equipment and labor required to furnish and install a complete generator assembly as indicated in the contract documents.

N. Bid Item No. 15: Generator canopy installed, complete in place. Generator canopy will be measured and paid for based on the unit and unit price indicated on the Bid Form. Payment shall include all materials, equipment and labor required to furnish and install the generator canopy including aggregate base, concrete footing, structural members, framing, sheathing, shingles, trim, and siding.

O. Bid Item No. 16: 48-inch Diameter Pre-cast Concrete Manhole, installed complete in place. Measurement of manholes will be made for each size manhole installed in accordance with the Contract Documents and satisfactorily tested regardless of depth. Payment for manholes will be at the unit price bid and will include, but not limited to the cost of the following:

1. Backfilling, compacting, and compaction testing.
2. Bedding as detailed in the contract documents.
3. Shoring and bracing.
4. Dewatering.
5. Disposal of surplus material.
6. Excavation.
7. Flushing.
8. Manhole base, riser sections, adjustment rings and appurtenances.
9. Benches, inverts and troughs.
10. Pipe openings and seals.
11. Main line and lateral connections.
12. Testing.

P. Bid Item No. 17: 48-inch Diameter Shallow Pre-cast Concrete Manhole, installed complete in place. Measurement of manholes will be made for each size manhole installed in accordance with the Contract Documents and satisfactorily tested regardless of depth. Payment for manholes will be at the unit price bid and will include, but not limited to the cost of the following:

1. Backfilling, compacting, and compaction testing.
2. Bedding as detailed in the contract documents.
3. Shoring and bracing.
4. Dewatering.
5. Disposal of surplus material.
6. Excavation.
7. Flushing.

8. Manhole base, riser sections, adjustment rings and appurtenances.
9. Pipe openings and seals.
10. Main line and lateral connections.
11. Testing.

Q. Bid Item No. 18: 60-inch Diameter Pre-cast Concrete Manhole with Type B Coating, installed complete in place. Measurement of manholes will be made for each size manhole installed in accordance with the Contract Documents and satisfactorily tested regardless of depth. Payment for manholes will be at the unit price bid and will include, but not limited to the cost of the following:

1. Backfilling, compacting, and compaction testing.
2. Bedding as detailed in the contract documents.
3. Shoring and bracing.
4. Dewatering.
5. Disposal of surplus material.
6. Excavation.
7. Flushing.
8. Manhole base, riser sections, adjustment rings and appurtenances.
9. Benches, inverts and troughs.
10. Coating system.
11. Pipe openings and seals.
12. Main line and lateral connections.
13. Testing.

R. Bid Item No. 19: Interior Manhole Drop Connections, installed complete in place. Measurement of interior manhole drop connections will be made in vertical linear feet as measured from the manhole invert to the influent sewer invert for each interior drop installed in accordance with the drawings and specifications and satisfactorily tested. Payment for interior manhole drop connections shall include all material, equipment and labor required to satisfactorily install the connections including pipe, fittings, couplings, joint materials, temporary and permanent bracing, straps and pipe clamps, and incidental work.

S. Bid Item No. 20: Watertight Manhole Frame and Cover, installed complete in place. Measurement of manhole frames and covers will be made for each manhole frame and cover satisfactorily installed in accordance with the Contract Documents and shall include all equipment, material and labor required to furnish and install the castings, to plan grade.

T. Bid Item No. 21: Yard Drain, installed complete in place. Measurement for yard drains will be made for each yard drain installed in accordance with the Contract Documents. Payment for yard drains will be at the unit price bid and will include, but not limited to the cost of the following:

1. Backfilling, compacting, and compaction testing.
2. Bedding as detailed in the contract documents.
3. Shoring and bracing.
4. Dewatering.
5. Disposal of surplus material.
6. Excavation.
7. Frame and grate.
8. Inlet shaping.
9. Pipe openings and seals.
10. Pipe connections.
11. Testing.

U. Bid Item No. 22: 12" Drain Basin, installed complete in place. Measurement for 12" drain basins will be made for each drain basin installed in accordance with the Contract Documents. Payment for drain basins will be at the unit price bid and will include all equipment, material and labor required to furnish and install the drain basins and grate in accordance with the manufacturer's recommendations.

V. Bid Item No. 23: 12" C900 Class 150 Gravity Sewer Main, installed complete in place. Gravity sewer mains will be measured along the centerline of the pipeline based on linear footage of pipe installed in accordance with the Contract Documents and satisfactorily tested, regardless of depth. Payment for gravity sewer main will be at the unit price bid and shall include all work necessary and incidental to gravity sewer main installation including, but not limited to the following:

1. Clearing and grubbing.
2. Stripping and stockpiling topsoil.
3. Temporary cofferdams and bypass pumping as required for stream diversion.
4. Temporary sheeting and bracing.
5. Excavation.
6. Dewatering.
7. Bedding as detailed in the contract documents.
8. Backfilling, compacting, and compaction testing.
9. Disposal of surplus material.
10. Gravity sewer pipe, fittings and appurtenances.
11. Flushing.
12. Testing.
13. Protecting existing underground utility lines from damage.
14. Surface and stream restoration.
15. Seeding.
16. Cleanup.

W. Bid Item No. 24 – 4" PVC SDR 26 Gravity Sewer Lateral, Installed Complete in Place. Gravity sewer laterals will be measured from the centerline of the manhole to the centerline of the clean out based on linear footage in the horizontal plane of pipe

installed in accordance with the Contract Documents and satisfactorily tested regardless of depth. Payment at the unit price bid shall include all work necessary and incidental to lateral installation including, but not be limited to:

1. Clearing and grubbing.
2. Stripping and stockpiling topsoil.
3. Temporary sheeting and bracing.
4. Grubbing.
5. Excavation.
6. Dewatering.
7. Bedding as detailed in the contract documents.
8. Backfilling, compacting, and compaction testing.
9. Disposal of surplus material.
10. Gravity sewer pipe, fittings and appurtenances.
11. Flushing.
12. Testing.
13. Protecting existing underground utility lines from damage.
14. Temporary seeding and stabilization.
15. Surface restoration.
16. Maintenance, restoration and replacement of any components of the existing septic system disturbed or otherwise displaced during construction.
17. Cleanup.

X. Bid Item No. 25: 4-inch PVC SDR 26 Gravity Sewer Lateral Cleanout Assembly, 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 shall include all work necessary and incidental including, but not limited to:

1. Clearing and grubbing.
2. Stripping and stockpiling topsoil.
3. Temporary sheeting and bracing.
4. Excavation.
5. Dewatering.
6. Bedding as detailed in the contract documents.
7. Backfilling, compacting, and compaction testing.
8. Disposal of surplus material.
9. All fittings, caps, pipe and necessary appurtenances.
10. Cleanout box, frame, and cover with bedding stone.
11. Flushing.
12. Testing.
13. Protecting existing underground utility lines from damage.
14. Temporary seeding and stabilization.
15. Surface restoration.

2. Stripping and stockpiling topsoil.
3. Temporary sheeting and bracing.
4. Excavation.
5. Dewatering.
6. Bedding as detailed in the contract documents.
7. Backfilling, compacting, and compaction testing.
8. Disposal of surplus material.
9. All fittings, caps, pipe and necessary appurtenances.
10. Cleanout box, frame, and cover with bedding stone.
11. Flushing.
12. Testing.
13. Protecting existing underground utility lines from damage.
14. Temporary seeding and stabilization.
15. Surface restoration.
16. Maintenance, restoration and replacement of any components of the existing septic system disturbed or otherwise displaced during construction.
17. Cleanup.

Z. Bid Item No. 27: 12" C900 Class 150 Storm Drain, installed complete in place. Storm drain will be measured along the centerline of the pipeline based on linear footage of pipe installed in accordance with the Contract Documents and satisfactorily tested, regardless of depth. Payment for storm drain main will be at the unit price bid and shall include all work necessary and incidental to storm drain installation including, but not limited to the following:

1. Temporary sheeting and bracing.
2. Excavation.
3. Dewatering.
4. Bedding as detailed in the contract documents.
5. Backfilling, compacting, and compaction testing.
6. Disposal of surplus material.
7. Storm drain pipe, fittings and appurtenances.
8. Flushing.
9. Testing.
10. Protecting existing underground utility lines from damage.

AA. Bid Item No. 28: 8" HDPE Storm Drain, installed complete in place. Storm drain will be measured along the centerline of the pipeline based on linear footage of pipe installed in accordance with the Contract Documents and satisfactorily tested, regardless of depth. Payment for storm drain main will be at the unit price bid and shall include all work necessary and incidental to gravity sewer main installation including, but not limited to the following:

1. Temporary sheeting and bracing.
2. Excavation.

to force main installation including, but not limited to the following:

1. Clearing and grubbing.
2. Stripping and stockpiling topsoil.
3. Temporary sheeting and bracing.
4. Excavation.
5. Dewatering.
6. Bedding as detailed in the contract documents.
7. Backfilling, compacting, and compaction testing.
8. Disposal of surplus material.
9. Force main pipe, fittings, joint restraint, tracer wire, and all other appurtenances not separately measured for payment.
10. Flushing.
11. Testing.
12. Protecting existing underground utility lines from damage.
13. Temporary seeding and stabilization.
14. Surface restoration.
15. Cleanup.

AB. Bid Item No. 30: Emergency Pump Connection, installed complete in place. Emergency pump connection will be measured based upon each installed in accordance with the Contract Documents and satisfactorily tested. Payment shall include installation as shown in the Emergency Pump Connection detail on Sheet G-3. The cost shall include all materials, equipment, and labor necessary and incidental to install the emergency pump connection.

AC. Bid Item No. 31: 8" Gate Valve, installed complete in place. Valves installed will be measured and paid for each gate valve satisfactorily installed and tested in accordance with the Contract Documents. Valves installed will be paid for at the unit price bid and will include the cost of the following:

1. Gate valve.
2. Valve box, frame and cover.
3. Excavation, dewatering, and shoring.
4. Bedding stone and backfilling.
5. Compaction and compaction testing.
6. Thrust restraint.
7. Flushing and testing.

AD. Bid Item No. 32: 2" PVC SCH 80 Water Service Complete in Place. Water service will be measured based upon the linear footage, installed in the horizontal plane installed in accordance with the Contract Documents and satisfactorily tested. Water service will be paid for at the unit price bid and shall include all work necessary and incidental including, but not be limited to the following:

1. Excavation.
2. Backfilling, compacting, and compaction testing.
3. Dewatering.
4. Flushing.
5. Water service pipe, including fittings, valves, valve boxes, and appurtenances excluding tracer wire box.
6. Testing.
7. Water for testing.
8. Tracer wire and subsurface marking tape (non-metallic pipe).
9. Surface restoration.
10. Temporary seeding and stabilization.
11. Cleanup.

AE. Bid Item No. 33 – Tracer Wire Box, Installed Complete in Place. Tracer wire boxes will be measured based upon each installed in accordance with the Contract Documents and satisfactorily tested. Tracer wire boxes will be paid for at the unit price bid and shall include all work necessary and incidental to tracer wire box installation including, but not limited to the following:

1. Excavation outside trench limits.
2. Backfilling, compacting, and compaction testing.
3. Bedding as detailed on the plans.
4. Shoring and bracing.
5. Dewatering.
6. Disposal of surplus material.
7. Valve box, frame, and cover, with bedding stone.
8. Tracer wire.

AF. Bid Item No. 34: Aggregate Stone Retaining Wall Backfill, complete in Place. Aggregate stone shall be measured and paid for based upon the unit price bid per ton of aggregate stone satisfactorily installed. Measurement for aggregate stone 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, filter fabric, equipment and labor required to furnish, haul, and place the aggregate stone material 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.

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.

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.

END OF SECTION

SECTION 01650

SYSTEM START-UP AND ACCEPTANCE TESTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall be responsible for demonstrating the proper operation of all equipment, controls, alarms, and appurtenances to the satisfaction of the Owner and Engineer. The Contractor shall provide at their expense all equipment, utilities, expendables and labor required to demonstrate proper operation.

B. Testing includes three discrete testing phases:

1. Factory Testing of Equipment
2. Operational Testing
3. Substantial Completion Testing

C. Operational testing and substantial completion testing shall be performed by the Contractor in the presence of the Owner.

D. The Contractor shall arrange the services of factory trained equipment representatives to assist in calibrating and testing significant equipment items for both Operational Testing and Substantial Completion Testing.

E. The Contractor shall be responsible for additional start-up and testing requirements as specified throughout the Contract Documents and as recommended by the equipment manufacturers.

F. The Contractor shall submit operation and maintenance manuals in accordance with Section 01781 after successfully completing substantial completion testing.

1.02 SUBMITTALS

Submit the following in accordance with Section 105 - Control of Work.

A. Factory testing and quality assurance reports:
1. Diesel Back-up Generator
2. Automatic Transfer Switch
3. Submersible Pumps
4. Control Systems

B. Testing equipment product data and calibration certificates.

C. Field Test Plans
1. Operational Testing

2. Substantial Completion Testing

D. Testing and Adjustment Reports
1. Operational Testing
2. Substantial Completion Testing

E. Certifications
1. Operational Testing
2. Substantial Completion Testing

PART 2 – PRODUCTS

2.01 TESTING DEVICES

The Contractor shall employ all testing devices and personnel trained in their use, required for testing as specified herein. Testing devices shall have valid calibrations performed by qualified independent calibration and testing agencies certified by the testing equipment manufacturer. All such calibrations shall be in accordance with applicable trade standards and recalibration schedules and in no case shall calibration certifications be more than 12 months old.

PART 3 – EXECUTION

3.01 OPERATIONAL TESTING

A. The Contractor shall perform Operational Testing of all installed equipment, controls, alarms and appurtenances prior to the Substantial Completion Testing.

B. Manufacturer's representatives. The Contractor shall contract with and pay for the services of the following manufacturer's representatives to be present for Operational Testing, to assist with equipment and control adjustments and bringing the system into service, and to furnish final equipment adjustment and testing reports:

1. Sewage Pumps
2. Pump Station Control Panel
3. Generator and Automatic Transfer Switch
4. Telemetry Systems

C. Operational Testing of pumping and control equipment components will be performed with potable water as required to demonstrate the proper operation of individual items of equipment, components and processes. Water for testing shall be obtained by and paid for by Contractor. Unused test water shall be disposed of in accordance with applicable laws.

D. The Contractor shall prepare and submit for approval a field test plan prior to scheduling the Operational Testing. The field test plan shall fully document all

proposed procedures, testing, and testing equipment to be utilized to demonstrate proper installation, operation and control of the station and its equipment. The field test plan shall clearly document testing of all control systems in manual and automatic operational modes, including alarm functions, control signals and any signal simulation required.

E. Schedule Operational Testing of individual components, groups of components or systems with the Owner at least seven days in advance of such testing. All Operational Testing shall be performed on the same date.

F. As a minimum, Operational Testing shall include demonstration of proper installation, operation and control of the following:
   1. Heaters
   2. Lighting Systems
   3. Exhaust Fans
   4. Louvers and Dampers
   5. Plumbing Fixtures
   6. Doors and Door Hardware
   7. Influent and Discharge Piping
   8. Gate Valves (Interior and Exterior)
   9. Check Valves
   10. Discharge Pressure Gauge and Flow Monitoring Equipment
   11. Sewage Pumps
   12. Trolleys, hoists and equipment retrieval systems
   13. Pump Control Systems
   14. Emergency Generator and Automatic Transfer Switch
   15. Alarm and Telemetry Systems

G. Results of Operational Testing shall be fully documented in an Operational Testing and Final Adjustment Report. The report shall include dates of testing, test equipment utilized, person performing tests and Owner witness, tests made, specified or manufacturer provided comparative acceptable test results, actual test results, corrections made and results of retesting for each piece of equipment or component tested.

H. Upon completion of Operational Tests, the Contractor shall make all final adjustments, repairs and replacements as required to comply with the Contract Documents and retest all components to demonstrate such.

I. The Contractor shall provide written certification that the Operational Testing was satisfactorily completed, all deficiencies were corrected, initially deficient components were successfully retested and that the Station is ready for Substantial Completion Testing.

3.02 SUBSTANTIAL COMPLETION TESTING

A. The Contractor shall perform Substantial Completion Testing of all installed

equipment, controls, alarms and appurtenances. During Substantial Completion Testing, the Contractor shall demonstrate proper repair of any items found deficient during Operational Testing. Testing to be performed system wide and not as separate components completed on the same day.

B. Manufacturer's representatives. The Contractor shall contract with and pay for the services of the following manufacturer's representatives to be present for Substantial Completion Testing, to assist with equipment and control adjustments and bringing the system into service, and to furnish final equipment adjustment and test reports:

1. Sewage Pumps
2. Pump Station Control Panel
3. Generator and Automatic Transfer Switch
4. Telemetry Systems

C. Substantial Completion Testing of pumping and control equipment components will be performed with potable water as required to demonstrate the proper operation of individual items of equipment, components and processes. Water for testing shall be obtained by and paid for by Contractor. Unused test water shall be disposed of in accordance with applicable laws.

D. The Contractor shall prepare and submit for approval a field test plan prior to scheduling the Substantial Completion Testing. The field test plan shall fully document all proposed procedures, testing, and testing equipment to be utilized to demonstrate proper installation, operational and control of the pump station and its equipment. The field test plan shall clearly document testing of all control systems in manual and automatic operational modes, including alarm functions, control signals and any signal simulation required. The test shall be performed with primary and stand-by (emergency) power systems. The test shall include all temporary facilities required to simulate actual station operating conditions.

E. Schedule Substantial Completion Testing with the Owner at least seven days in advance of such testing.

F. As a minimum, testing shall include demonstration of proper operation and control of the following:

1. Sewage Pumps
2. Pump Control Systems
3. Emergency Power Systems
4. Flow Metering Equipment
5. Alarm and Telemetry Systems

G. Results of testing shall be fully documented in a Substantial Completion Testing and Final Adjustment Report. The report shall include dates of testing, test equipment utilized, person performing tests, tests made, specified or manufacturer provided comparative acceptable test results, actual test results, corrections made and results of retesting for each piece of equipment of component tested.

H. Upon completion of Substantial Completion Testing the Contractor shall make all final adjustments, repairs and replacements as required to comply with the Contract Documents and retest all components to demonstrate such.

I. The Contractor shall provide written certification that the Substantial Completion Testing was satisfactorily completed, all deficiencies were corrected, initially deficient components were corrected and successfully retested and that the Station is ready for operation.

J. After receipt of the Contractor's certification, the Owner will provide the contractor a punch list of any remaining items to be corrected by the Contractor.

K. Satisfactory operation of the standby and portable power systems shall include successful demonstration of power transfer and equipment operations to verify loaded operability of the power systems.

END OF SECTION

SECTION 01781

OPERATION AND MAINTENANCE DATA/MANUAL

PART 1 - GENERAL

1.01 SUBMISSION OF OPERATION AND MAINTENANCE DATA/MANUAL

A. Submit Operation and Maintenance (O&M) Data/Manuals specifically applicable to this contract and a complete and concise depiction of the provided equipment or product. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal.

1.02 QUANTITY

A. Submit three (3) sets of paper copies and one (1) digital copy (PDF format) of the supplier/manufacturers' O&M information specified herein for the components, assemblies, subassemblies, attachments, and accessories. The items for which O&M Data/Manuals are required are listed in the technical sections, those which specify those particular items, and as summarized herein.

B. Submit three (3) sets of paper copies and one (1) digital copy on a separate disk from above (in vendor's standard programming language) of the PLC program.

1.03 PACKAGE QUALITY

A. Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

1.04 PACKAGE CONTENT

A. For each product, system, or component piece of equipment requiring submission of O&M Data, submit the data specified in the individual technical section.

1.05 DELIVERY

A. Submit O&M Data Manuals to the Owner for review and acceptance. O & M manuals are to be submitted with Record Drawings. O & M manuals must be submitted and approved before the work can be considered Substantially Complete. Submittals provided at the outset of the Project do not constitute O&M Manuals in whole or in part.

1.06 CHANGES TO SUBMITTALS

A. Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M data.

1.07 EQUIPMENT WARRANTY AND CERTIFICATION FORM

A. General

1. The Contractor shall furnish at the time of submitting shop drawings the manufacturer's certificates on the form provided at the end of this section for all items of equipment and products in the various sections of these Specifications.
2. The equipment 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 that the equipment provided meets the performance criteria and conforms to specification requirements.
3. 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 be finally accepted.

PART 2 – PRODUCTS

2.01 OPERATING INSTRUCTIONS

A. Include specific instructions, procedures, and illustrations for the following phases of operation:

1. Safety Precautions: List personnel hazards and equipment or product safety precautions for all operating conditions.

2. Operator Prestart: Include procedures required to set up and prepare each system for use.

3. Startup, Shutdown, and Post-shutdown Procedures: Provide narrative description for each operating procedure including control sequence for each.

4. Normal Operations: Provide narrative description of normal operating procedures. Include control diagrams with data to explain operation and control of systems and specific equipment.

5. Emergency Operations: Include emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies.

6. Operator Service Requirements: Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and gage reading recording.

7. Environmental Conditions: Include a list of environmental conditions (temperature, humidity, and other relevant data), which are best suited for each product or piece of equipment and describe conditions under which equipment should not be allowed to run.

B. Preventive Maintenance: Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair.

1. Lubrication Data: Include the following lubrication data:

a. A table showing recommended lubricants for specific temperature ranges and applications;

b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities; and

c. A lubrication schedule showing service interval frequency.

2. Preventive Maintenance Plan and Schedule: Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

3. Corrective Maintenance (Repair): Include manufacturer's recommendations on procedures and instructions for correcting problems and making repairs.

4. Troubleshooting Guides and Diagnostic Techniques: Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or requires replacement.

5. Wiring Diagrams and Control Diagrams: Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specified wiring and pneumatic control tubing and the terminals for each type, identically to actual installation numbering.

6. Maintenance and Repair Procedures: Include instructions and list tools required to restore product or equipment to proper condition or operating standards.

7. Removal and Replacement Instructions: Includes step-by-step procedures and provide a list of required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

8. Spare Parts and Supply Lists: Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead time to obtain.

C. Appendices: Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1. Parts Identification: Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall be grouped by components, assemblies and subassemblies. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as a master parts catalog, in accordance with the manufacturer's standard practice.

2. Warranty Information: List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force. Include warranty information for primary components such as the elements on unit heaters.

3. Personnel Training and Requirements: Provide information available from the manufacturers to use in training designated personnel to operate and maintain the equipment and systems properly.

4. Testing Equipment and Special Tool Requirement: Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. See individual specification sections for the requirements for provision of special tools.

5. Contractor Information: Provide a list that includes the name, address, and telephone number of the General Contractor and each subcontractor installing the product or equipment. Include local representatives and service organizations most convenient to the project site. Provide the name, address, and telephone number of the product or equipment manufacturers.

6. Copy of the approved shop drawing shall be included.

7. The manual shall contain adequate information to be in conformance with the Commonwealth of Virginia, Department of Health "Water Works Regulations".

8. Equipment manufacturer's warranty and certification. See paragraph 1.07 for requirements.

9. Provide web page and electronic web page information where available.

PART 3 – EXECUTION

3.01 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall furnish three (3) copies of a 3-ring binder type manual and one digital manual (PDF format) on CD that contains complete operation, maintenance and repair instructions for each of the following equipment:

1. Sewage Pumps, including pump curve
2. Electric Motors
3. Generator Set
4. Automatic Transfer Switch
5. Alarm Systems
6. Ventilation Systems
7. Pump and Level Control Systems: To include as-built wiring diagrams and software ladder diagrams
8. Panels and electrical components (breakers, bus bars, etc.)

9. Shingles
10. Louvers and Dampers
11. Check Valves
12. Gate Valves
13. Lighting
14. Heaters
15. Electrical Panels
16. Copy of Radio Survey Report

3.02 FORMAT

A. Hard Cover Binders: Submit manuals on 8 ½" x 11" sheets or booklets, loose bound in three-ring binders with front and back page lifters. The following identification must appear on the cover: The words "EQUIPMENT OPERATING, MAINTENANCE, AND INSTALLATION MANUAL"; "*Project Name*" and indication of systems covered. Furnish drawings included in the manuals on 11" x 17" sheets laminated and folded to 8 ½" x 11", or folded and placed in vinyl "envelop pockets" incorporated into the binder. All materials in manuals shall be original print quality manufacturer literature or photo static copies of same. All manuals must be similar in appearance.

B. Warning Page: Provide the appropriate warning pages to warn of potential dangers (if they exist), such as high voltage, flammable liquid, carcinogens, high pressures, etc. Place warning pages inside the front cover, in front of the title page.

C Title Page: The title page shall show the name of the firm (designer or contractor) preparing the manual and the date of publication.

D. Table of Contents: Provide in accordance with York County Standards.

E. Material

1. Paper: Loose leaf on 20 pound, punched.
2. Holes: Reinforced with plastic cloth or metal.
3. Page Size: 8 ½" x 11".
4. Diagrams and Illustrations: Attach foldouts as required or original quality, reproducible by dry copy method.
5. Covers: Oil, moisture, and wear resistant 9" x 12" size.

EQUIPMENT WARRANTY AND CERTIFICATION FORM

Reference: County of York, Virginia
Project:
IFB No.:

The undersigned hereby attests that he has examined all the referenced Project Drawings and Specifications and hereby warrants and certifies the equipment, component or system he proposes to furnish and deliver meets or exceeds Contract Specifications, is suitable for its intended purpose and installation, and will provide satisfactory performance at the design criteria specified. This warranty shall be in addition to and not in lieu of all other warranties, express or implied.

Equipment: _____

_____

Manufacturer: _____

Address: _____

_____

By: _____ (SEAL)
(Type Name and Title)

_____ /s/ _____
(Signature) (Date)

Equipment Warranty and Certification must be signed by a Principal person (President, Vice-President, etc.) of the equipment manufacturer. In the event the manufacturer is not the Supplier, then a Principal Person of the Supplier must also sign this form.

Supplier: _____

Address: _____

_____

By: _____ (SEAL)
(Type Name and Title)

_____ /s/ _____
(Signature) (Date)

END OF SECTION

SECTION 02010

SUBSURFACE EXPLORATION

PART 1 - GENERAL

1.01 Related Documents

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

B. Related Work Specified Elsewhere

1. Section 02151 – Shoring
2. Section 02200 – Earthwork
3. Section 02223 – Subgrade Preparation for Drives

1.02 Site Conditions

A. Geotechnical Engineering Data: Subsurface exploration and analysis data included in whole or in part in the appendix of this document, gives physical data on sub-surface conditions as obtained for information for the Owner only, and in no event is this information to be considered as part of the Contract. It is expressly understood that the Owner and the Engineer will not be responsible for any interpretation or conclusions drawn therefrom by the Contractor.

B. Bidders are cautioned that the subsurface boring data was used for general design purposes only and may be inadequate for the purposes of bidding or performing the work. It is strongly recommended that the Contractor perform his own subsurface investigation to the extent necessary to satisfy himself as to the subsurface conditions. It is the Contractor's responsibility to thoroughly investigate the site including subsurface conditions and under no circumstance is the Contractor to rely on the subsurface information that was obtained for the information of the Owner.

C. Limitations of Subsurface Information Indicated on Drawings: Certain information regarding the reputed presence, size, character and location of existing underground structures, pipe lines and electrical and signal facilities has been indicated on the Drawings for the benefit of the Owner.

1. Accuracy of Location: There is no certainty of the accuracy of this information, and the location of underground structures indicated may be inaccurate, and other obstructions than those indicated may be encountered.
2. The Contractor hereby distinctly agrees:

a. That neither the Owner nor the Engineer is responsible for the correctness or sufficiency of the information given;
b. That in no event is this information to be considered as a part of the Contract;
c. That the Contractor shall have no claim for delay or extra compensation or damage against the Owner or the Engineer on account of incorrectness of information given; or on account of the insufficiency or absence of information regarding obstruction either revealed or not revealed by the Drawings; and
d. That the Contractor shall have no claim for relief from any obligation or responsibility under the Contract, in case the location, size or character of any pipe, electrical or signal facility or other underground structure is not as indicated on the Drawings, or in case any pipe, electrical or signal facility or other underground structure is encountered that is not indicated on the Drawings.

D. Digging Test Pits: Test pits are recommended but not required to determine the location and elevation of existing subsurface utility pipelines, electrical facilities or structures. If the Contractor chooses to dig such test pits they shall be done in the presence of an authorized representative of the owner of the subsurface utility pipelines, electrical facilities or structures.

1. The Contractor is advised that Miss Utility must be notified before any test pits are excavated.
2. In locations where new sewers are to be connected to existing sewers, the Contractor shall not proceed with new construction until he has dug test pits and determined the exact location and elevation of the existing sewers. Dig such test pits only at the locations agreed to by the Owner and the Owner of such utilities.
3. No additional payment will be made for performing test pits.

2. PRODUCTS (NOT APPLICABLE)

3. EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 02151

SHORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Related Work Specified Elsewhere:

1. Section 02200 – Earthwork
2. Division 2 – Sections Involving Excavations

1.02 SUMMARY

A. Section Includes: The work specified in this Section consists of providing shoring which conforms to Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees, and which will be used to maintain structures and roadways, existing, proposed, and under construction.

1.03 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Shoring materials and installation work shall conform to Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees.

B. Provide for the protection of the public, employees and property, in accordance with applicable requirements of Part 1926, Subpart P, "Excavation, Trenching and Shoring", Construction Safety and Health Regulations (OSHA), which, by reference, is made a part of this specification, including sections relative to protection of the public; shoring and bracing; trenches and excavating equipment.

C. Shoring Design: The design and the adequacy of the Shoring installed is the responsibility of the Contractor.

1.04 SITE CONDITIONS

A. Responsibility for Condition of Excavation: The Contractor is solely responsible for the condition of the excavations.

1. The failure or refusal of the Engineer or Owner to suggest the use of Shoring, or a better quality, grade, or section, or larger sizes of Shoring materials, or to suggest that Shoring be left in place, shall in no way or extent relieve the Contractor of his responsibility concerning the condition of excavation or of his obligations under the Contract, nor impose liability on the Engineer or the Owner.

2. No delay, whether caused by an action or want of action on the part of the Contractor, or by an act of the Engineer, Owner, or their agents, or employees, resulting in the keeping of any excavation open longer than would otherwise have been necessary, relieves the Contractor from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from his obligations under the Contract relating to injury to persons or property, nor entitle him to claims for extra compensation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sheeting, Shoring, Bracing, and Trench Box materials shall conform to Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Shoring installations shall conform to Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees.

3.02 SAFETY

A. The Contractor is solely responsible for injury or damage resulting from shoring failure. Maintenance of the shoring is the Contractor's responsibility.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Related Work Specified Elsewhere:

1. Section 200 – Products and Materials
2. Section 301 – Clearing and Grubbing
3. Section 303 – Earthwork
4. Section 02151 – Shoring
5. Section 02270 – Slope Protection and Erosion Control

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 SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM D 698, (2000a) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3-(600 kN-m/m^3))
2. ASTM D 1556, (2000) Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method
3. ASTM D 2167, (2001) Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
4. ASTM D 2487, (2000) Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
5. ASTM D 2922, (2001) Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
6. ASTM D 3017, (2001) Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.03 SUMMARY

A. This Section includes the following:

1. Preparing of subgrade for building slabs, foundations, valve vault, and walks.
2. Earthwork for building construction including foundations and walls.
3. Excavating and backfilling of trenches within building lines.
4. Excavating and backfilling for underground mechanical, electrical and site utilities and appurtenances.

1.04 DEFINITIONS

A. Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Owner. Unauthorized excavation, as well as remedial work directed by Owner, shall be at Contractor's expense.

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Controlled low strength material (see definition, 2.01.H) fill may be used to bring elevations to proper position, when acceptable to Owner.
2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Owner.

C. Additional Excavation: When excavation has reached required subgrade elevations, notify Owner and the Contractor's approved Testing and Inspection Consultant. The Contractor shall perform compaction testing prior to placement of structural fill. Areas of proposed excavation should be tested until rough finished subgrade is achieved. If low consistency soils are encountered which cannot be adequately densified in place, such soils shall be removed and replaced with well-compacted fill material. If Owner determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Owner.

1. Removal of unsuitable material and its replacement as directed will be paid on a cubic yard basis measured in place.

D. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular base, drainage fill, or topsoil materials.

E. Structure: Buildings, foundations, slabs, fences, and other man-made stationary features occurring above or below ground surface.

1.05 SUBMITTALS

Submit the following in accordance with Section 105 - Control of Work.

A. Subgrade and backfill Testing and Inspection Reports.

1.06 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

B. Testing and Inspection Service: Contractor shall employ and pay for a qualified independent geotechnical testing and inspection laboratory to perform soil testing and inspection service deemed appropriate by the Owner during earthwork operations.

C. All soil tests that fail to meet a compaction of 95 percent of maximum dry density per ASTM D-698, Standard Proctor shall be re-tested at the expense of the Contractor. Contractor shall notify the Owner when work has been corrected and is ready for the re-test.

1.07 PROJECT CONDITIONS

A. Site Information: Data in subsurface investigation reports was used for the basis of the design and is available in Appendix A for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.

1. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

2. Other applicable requirements for Project Conditions, including but not limited to, existing utilities, and protection of persons and property are specified in the Regional Construction Standards, as amended.

B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

2. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Owner and then only after acceptable temporary utility services have been provided.
   a. Provide minimum of 48-hour notice to Owner and receive written notice to proceed before interrupting any utility.

3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active.

C. Use of Explosives: Will not be permitted.

D. Protection of Persons and Property: Barricade open excavations occurring as part of this work.

1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations. Reference temporary chain link fences as found on the drawings.
2. No excavation will be permitted within the drip line of trees.
3. Excavation shall be performed in strict compliance with regulations of authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Satisfactory Soil Materials: Per Section 200.

B. Unsatisfactory Soil Materials: Per Section 200.

C. Drainage Fill: Washed, evenly graded mixture of crushed stone, or gravel, with 100 percent passing a 1-1/2 inch sieve and not more than 5 percent passing a No. 4 sieve.

D. Backfill and Fill Materials:

1. 5 feet beyond structures: Satisfactory soil materials free of clay, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.
2. Within 5 feet of structures and as backfill between sheeting and structure use select material.

E. Select Material (Subbase Material): Per Sections 200 and 602.

F. Topsoil: Per Sections 200 and 602.

G. Lime: Per Section 200.

H. Controlled Low Strength Material: Flowable fill may be used on an Owner approved, case-by-case basis for trench backfill and pipe abandonment fill. Pipe bedding requirements will remain unchanged unless otherwise specified in the Special Provisions. Fly ash may be approved for use provided it complies with VDOT Section 241.

PART 3 - EXECUTION

3.01 EXCAVATION

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing: See Section 02151, Shoring

3.02 DEWATERING

A. Per Section 107.

3.03 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable and necessary for backfill and fill within the site work area. Place, grade, and shape stockpiles for proper drainage. Install and maintain sedimentation and erosion control devices as required. Excavation in excess of the material necessary or not acceptable for backfill and fill shall be removed off site by the Contractor and lawfully disposed at the Contractor's expense.

1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
2. Provide silt fencing around toe of stockpile.

3.04 EXCAVATION FOR STRUCTURES

A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

1. Excavations for footings and foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before subgrade stone is placed. Excavation to final grade shall not be made until just before the concrete is to be placed. If structural concrete cannot be placed the same day excavation is completed, a three-inch thick controlled low strength material mud mat shall be placed to prevent degradation of the subgrade. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Basins, and Mechanical or Electrical Structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection. Do not disturb bottom of excavations, intended for bearing surface.

3.05 TRENCH EXCAVATION FOR PIPES AND CONDUIT

A. Per Section 303.

3.06 COLD WEATHER PROTECTION

A. Protect subgrade against freezing.

3.07 BACKFILL AND FILL

A. General: Place soil material in layers to required elevations, using materials specified herein and in Part 2 of this Section.

1. Under grassed areas, use satisfactory excavated or borrow material.
2. Under walks and pavements, per Section 303.
3. Under steps, use No. 57 stone.
4. Under building slabs, use No. 57 stone or mud slab, as required.
5. Valve vaults; use No. 57 stone.

B. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, where applicable dampproofing, waterproofing, and perimeter insulation.
2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
3. Removal of concrete formwork.
4. Removal of trash and debris from excavation.
5. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.08 PLACEMENT AND COMPACTION

A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, construction materials and other deleterious materials from ground surface prior to placement of fill materials. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

1. Contractor is to hire a third party soil-testing firm approved by the Owner, at Contractor's expense. Minimum testing to include 3 compaction tests on every other layer/lift placed.

B. Place backfill and fill materials in layers not more than 6 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Unless specified otherwise, compact each layer to 95 percent of

maximum dry density ASTM D-698 Standard Proctor for each area classification. Contractor to provide, install and compact select fill materials within a perimeter of 5-feet around the pump station footprint to 100 percent of the maximum dry density ASTM D-698 Standard Proctor. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

D. Place backfill and fill materials evenly when filling adjacent to structures, piping, or conduit. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

E. Control soil and fill compaction. Correct improperly compacted areas or lifts as directed by Owner if soil density tests indicate inadequate compaction.

1. Unless otherwise indicated, compact to 95 Percent of Maximum Density per ASTM D-698, Standard Proctor.
2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.

    a. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
    b. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

F. Fill adjacent to structures shall be compacted by manually directed power tampers or plate vibrators. Heavy equipment shall not be operated within two feet of any structure. Vibrating roller shall not be operated within five feet of any structure without written approval. Compaction by means of a drop weight operating from a crane or hoist will not be permitted.

G. During construction, the passage of heavy equipment will not be allowed over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one-half the clear span width of the structure or pipe or two feet, whichever is greater.

H. Compaction of fill adjacent to structures shall not be started until the following time intervals have elapsed after placement of the concrete:

1.	Retaining walls	14 days
2.	Walls backfilled on both sides simultaneously	7 days

3.	Conduits, precast, cradled	2 days
4.	Conduits, precast, bedded	1 day
5.	Under piping and conduit - per Section 303.	

3.09 GRADING

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

B. All ditches, swales and gutters shall be finished to drain readily. Unless otherwise indicated greater, the finished grade shall be uniformly sloped to provide drainage away from building walls in all directions at grade not less than 2.0% (2 feet per 100 feet). No asphalt or concrete walks shall have less than 1% (1 foot per 100 feet) of slope.

C. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces shall be free from irregular surface changes and as follows:

1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
2. Walks: Shape surface of areas under walks to line, grade, and cross-section indicated. Finish surface not more than 0.10 foot above or below required subgrade elevation.
3. Pavements: Shape surface of areas under pavement to line, grade, and cross-section indicated. Finish surface not more than 0.05 foot above or below required subgrade elevation.

D. Grading Surface of Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 0.10 foot when tested with a 10-foot straightedge.

E. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum density for each area classification.

F. All filled surfaces at building pads and roadways shall be sealed by rolling with a steel-drum or pneumatic tire roller at the end of each day to minimize surface infiltration from precipitation.

G. Equipment with excessive fuel or lubricant leaks shall not be used at any time. Repair equipment immediately or remove from job site.

3.10 PREPARATION OF SUBGRADE

A. General

1. After the earthwork has been substantially completed and related work has been completed, the subgrade shall be brought to the lines, grades, and typical cross-section shown on the plans, and finished in accordance with these specifications.
2. The subgrade shall be properly shaped and thoroughly compacted so that it conforms to the lines and yielding condition before placement of material. If the subgrade does not contain sufficient moisture for compaction, it shall be wetted to optimum moisture content.
3. All soft and yielding material, rock greater than 6-inches in diameter measured on any plane, loose stones or any other unsuitable material in the subgrade, which will not compact readily, shall be removed and replaced with suitable material, which shall be thoroughly compacted. All roots, stumps, or other perishable matter encountered in the preparation of the subgrade shall be removed, regardless of burial/partial burial.
4. In preparing the subgrade, the material excavated shall not be piled outside and along the forms in such a manner as to interfere with the proper surface finishing or the proper drainage of the subgrade.

B. Compaction of Subgrade

1. The subgrade shall be compacted as required by the Engineer for the entire length of the project with appropriate equipment. Compaction shall be continued until the subgrade has been compacted throughout to its maximum practical density as determined by the Engineer. A density of at least 95% Standard Proctor Maximum Dry Density of optimum moisture content shall be obtained in accordance with ASTM D-698 as amended.

C. Protection of Subgrade

1. Ditches and drains shall be provided and maintained to satisfactorily drain the subgrade. In no case shall any base course be placed on frozen or muddy subgrade. Frost crystals or mud caused by freezing and thawing shall be removed and replaced with suitable material or allowed to dry before placing any base course. If ruts are formed in the prepared subgrade, the subgrade shall be scarified and thoroughly compacted.

3.11 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.

1. Field density tests shall be performed by the nuclear method in accordance with ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. In conjunction with each density calibration check, the calibration curves will be checked with moisture gauges in accordance with ASTM D 3017. Calibration checks of both density and moisture gages will be made at beginning of work, on each different type of material encountered, and at intervals as directed by the Owner.
2. Footing Subgrade: For each strata of soil on which footings will be placed, at least one test will be performed to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to Owner.
3. Paved Areas and Building Slab Subgrade: At least one field density test will be performed of subgrade for every 2,000 sq. ft. of paved area or building slab, but in no case fewer than 8 tests. In each compacted fill layer, one field density test will be performed for every 2,000 sq. ft. of overlaying building slab or paved area, but in no case fewer than three tests.
4. Foundation Wall Backfill: At least three field density tests will be performed every other lift.
5. If in the opinion of the Owner, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, additional compaction and testing will be performed until specified density is obtained.

3.12 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather; scarify surface, reshape, and compact to required density prior to further construction.

D. Settling: Where settling is measurable or observable in areas where earthwork has been performed by the Contractor, remove surface (pavement, lawn, or other finish), determine cause of settlement, add fill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible. Corrective work will be performed within 14 calendar days of Owner Notice to Contractor.

3.13 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Transport waste material, including surplus excavated material, unsuitable soils, trash, and debris to lawful spoil or disposal areas and dispose of in a lawful manner at Contractor's expense.

END OF SECTION

SECTION 02270

SLOPE PROTECTION AND EROSION CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Contractor shall furnish all labor, materials, equipment and incidentals required and perform all slope and erosion control work as specified herein. The work includes, but is not limited to temporary seeding, use of silt fencing, tree protection fence, and soil retention coverings for erosion control.

B. Related Work Specified Elsewhere:

1. Section 303 – Earthwork
2. Section 602 – Topsoil
3. Section 603 – Seeding
4. Section 604 – Sodding
5. Section 02151 – Shoring
6. Section 02200 – Earthwork for Buildings

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. Virginia Department of Transportation, Road and Bridge Specifications, latest edition.
   a. Section 606, Soil Retention Coverings.
2. Virginia Erosion and Sediment Control Handbook, Latest Edition.

PART 2 - PRODUCTS

2.01 SOIL RETENTION COVERINGS

A. The Contractor shall furnish a certification from the manufacturer that the matting conforms to the requirements prescribed hereinafter.

B. Jute Mesh – shall be a uniform, open plain weave of undyed and unbleached single layer jute yarn. The yarn shall be loosely twisted and shall not vary in thickness by more than its normal diameter. Jute mesh shall be new, and its length marked on each roll. Between strands lengthwise, openings shall be 0.60 inch +/- 25 percent. Between strands crosswise, openings shall be 0.90 inch +/- 25 percent. Jute mesh shall weigh 0.9 pounds per square yard +/- 5 percent.

C. Soil Retention Mats - shall consist of a machine-produced mat of wood fibers, wood excelsior, or manmade fiber that shall intertwine or interlock. Matting shall be nontoxic to vegetation and germination of seed and shall not be injurious to unprotected skin of a human body. Mats shall be of consistent thickness, with fiber evenly distributed over its entire area, and covered on top and bottom side with netting having high web strength and machine sewn on 2-inch centers along the longitudinal axis of the material. Netting shall be entwined with the mat for maximum strength and ease of handling.

2.02 EROSION CONTROL DEVICES

A. Silt Fence:

1. In accordance with Virginia Erosion and Sediment Control Handbook, Latest Edition.

B. Rip Rap:

1. Rip Rap and geotextile fabric to be installed as specified in section 3.19 of the Virginian Erosion and Sediment Control Handbook, latest edition.

2.03 TEMPORARY SEEDING MIXTURES

A. As specified in Section 603.

2.04 SOIL SUPPLEMENT MATERIALS

A. Fertilizer: As specified in Section 603.

B. Agricultural Lime: As specified in Section 603.

2.05 MULCHING MATERIALS

A. Straw: To be placed on areas receiving grass seed.

B. Lawn Mulch: As specified in Section 603.

PART 3 - EXECUTION

3.01 PREPARATION

A. Erosion Control Devices: Provide in place prior to the start of construction.

1. Silt Fence: Maintain near the limits of clearing or excavation where surrounding grades are lower than the construction area to prevent flow of sediment outside the permanent easement or limits of clearing until such time the disturbed areas are permanently stabilized.
2. Construction Entrance: installed at project entrance before construction begins.

B. Erosion Control Devices: Provide in place after construction in any area.

1. Temporary Seeding and Mulching or Mulching Only: Apply temporary seeding and/or mulching when the disturbed area can not be prepared for final grading and seeding or weather conditions are not suitable for permanent seeding. Mulch alone shall be utilized from November 15 - February 15. Seeding must then occur as soon as the season permits.
2. Use of temporary seeding and/or mulching shall be determined by the Owner.

3.02 PERFORMANCE

A. All installations must conform to the Virginia Erosion and Sediment Control Handbook, VDOT Road and Bridge Specifications, and local ordinances.

B. Erosion and sediment control measures may require minor field adjustments at time of construction to insure their intended purpose is accomplished.

C. Seeding and Mulching:

1. General: The Owner reserves the right to direct temporary seeding and/or mulching of disturbed areas in the event the permanent grading and seeding can not be immediately performed. The cost of such temporary erosion control measures shall be included at no additional cost to the Owner.
2. Permanent or temporary soil stabilization must be applied to all disturbed areas within 7 days after final grade is reached on any portion of the site. Soil stabilization must also be applied to disturbed areas which may not be at final grade but which will remain dormant for longer than 30 days. Permanent seeding shall be in accordance with Section 603: Seeding.
3. Liming: As specified in Section 603.
4. Fertilizer: As specified in Section 603.

5. Tilling: The seedbed shall be tilled to a depth of 3-inches prior to seeding. The lime (if required) and fertilizer may be applied during the tilling operation.
6. Seeding: As specified in Section 603.
7. Mulching: As specified in Section 603.

D. Mulching Alone: Whenever weather conditions prohibit planting seed, apply two tons per acre of straw or hay mulch for temporary erosion control, for embankments or cuts flatter than 3 to 1. The straw or hay may be rolled immediately with a sheep foot roller to anchor the mulch. When the weather becomes favorable, the areas provided with a mulch cover alone shall be seeded using the normal application rates of seed, fertilizer and lime. If additional mulch is needed, the rate of application and area to be mulched shall be as determined by the Owner's Representative. For slopes 3 to 1 or steeper, erosion control matting shall be used.

E. Soil Retention Coverings: shall be used in lieu of mulch on slopes 3 to 1 or steeper, or where indicated on the Drawings, or when directed by the Owner's Representative.

1. If used in conjunction with temporary seeding, the area to be covered shall be prepared as a fine seedbed, fertilized and seeded. The matting shall be placed immediately and shall be watered to give a firm bond to the soil and start the germination of the seed. Either organic fiber or excelsior matting may be used.

F. Construction Entrance: Provide where shown on drawings or where directed by the Owner.

3.03 MAINTENANCE

A. Maintenance operations shall begin immediately and shall continue throughout the construction period until the Contract has been completed.

1. Erosion control devices shall be inspected immediately after each rainfall and at least daily during prolonged rainfall.

2. Close attention shall be paid to the repair of end runs and undercutting beneath the erosion control devices.
3. Sediment deposits along erosion control devices should be removed after each rainfall. They must be removed when the level of deposition reaches approximately one-half the height of the barrier.
4. Any sediment deposits remaining in place after the erosion control device is no longer required shall be dressed to conform to the existing grade, prepared and seeded.

B. Refer to Section 603 for establishment and maintenance of seeded areas.

3.04 REMOVAL

A. Temporary erosion control measures (silt fences, construction entrance) shall not be removed until all disturbed areas are stabilized. After stabilization is complete, all measures shall be removed within 30 days. Trapped sediment shall be spread and seeded.

END OF SECTION

SECTION 02724

INTERIOR PIPING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: The work specified in this Section consists of constructing wastewater piping and appurtenances within the pump station structure. Refer to Sections 802 and 803 for exterior piping.

B. Related Sections:

1. Section 03300 – Cast-in-Place Structural Concrete
2. Section 03410 – Precast Concrete Wet Well
3. Section 15100 – Submersible Pumping Equipment

1.02 REFERENCES

A. AMERICAN SOCIETY FOR TESTING AND MATERIALS
1. ASTM A 36, (1994a) Carbon Structural Steel

B. AMERICAN WATER WORKS ASSOCIATION
1. AWWA C104, (1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2. AWWA C105, (1999) Polyethylene Encasement of Ductile Iron Pipe Systems
3. AWWA C110, (1998) Ductile Iron and Gray-Iron Fittings, 3-Inch Through 48-Inch (75mm through 1200 mm), for Water and Other Liquids
4. AWWA C111, (2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
5. AWWA C115, (1999) Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. AWWA C116, (1998) Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior of Ductile and Gray Iron Fittings for Water Supply Service
7. AWWA C151, (1996) Ductile-Iron Pipe, Centrifugally cast for Water or Other Liquids
8. AWWA C508, (2001) Swing-Check Valves for Waterworks Service
9. AWWA C509, (2001) Resilient-Seated Gate Valves for Water Supply Service
10. AWWA C550, (2001) Protective Interior Coatings for Valves and Hydrants
11. AWWA C600, (1993) Installation of Ductile-Iron Water Mains and Their Appurtenances.

C. Manufacturers Standardization Society of the Valve and Fitting Industry

1. MSS SP-58, (1993) Pipe Hangers and Supports – Materials, Design and Manufacture
2. MSS SP-69, (1996) Pipe Hangers and Supports – Selection and Application
3. MSS SP-89, (1998) Pipe Hangers and Supports – Fabrication and Installation Practices

1.03 SUBMITTALS

The following shall be submitted in accordance with Section 105 - Control of Work.

A. Shop Drawings and Product Data: Submit completely dimensioned shop drawings, catalog cuts and such other data as required to provide complete descriptive information for the following:
1. Interior Pipe, Fittings, and Appurtenances
2. Gate Valves
3. Check Valves
4. Wall Sleeves and Pipe to Wall Sleeve Seals
5. Pipe Supports
6. Flexible Expansion Joints
7. Flexible Check Valves

B. Certificates: Submit certified records or reports of results of shop tests, with such records or reports containing a sworn statement that shop tests have been made as specified.
1. Provide manufacturer's certification that pipe and fittings were manufactured in accordance with specified reference standards for each pipe type.

1.04 QUALITY ASSURANCE

A. Design Criteria:
1. Use only one type and class of pipe, unless otherwise indicated on the Drawings.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Transport, handle and store pipe materials and the associated materials specified herein, in a manner recommended by the respective manufacturers to prevent damage and defects.

B. Particular care shall be taken to ensure the coating and lining of pipe, fittings and appurtenances are not damaged. Where lining or coating damage occurs, repair

shall be made at the contractor's expense, in accordance with the manufacturer's instructions as approved by the Owner and in the presence of the Owner.

C. Rubber gaskets that are not to be immediately installed shall be stored in a cool and dark place.

D. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating is applied.

E. Clean the interior of pipe, fittings and accessories prior to installation.

F. Thoroughly inspect pipe, fittings and appurtenances for damage/defects prior to installations. Damaged or defective materials shall be replaced at no additional cost to the Owner.

G. Pipe shall be carried or lifted into position. Nylon slings shall be utilized to lift pipe and appurtenances. Dragging pipe is not acceptable.

H. The interior of pipe, fittings and appurtenances shall be maintained clean during installation by plugging or other approved methods.

PART 2 - PRODUCTS

2.01 FORCE MAIN PIPE AND FITTINGS

A. Pipe and fittings shall conform to the respective specifications and other requirements specified. Interior pipe, flanges and fittings for force mains shall be ductile iron, Class 53, Pressure Class 350, flanged pipe conforming to AWWA C151 and AWWA C110 with ductile iron bolted flange joints conforming to AWWA C115. Fittings and specialties for flanged joint pipe shall conform to the respective requirements of AWWA C110 and AWWA C115. Rubber gaskets and lubricants shall conform to the applicable requirements of AWWA C111. Interior of pipe and fittings to be double thickness cement-mortar lined in accordance with the requirements of AWWA C104.

2.02 GATE VALVES

A. 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 hand wheels 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.

2.03 CHECK VALVES

A. 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. Acceptable manufacturers include AFC, M&H Valve Company or Mueller Company.

2.04 WALL SLEEVES AND SEALS

A. Wall Sleeves: Wall openings for pipes shall be sleeved with cast-in-place ductile iron or steel sleeves appropriately sized for use with the specified pipe to wall sleeve closure seals for the pipe size and material used.

B. Pipe to Wall Sleeve Closure Seals: Pipe to wall sleeve closure seals shall be modular mechanical type consisting of interlocking synthetic rubber links and stainless steel components designed to fill annular space and provide watertight seal between wall sleeves and pipe. Seals shall be Link-Seal type as manufactured by Thunderline Corporation, Wayne Michigan or approved equal.

2.05 PIPE HANGERS AND SUPPORTS

A. Pipe hangers and supports shall be specifically designed and fabricated for permanent suspension of the specified AWWA ductile iron or PVC pipe as required on the drawings. Pipe hangers shall conform to MSS SP-58, MSS SP-69 and MSS SP-89 standards. (Pipe hangers and hardware located in the wet well shall be fabricated of 316 SS.)

B. Pipe supports shall be as shown on drawings.

2.06 MISCELLANEOUS MATERIALS

A. Flexible Expansion Joint: shall be the force balanced FLEX-TEND as manufactured by EBAA Iron.

B. Flexible Check Valve: shall be the Tideflex Series TF-2 as manufactured by Red Valve.

C Valve Vault Drain: ASTM D-1785 Schedule 80 solvent welded PVC.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect each section of pipe and each pipe fitting before placement in conformance with the inspection requirements of the appropriate referenced standard.

B. Remove rejected Products from the project site and replace with new Products at no increase in Contract price.

3.02 PREPARATION

A. General Requirements: Clean piping interior prior to placing pipe and following pipe placement, and keep open ends of piping and pipe attachment openings capped or plugged until actual connection or actual pipe testing.

3.03 INTERIOR PIPING CONSTRUCTION

A. Flanged Joints: Make flanged joints with gaskets, and 316 s.s. bolts and nuts. Make flanged joints up tight, taking care to avoid undue strain on flanges, fittings, and other accessories. Align bolt holes for each flanged joint. Use properly sized bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or fan any other purpose will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flanges.

B. Pipe Support: Exercise extreme caution in constructing interior piping ensuring that all piping and appurtenances installed, being installed or awaiting installation are properly secured and protected at all times. All pipe support hardware to be 316 stainless steel.

C. Pipe Hangers and Support: In accordance with to MSS SP-58, MSS SP-69 and MSS SP-89 standards.

D. Pipe Restraint: Restrain interior piping with vertical and horizontal bracing indicated on the drawings. All pipe restraint hardware to be stainless steel.

3.04 FIELD QUALITY CONTROL

A. Force Main Hydrostatic and Leakage Testing per Section 803.

B General Requirements: Conduct tests specified herein so that each force main (interior and exterior piping) installed in the Project is tested to the Owner's satisfaction.

C. Prepare and submit to the Owner for approval a hydrostatic test plan including: detailed description of proposed testing procedures, list of test equipment, schedule of testing sequence, and certification of test gauge calibration.

D. Provide tools, materials (including water), apparatus and instruments necessary for force main testing.

E. Conduct acceptance tests of every kind in the presence of and to the satisfaction of the Owner.

F. Retesting

If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be re-conducted until the results of the tests are within specified allowances at the expense of the Contractor.

END OF SECTION

SECTION 03100

STRUCTURAL CONCRETE FORMWORK

PART 1 - GENERAL

1.01 SUMMARY

A. The work includes all labor, materials, tools, equipment, supplies, services; and related work for the construction and removal of structural concrete formwork, provided complete and ready for operations.

B. Related work specified elsewhere includes:

1. Section 03200 – Concrete Reinforcement
2. Section 03250 – Waterstops
3. Section 03300 – Cast-In-Place Structural Concrete

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. ACI INTERNATIONAL (ACI)
1. ACI 347R - (1994) Guide to Formwork for Concrete

B. AMERICAN HARDBOARD ASSOCIATION (AHA)
1. AHA A135.4 - (1995) Basic Hardboard

C. DEPARTMENT OF COMMERCE (DOC)
1. DOC PS 1 - (1983) Construction and Industrial Plywood

1.03 SUBMITTALS

A. The following shall be submitted in accordance with Section 105 CONTROL OF WORK.
1. Product Data
2. Concrete Formwork.
Manufacturer's data including literature describing form materials, accessories, and form releasing agents.

B. Instructions.
1. Form Releasing Agents.
Manufacturer's recommendation on method and rate of application of form releasing agents.

1.04 DESIGN

Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface that meets the requirements of the class of finish specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

PART 2 - PRODUCTS

2.01 FORMS FOR CLASS A AND CLASS B FINISH

A. Forms for Class A and Class B finished surfaces shall be plywood panels conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood concrete form panels.

2.02 FORMS FOR CLASS C FINISH

A. Forms for Class C finished surfaces shall be shiplap lumber; plywood conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II; tempered concrete form hardboard conforming to AHA A135.4; other approved concrete form material; or steel, except that steel lining on wood sheathing shall not be used.

2.03 FORMS FOR CLASS D FINISH

A. Forms for Class D finished surfaces, except where concrete is placed against earth, shall be wood or steel or other approved concrete form material.

2.04 FORM TIES

A. Form ties shall be factory-fabricated metal ties, shall be of the removable or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spall concrete upon removal. Solid backing shall be provided for each tie. Except where removable tie rods are used, ties shall not leave holes in the concrete surface less than 1/4 inch nor more than 1 inch deep and not more than 1 inch in diameter. Removable tie rods shall be not more than 1-1/2 inches in diameter.

2.05 FORM RELEASING AGENTS

A. Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent

treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

PART 3 - EXECUTION

3.01 FORMWORK

A. Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE and conforming to construction tolerance given in TABLE 1. Where concrete surfaces are to have a Class A or Class B finish, joints in form panels shall be arranged as approved. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be reused if there is any evidence of surface wear and tear or defects, which would impair the quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concreting and of all other foreign material before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

3.02 CHAMFERING

A. Except as otherwise shown, external corners that will be exposed shall be chamfered, beveled, or rounded by moldings placed in the forms.

3.03 COATING

A. Forms for Class A and Class B finished surfaces shall be coated with a form-releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Forms for Class C and D finished surfaces may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.04 REMOVAL OF FORMS

A. Forms shall be removed in a manner that will prevent injury to the concrete and ensure the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement. Supporting forms and shores shall not be removed from beams, floors and walls until the structural units are strong enough to carry their own weight and

any other construction or natural loads. In no case will supporting forms or shores be removed before the concrete strength has reached 70 percent of design strengths as determined by field cured cylinders in accordance with Section 03300.

TABLE 1 TOLERANCES FOR FORMED SURFACES	
Variations from the plumb:	In any 10 feet of length: 1/4 inch
Variation from the level or from the grades indicated on the drawings:	In any 10 feet of length: 1/4 inch
Variation of the linear building lines from established position in plan:	In any 20 feet: 1/2 inch Maximum: 1 inch
Variation in the sizes and locations of sleeves, floor openings, and wall openings:	Minus: 1/4 inch Plus: 1/2 inch
Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls:	Minus: 1/4 inch Plus: 1/2 inch
Footings, variation of dimensions in plan	Minus: 1/2 inch Plus: 2 inches when formed or plus 3 inches when placed against unformed excavations.
Footings, reduction in thickness	Minus: 1/4 inch

End of Section

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. The work includes all labor, materials, tools, equipment, supplies, services; and related work for the construction of structural concrete reinforcing, provided complete and ready for operations.

B. Related work specified elsewhere includes:

1. Section 03100 – Structural Concrete Formwork
2. Section 03250 – Waterstops
3. Section 03300 – Cast-In-Place Structural Concrete
4. Section 04200 – Masonry
5. Section 05500 – Miscellaneous Metals

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. ACI INTERNATIONAL (ACI)
1. ACI 318/318R - (1995) Building Code Requirements for Structural Concrete and Commentary

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM A 185 - (1994) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
2. ASTM A 615/A 615M -(1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
3. ASTM A 706/A 706M - (1995b) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

C. CONCRETE REINFORCING STEEL INSTITUTE (CRSI)
1. CRSI MSP-1 - (1996) Manual of Standard Practice

1.03 SUBMITTALS

The following shall be submitted in accordance with Section 105 CONTROL OF WORK.

1. Drawings
2. Concrete Reinforcement System.
   Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

1.04 DELIVERY AND STORAGE

A. Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 - PRODUCTS

2.01 REINFORCING STEEL

A. Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M or ASTM A 706/A 706M, grades and sizes as indicated.

2.02 WIRE TIES

A. Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.03 SUPPORTS

A. Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

PART 3 - EXECUTION

3.01 REINFORCEMENT

A. Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318/318R. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field, at a suitable fabrication facility, or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Impalement hazards shall be mitigated in accordance with OSHA job site safety requirements. Wire tie ends shall face away from the forms.

B. Placement: Reinforcement shall be free from loose rust and scale, dirt, oil, and other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318/318R at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318/318R. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

C. Splicing: Splices of reinforcement shall conform to ACI 318/318R and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6 inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Mechanical splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices.

End of Section

SECTION 03250

WATERSTOPS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes: The work specified in this Section consists of the provision and installation of waterstops.

B. Related Sections:

1. Section 03100 – Structural Concrete Formwork
2. Section 03200 – Concrete Reinforcement
3. Section 03300 – Cast-in-Place Structural Concrete

1.02 REFERENCES

A. AMERICAN SOCIETY FOR TESTING AND MATERIALS:
1. ASTM D 471 (1995) Rubber Property - Effect of Liquids
2. ASTM C 923 (2000) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals

B. CORPS OF ENGINEERS (COE)
1. COE CRD-C 513(1974) Corps of Engineers Specifications for Rubber Waterstops
2. COE CRD-C 572(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstops

1.03 SUBMITTALS

The following shall be submitted in accordance with Section 105 CONTROL OF WORK.

Shop Drawings and Product Data: Submit completely dimensioned shop drawings, catalog cuts and such other data as required to provide complete descriptive information for the following products:

1. Waterstops
2. Waterstop Grouting Rings

A. Instructions: Submit instructions describing in detail all procedures for

installation of waterstops including splicing of non-metallic water stops and water stop grouting rings.

B. Samples Non-metallic Waterstops and Splices. Specimens identified to indicate manufacturer, type of material, size, quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 12 inches long cut from each 200 ft of finished waterstop furnished, but not less than a total of 4 ft of each type, size, and lot furnished.

1.04 DELIVERY AND STORAGE

A. Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants.

PART 2 – PRODUCTS

2.01 WATERSTOPS

A. Intersection and change of direction waterstops shall be shop fabricated or as recommended by the manufacturer. Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471.

2.02 WATERSTOP GROUTING RINGS

A. Waterstop grouting rings shall comply with ASTM C 923 as manufactured by Press Seal Gasket Corporation or approved equal.

PART 3 – EXECUTION

3.01 JOINTS

A. Joints shall be installed at locations indicated and as approved by owner.

3.02 WATERSTOPS, INSTALLATION AND SPLICES

Waterstops shall be installed at the locations shown to form a continuous water-tight diaphragm. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced.

Exposed waterstops shall be protected during application of form release agents to avoid being coated. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Splices shall be made by certified trained personnel using approved equipment and procedures.

A. Non-Metallic

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependant), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) shall be maintained across the splice.

1. Rubber Waterstop
   Splices shall be vulcanized or shall be made using cold bond adhesive as recommended by the manufacturer. Splices for TPE-R shall be as specified for PVC.
2. Polyvinyl Chloride Waterstop
   Splices shall be made by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. The correct temperature shall be used to sufficiently melt without charring the plastic. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible

3.03 QUALITY ASSURANCE

A. Edge welding will not be permitted. Centerbulbs shall be compressed or closed when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following:

1. Tensile strength less than 80 percent of parent section.
2. Free lap joints.
3. Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch.
4. Misalignment which reduces waterstop cross section more than 15 percent.
5. Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness.
6. Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 1/2 inch in 10 feet.
7. Visible porosity in the weld area, including pin holes.

8. Charred or burnt material.
9. Bubbles or inadequate bonding.
10. Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

3.04 CONSTRUCTION JOINTS

Construction joints are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE except that construction joints coinciding with expansion and contraction joints shall be treated as expansion or contraction joints as applicable.

End of Section

SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. The work includes all labor, materials, tools, equipment, supplies, services; and related work for the construction of structural concrete, including foundations, slabs, walls, walks, and housekeeping pads provided complete and ready for operations.

B. Related work specified elsewhere includes:

1. Section 03100 – Structural Concrete Formwork
2. Section 03200 – Concrete Reinforcement
3. Section 03250 – Waterstops
4. Section 04200 – Masonry
5. Section 05500 – Miscellaneous Metal
6. Section 07920 – Joint Sealants
7. Section 09900 – Painting

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. ACI INTERNATIONAL (ACI)
1. ACI 117/117R - (1990; Errata) Standard Tolerances for Concrete Construction and Materials
2. ACI 211.1 - (1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
3. ACI 305R - (1991) Hot Weather Concreting
4. ACI 318 – 02/318R – 02 Building Code and Commentary

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM C 31 - (1991) Making and Curing Concrete Test Specimens in the Field
2. ASTM C 33 - (1993) Concrete Aggregates
3. ASTM C 39 - (1994) Compressive Strength of Cylindrical Concrete Specimens
4. ASTM C 94 - (1996) Ready-Mixed Concrete

5. ASTM C 143 - (1990a) Slump of Hydraulic Cement Concrete
6. ASTM C 150 - (1995) Portland Cement
7. ASTM C 171 - (1995) Sheet Materials for Curing Concrete
8. ASTM C 172 - (1990) Sampling Freshly Mixed Concrete
9. ASTM C 173 - (1994a) Air Content of Freshly Mixed Concrete by the Volumetric Method
10. ASTM C 231 - (1991b) Air Content of Freshly Mixed Concrete by the Pressure Method
11. ASTM C 260 - (1995) Air-Entraining Admixtures for Concrete
12. ASTM C 309 - (1995) Liquid Membrane-Forming Compounds for Curing Concrete
13. ASTM C 494 - (1992) Chemical Admixtures for Concrete
14. ASTM C 595 - (1995a) Blended Hydraulic Cements
15. ASTM C 618 - (1996a) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
16. ASTM C 881 - (1990) Epoxy-Resin-Base Bonding Systems for Concrete
17. ASTM C 940 - (1989) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
18. ASTM C 989 - (1994a) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
19. ASTM C 1017 - (1992) Chemical Admixtures for Use in Producing Flowing Concrete
20. ASTM C 1059 - (1991) Latex Agents for Bonding Fresh to Hardened Concrete
21. ASTM C 1064 - (1986; R 1993) Temperature of Freshly Mixed Portland Cement Concrete
22. ASTM C 1107 - (1991a) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
23. ASTM D 1751 - (1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
24. ASTM D 1752 - (1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

C. CORPS OF ENGINEERS (COE)
1. COE CRD-C 400 - (1963) Requirements for Water for Use in Mixing or Curing Concrete
2. COE CRD-C 521 - (1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete

D. NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)
1. NRMCA TMMB-01 - (1992) Truck Mixer Agitator and Front Discharge Concrete Carrier Standards of the Truck Mixer Manufacturers Bureau

2. NRMCA QC 3 - (1984) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities

1.03 SUBMITTALS

The following shall be submitted in accordance with Section 105 CONTROL OF WORK.

A. Contractor Quality Control Procedures
Provide a quality control plan outlining testing agency qualifications and field procedures for assuring compliance with project specifications. Include schedule of inspections, sampling and testing for cast in place concrete to be completed by a qualified independent testing agency at the contractor's expense. Qualifications of all personnel responsible for inspections, sampling and testing shall be provided as part of the plan. The plan shall include procedures for complying with the requirements for placing concrete in hot and cold weather.

B. Statements

1. Mixture Proportions.

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size, aggregate sieve analysis reports, and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

2. Truck Mixer Uniformity

3. Provide certificates certifying truck mixers comply with ASTM C94.

C. Reports

1. Testing and Inspection for Quality Control.

2. Certified copies of laboratory test reports, including mill tests and all other test data, for all materials proposed for use on this project.

1.04 GENERAL REQUIREMENTS

A. Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117/117R. Level and grade tolerance measurements of slabs shall be made as soon as possible after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

B. Floors

1. Levelness tolerance shall not apply where design requires floors to be sloped to drains or sloped for other reasons.

2. Floors by the Straightedge System

The flatness of the floors shall be carefully controlled and the tolerances shall be measured by the straightedge system as specified in paragraph 4.5.7 of ACI 117/117R, using a 10 foot straightedge, within 72 hours after floor slab installation and before shores and/or forms are removed. The listed tolerances shall be met at any and every location at which the straightedge can be placed. All floors and tops of slabs shall be trowel finished.

D. Strength Requirements and Water-Cement (w/c) Ratio

1. Strength Requirements

Specified compressive strength (f'c) shall be 4000 psi at 28 days for all concrete. Concrete made with high-early strength cement shall have a 7-day strength equal to the specified 28-day strength for concrete made with Type I or II portland cement. Compressive strength shall be determined in accordance with ASTM C 39.

E. Water-Cement (w/c) Ratio

1. Maximum water-cement ratio (w/c) for normal weight concrete shall be 0.45 by weight for all concrete. The w/c may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where GGBF slag is used, the weight of the GGBF slag shall be included in the equations of ACI 211.1 for the

term P that is used to denote the weight of pozzolan.

F. Air Entrainment

1. Except as otherwise specified for lightweight concrete, all normal weight concrete shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 3/4 inch or smaller it shall be between 4.5 and 7.5 percent. Specified air content shall be attained at point of placement into the forms. Air content for normal weight concrete shall be determined in accordance with ASTM C 231.

G. Slump

1. Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C 143.

Structural Element	Slump	
	Minimum	Maximum
Walls, columns and beams	2 inches	4 inches
Foundation walls, substructure walls, footings, slabs	1 inch	3 inches
Any structural concrete approved for placement by pumping:		
At pump	2 inches	6 inches
At discharge of line	1 inch	4 inches

2. When use of a plasticizing admixture conforming to ASTM C 1017 or when a Type F or G high range water reducing admixture conforming to ASTM C 494 is permitted to increase the slump of concrete, concrete shall have a slump of 2 to 4 inches before the admixture is added and a maximum slump of 8 inches at the point of delivery after the admixture is added.

H. Concrete Temperature

1. The temperature of the concrete as delivered shall not exceed 90 degrees F. When the ambient temperature during placing is 40 degrees F or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 55 and 75 degrees F.

I. Size of Coarse Aggregate

1. The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

J. Special Properties and Products

1. Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies.

1.05 MIXTURE PROPORTIONS

A. Concrete shall be composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified. Concrete mix design shall be in accordance with ACI 211.1. Submit mix design for approval by the Owner.

1.06 STORAGE OF MATERIALS

A. Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos, which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

1.07 CONTRACTOR INSPECTION AND TESTING

A. Day to day inspection and testing shall be the responsibility of the contractor in

accordance with the approved quality control plan. Testing will be completed in the presence of the Owner.

1. Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications. Sample fresh concrete at the rate of not less than one sample for each 20 cubic yards of concrete placed. Sample shall consist of tests for slump, air content and compressive strength. Sampling for compressive strength testing shall consist of a minimum of four cylinders for each type and class of concrete placed each day and not less than four cylinders for each 20 cubic yards of concrete placed or a minimum of one cylinder per each five cubic yards if the pour is less than 20 cubic ysrds.

2. Hardened Concrete

Tests on hardened concrete will be performed by the contractor when directed by the Owner. This additional testing may be directed by the Owner at the sole discretion of the Owner. In the event that the testing demonstrates compliance with the contract requirements, the Owner will reimburse the contractor for the cost of the additional testing. When such tests demonstrate that the contract requirements have not been met, the testing shall be at the contractor's expense (refer to section 1.08).

3. Inspection

Concrete operations may be tested and inspected by the Owner as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Owner for final acceptance.

1.08 Defective Work

A. The contractor shall remove any work demonstrated as defective or not in compliance with the contract requirements. Any work so removed shall be replaced with work in compliance with the contract requirements at the contractor's expense.

PART 2 - PRODUCTS

A. CEMENTITIOUS MATERIALS

1. Cementitious Materials shall be portland cement, portland-pozzolan cement, portland blast-furnace slag cement, or portland cement in combination with

pozzolan, or ground granulated blast furnace slag, and shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

2. Portland Cement

ASTM C 150, Type II or Type V. White portland cement shall meet the above requirements except that it may be Type II or Type III. White Type III shall be used only in specific areas of the structure, when approved in writing by the Owner.

3. High-Early-Strength Portland Cement

ASTM C 150, Type III with tricalcium aluminate limited to 5 percent. Type III cement shall be used only in isolated instances and only when approved in writing by the Owner

4. Blended Cements

ASTM C 595, Type IP or IP (MS).

5. Pozzolan (Fly Ash)

ASTM C 618, Class F with the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A of ASTM C 618. Requirement for maximum alkalies from Table 1A of ASTM C 618 shall apply. If pozzolan is used, it shall never be less than 15 percent or more than 35 percent by weight of the total cementitious material.

6. Ground Granulated Blast-Furnace (GGBF) Slag

ASTM C 989, Grade 120.

2.02 AGGREGATES

A. Aggregates shall conform to the following.

1. Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33.

2. Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S, size designation 57 or 67.

2.03 CHEMICAL ADMIXTURES

A. Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

1. Air-Entraining Admixture

ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.

2. Accelerating Admixture

ASTM C 494, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

3. Water-Reducing or Retarding Admixture

ASTM C 494, Type A, B, or D, except that the 6-month and 1-year compressive and flexural strength tests are waived.

4. High-Range Water Reducer

ASTM C 494, Type F or G, except that the 6-month and 1-year strength requirements are waived. The admixture shall be used only when approved in writing by the Owner, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

5. Other Chemical Admixtures

Chemical admixtures for use in producing flowing concrete shall comply with ASTM C 1017, Type I or II. These admixtures shall be used only when approved in writing by the Owner, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.04 CURING MATERIALS

A. Impervious-Sheet

1. Impervious-sheet materials shall conform to ASTM C 171, type optional, except, that polyethylene sheet shall not be used.

A. Membrane-Forming Compound

1. Membrane-Forming curing compound shall conform to ASTM C 309, Type 1-D or 2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing, or flooring specified. Nonpigmented compound shall contain a fugitive dye, and shall have the reflective requirements in ASTM C 309 waived.

C. Burlap and Cotton Mat

1. Burlap and cotton mat used for curing shall conform to AASHTO M 182.

2.05 WATER

A. Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali.

2.06 NONSHRINK GROUT

A. Nonshrink grout shall conform to ASTM C 1107, Grade A, and shall be a commercial formulation suitable for the proposed application.

2.07 LATEX BONDING AGENT

A. Latex agents for bonding fresh to hardened concrete shall conform to ASTM C 1059.

2.08 EPOXY RESIN

A. Epoxy resins for use in repairs shall conform to ASTM C 881, Type V, Grade 2. Class as appropriate to the existing ambient and surface temperatures.

2.09 EMBEDDED ITEMS

A. Embedded items shall be of the size and type indicated or as needed for the application.

2.10 FLOOR HARDENER

A. Floor hardener shall be a colorless aqueous solution containing zinc silicofluoride, magnesium silicofluoride, or sodium silicofluoride. These silicofluorides can be used individually or in combination. Proprietary hardeners may be used if approved in writing by the Owner.

2.11 JOINT MATERIALS

A. Expansion joint fillers shall be preformed materials conforming to ASTM D 1751 or ASTM D 1752.

PART 3 - EXECUTION

3.01 PREPARATION FOR PLACING

A. Before commencing concrete placement, the following shall be performed. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and standing or ponded water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with Section 03100, "Structural Concrete Formwork". Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with Section 03200, "Concrete Reinforcement". Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

1. Foundations

2. Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

3. Excavated Surfaces in Lieu of Forms
Concrete for footings may be placed directly against the soil provided the

earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of Section 02220, "Earthwork for Buildings". The concrete shall be placed without becoming contaminated by loose material and the limits of the concrete shall be within the specified tolerances.

4. Preparation of Previously Placed Concrete
Concrete surfaces to which other concrete is to be bonded shall be abraded in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be thoroughly washed and shall be moist, but without free water, when concrete is placed. Prepared surfaces shall receive a coat of ASTM C 1059 bonding agent.

5. Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Welding shall not be performed on embedded metals within 1 foot of the surface of the concrete. Tack welding shall not be performed on or to embedded items.

3.02 CONCRETE PRODUCTION

A. Concrete shall be furnished from a ready-mixed concrete plant. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA TMMB-01. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete.

3.03 TRANSPORTING CONCRETE TO PROJECT SITE

A. Concrete shall be transported to the placing site in truck mixers.

3.04 CONVEYING CONCRETE ON SITE

A. Concrete shall be conveyed from mixer or transporting unit to forms as rapidly as possible and within the time interval specified by methods which will prevent

segregation or loss of ingredients using following equipment. Conveying equipment shall be cleaned before each placement.

1. Trucks

   Truck mixers operating at agitating speed or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of ASTM C 94.

2. Chutes

   When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes normally attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Owner. Separate chutes and other similar equipment will not be permitted for conveying concrete.

3. Concrete Pumps

   Concrete may be conveyed by positive displacement pump when approved by the Owner. The pumping equipment shall be piston or squeeze pressure type; pneumatic placing equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 3 times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 4 inches. Aluminum pipe shall not be used.

3.05 PLACING CONCRETE

A. Mixed concrete shall be discharged within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

1. Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary.

2. Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.025 inch, and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Insert the vibrator both sides of vertical planes of reinforcing, without contacting reinforcing or forms. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segregation or flotation of coarse aggregate shall be prevented. Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Grate tampers ("jitterbugs") shall not be used.

3. Cold Weather Requirements

Special protection measures, approved by the Owner, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 40 degrees F. The temperature of the concrete when placed shall be not less than 50 degrees F or more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval from the Owner, an accelerating admixture conforming to ASTM C 494, Type C or E may be used, provided it contains no calcium chloride. Calcium chloride shall not be used.

4. Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 85 degrees F, the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the day may be required to obtain an adequate placing temperature. Ice may be used for cooling of the mixture providing it melts completely during mixing and prior to placement. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 120 degrees F. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

Maximum Allowable Concrete Placing Temperature	
Relative Humidity, Percent During Time of Concrete Placement.	Maximum Allowable Concrete Temperature, Degrees
Greater than 60	90 F
40-60	85 F
Less than 40	80 F

5. Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, the Contractor shall be alert to the tendency for plastic shrinkage

cracks to develop and shall institute measures to prevent this. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition, the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

6. Placing Concrete in Congested Areas

Special care shall be used to ensure complete filling of the forms, elimination of all voids, and complete consolidation of the concrete when placing concrete in areas congested with reinforcing bars, embedded items, waterstops and other tight spacing. An appropriate concrete mixture shall be used, and the nominal maximum size of aggregate (NMSA) shall meet the specified criteria when evaluated for the congested area. Vibrators with heads of a size appropriate for the clearances available shall be used, and the consolidation operation shall be closely supervised to ensure complete and thorough consolidation at all points. Where necessary, splices of reinforcing bars shall be alternated to reduce congestion.

7. Placing Flowable Concrete

If a plasticizing admixture conforming to ASTM C 1017 is used or if a Type F or G high range water reducing admixture is permitted to increase the slump, the concrete shall meet all requirements of paragraph GENERAL REQUIREMENTS in PART 1. Extreme care shall be used in conveying and placing the concrete to avoid segregation. Consolidation and finishing shall meet all requirements of paragraphs Placing Concrete, Finishing Formed Surfaces, and Finishing Unformed Surfaces. No relaxation of requirements to accommodate flowable concrete will be permitted.

3.06 JOINTS

A. Joints shall be located and constructed as indicated or approved by the Owner. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. In general, such joints shall be located near the middle of the spans of supported slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor

slabs, unless otherwise approved. Joints shall be perpendicular to the main reinforcement. All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement shall be 2 inches clear from each joint. Except where otherwise indicated, expansion joints between interior slabs on grade and vertical surfaces shall consist of 30-pound asphalt-saturated felt, extending for the full depth of the slab. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints. Joints to be sealed shall be cleaned and sealed as indicated.

1. Construction Joints

For concrete other than slabs on grade, construction joints shall be located so that the unit of operation does not exceed 12 feet. Concrete shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Construction joints shall be located as indicated or approved by the Owner. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the Owner. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints in walls or columns are required, a strip of 1 inch square-edge lumber, beveled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 1 inch above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Preparation of Previously Placed Concrete.

2. Dowels and Tie Bars

Dowels and tie bars shall be installed at the locations shown on the drawings

and to the details shown, using materials and procedures specified in Section 03200, "Concrete Reinforcement" and herein. Deformed bar dowels, or tie bars, shall be installed to meet the specified tolerances. Care shall be taken during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel or tie bar and that the concrete completely embeds the dowel or tie bar and is thoroughly consolidated.

3.07 FINISHING FORMED SURFACES

A. Forms, form materials, and form construction are specified in Section 03100, "Structural Concrete Formwork". Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Unless painting of surfaces is required, uniform color of the concrete shall be maintained by use of only one mixture without changes in materials or proportions for any structure or portion of structure that requires a Class A or B finish. Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of Table I, Section 03100. These tolerances apply to the finished concrete surface, not to the forms themselves; forms shall be set plumb, level and true to line and grade. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs shall be a blend of job cement with white cement proportioned so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable and free from cracks or loose or drummy areas at the completion of the Contract and, for Class A and B Finishes, shall be inconspicuous. Repairs not meeting these requirements will be rejected and shall be replaced.

1. Class A and Class B Finish

Class A finish is required unless otherwise noted or specified. Fins, ravelings, and loose material shall be removed, all surface defects over 1/2 inch in diameter or more than 1/2 inch deep, shall be repaired and, except as otherwise indicated or as specified in Section 03100, "Structural Concrete Formwork", holes left by removal of form ties shall be reamed and filled. Defects more than 1/2 inch in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep. Metal tools shall not be used to finish

repairs in Class A surfaces.

2. Class C and Class D Finish

Class D finish is required on all exterior walls of wet well and dry well. Fins, ravelings, and loose material shall be removed, and, except as otherwise indicated or as specified in Section 03100, "Structural Concrete Formwork", holes left by removal of form ties shall be reamed and filled. Honeycomb and other defects more than 1/2 inch deep or more than 2 inches in diameter shall be repaired. Defects more than 2 inches in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep.

3.08 REPAIRS

A. Damp-Pack Mortar Repair

1. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter but not over 4 inches shall be repaired by the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the No. 16 mesh sieve, and minimum amount of water. Only sufficient water shall be used to produce a mortar which, when used, will stick together on being molded into a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to 45 minutes before use with remixing performed immediately prior to use. Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured for at least 48 hours.

B. Repair of Major Defects

1. Major defects will be considered to be those more than 1/2 inch deep or, for Class A and B finishes, more than 1/2 inch in diameter and, for Class C and D finishes, more than 2 inches in diameter. Also included are any defects of any kind whose depth is over 4 inches or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

2. Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose the reinforcement for at least 2 inches on all sides. All such defective areas greater than 12 square inches shall be outlined by saw cuts at least 1 inch deep. Defective areas less than 12 square inches shall be outlined by a 1 inch deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by high pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Owner, immediately before completion of the Contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-pressure stream, as approved. Repairs made using shotcrete equipment will not be accepted. The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Burlap shall be kept continually wet.

C. Repair of Deep and Large Defects

1. Deep and large defects will be those that are more than 6 inches deep and also have an average diameter at the surface more than 18 inches or that are otherwise so identified. Such defects shall be repaired as specified herein or directed, except that defects, which affect the strength of the structure, shall not be repaired and that portion of the structure shall be completely removed

and replaced. Deep and large defects shall be repaired by procedures approved in advance including forming and placing special concrete using applied pressure during hardening. Preparation of the repair area shall be as specified for surface application of mortar. In addition, the top edge (surface) of the repair area shall be sloped at approximately 20 degrees from the horizontal, upward toward the side from which concrete will be placed. The special concrete shall be a concrete mixture with low water content and low slump, and shall be allowed to age 30 to 60 minutes before use. Concrete containing a specified expanding admixture may be used in lieu of the above mixture; the paste portion of such concrete mixture shall be designed to have an expansion between 2.0 and 4.0 percent when tested in accordance with ASTM C 940. A full width "chimney" shall be provided at the top of the form on the placing side to ensure filling to the top of the opening. A pressure cap shall be used on the concrete in the chimney with simultaneous tightening and revibrating the form during hardening to ensure a tight fit for the repair. The form shall be removed after 24 hours and immediately the chimney shall be carefully chipped away to avoid breaking concrete out of the repair; the surface of the repair concrete shall be dressed as required.

3.09 FINISHING UNFORMED SURFACES

A. The finish of all unformed surfaces shall meet the requirements of Table I, Section 03100 Structural Concrete Formwork, when tested as specified herein.

1. General

The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed shall be not less than 50 degrees F. In hot weather, all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage, as directed. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous

materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any slabs with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

2. Rough Slab Finish

As a first finishing operation for unformed surfaces and as final finish for slabs to receive mortar-setting beds, the surface shall receive a rough slab finish prepared as follows. The concrete shall be uniformly placed across the slab area, consolidated as previously specified, and then screeded with straightedge strikeoffs immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible. Side forms and screed rails shall be provided, rigidly supported, and set to exact line and grade. Allowable tolerances for finished surfaces apply only to the hardened concrete, not to forms or screed rails. Forms and screed rails shall be set true to line and grade. "Wet screeds" shall not be used.

3. Floated Finish

Slabs to receive more than a rough slab finish shall next be given a wood float finish. The screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. Then, after the concrete has stiffened so that it will withstand a man's weight without imprint of more than 1/4 inch and the water sheen has disappeared, it shall be floated to a true and even plane free of ridges. Floating shall be performed by use of suitable hand floats or power driven equipment. Sufficient pressure shall be used on the floats to bring a film of moisture to the surface. Hand floats shall be made of wood, magnesium, or aluminum. Lightweight concrete or concrete that exhibits stickiness shall be floated with a magnesium float. Care shall be taken to prevent over-finishing or incorporating water into the surface.

4. Troweled Finish

Unless otherwise noted, all slabs shall be given a trowel finish. After floating is complete and after the surface moisture has disappeared, unformed surfaces shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks. In lieu of hand finishing, an approved power-finishing machine may be used in accordance with the directions of the

machine manufacturer. Additional trowelings shall be performed, by either hand or machine until the surface has been troweled 3 times, with waiting period between each. Care shall be taken to prevent blistering and if such occurs, troweling shall immediately be stopped and operations and surfaces corrected. A final hard steel troweling shall be done by hand, with the trowel tipped, and using hard pressure, when the surface is at a point that the trowel will produce a ringing sound. The finished surface shall be thoroughly consolidated and shall be essentially free of trowel marks and be uniform in texture and appearance. The concrete mixture used for troweled finished areas shall be adjusted, if necessary, in order to provide sufficient fines (cementitious material and fine sand) to finish properly.

5. Non-Slip (Broomed) Finish

Areas as indicated on the drawings shall be given a broomed finish. After floating, the surface shall be lightly steel troweled, and then carefully scored by pulling a coarse fiber push-type broom across the surface. Brooming shall be transverse to traffic or at right angles to the slope of the slab. After the end of the curing period, the surface shall be vigorously broomed with a coarse fiber broom to remove all loose or semi-detached particles.

3.10 FLOOR HARDENER

A. All interior floor slabs and areas as indicated on the drawings shall be treated with floor hardener. Floor hardener shall be applied after the concrete has been cured and then air-dried for 28 days. Three coats shall be applied, each the day after the preceding coat was applied. For the first application, one pound of the silocofluoride shall be dissolved in one gallon of water. For subsequent applications, the solution shall be two pounds of silicofluoride to each gallon of water. Floor should be mopped with clear water shortly after the preceding application has dried to remove encrusted salts. Proprietary hardeners shall be applied in accordance with the manufacturer's instructions. During application, area should be well ventilated. Precautions shall be taken when applying silicofluorides due to the toxicity of the salts. Any compound that contacts glass or aluminum should be immediately removed with clear water.

3.11 CURING AND PROTECTION

A. General

Concrete shall be cured by an approved method for the period of time given below:

Concrete with Type III cement	3 days
All other concrete	7 days

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water for the duration of the curing period. Air and forms in contact with concrete shall be maintained at a temperature above50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure, and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except as otherwise permitted by paragraph Membrane Forming Curing Compounds, moist curing shall be provided for any areas to receive floor hardener, any paint or other applied coating, or to which other concrete is to be bonded. Except for plastic coated burlap, impervious sheeting alone shall not be used for curing.

1. Moist Curing

   Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. If water or curing materials used stain or discolor concrete surfaces, which are to be permanently exposed, the concrete surfaces shall be cleaned as approved. When wooden forms are left in place during curing, they shall be kept wet at all times. If steel forms are used in hot weather, nonsupporting vertical forms shall be broken loose from the concrete soon after the concrete hardens and curing water continually applied in this void. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. The Contractor shall have an approved work system to ensure that moist curing is continuous 24 hours per day.

2. Membrane Forming Curing Compounds

   Concrete may be cured with a nonpigmented curing compound containing a fugitive dye in lieu of moist curing. Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete, including surfaces to which a smooth finish is to be applied or other concrete to be bonded. However, a styrene acrylate or

chlorinated rubber compound meeting ASTM C 309, Class B requirements, may be used for surfaces that are to be painted. The curing compound selected shall be compatible with any subsequent paint. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. All surfaces shall be thoroughly moistened with water. Curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. The curing compound shall be applied in a two-coat continuous operation by approved motorized power-spraying equipment operating at a minimum pressure of 75 psi, at a uniform coverage of not more than 400 square feet per gallon for each coat, and the second coat shall be applied perpendicular to the first coat. Concrete surfaces that have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified. Surfaces on which clear compound is used shall be shaded from direct rays of the sun for the first 3 days. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

3. Impervious Sheeting

Concrete surfaces may be cured using impervious sheets. However, except for plastic coated burlap, impervious sheeting alone shall not be used for curing. Impervious-sheet curing shall only be used on horizontal or nearly horizontal surfaces. Surfaces shall be thoroughly wetted and be completely covered with the sheeting. Sheeting shall be at least 18 inches wider than the concrete surface to be covered. Covering shall be laid with light-colored side up. Covering shall be lapped not less than 12 inches and securely weighted down or shall be lapped not less than 4 inches and taped to form a continuous cover with completely closed joints. The sheet shall be weighted to prevent displacement so that it remains in contact with the concrete during the specified length of curing. Coverings shall be folded down over exposed edges of slabs and secured by approved means. Sheets shall be immediately repaired or replaced if tears or holes appear during the curing period.

4. Ponding or Immersion

Concrete shall be continually immersed throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete.

5. Cold Weather Curing and Protection

When the daily ambient low temperature is less than 32 degrees F the temperature of the concrete shall be maintained above 40 degrees F for the first seven days after placing. During the period of protection removal, the air temperature adjacent to the concrete surfaces shall be controlled so that concrete near the surface will not be subjected to a temperature differential of more than 25 degrees F as determined by suitable temperature measuring devices furnished by the Contractor, as required, and installed adjacent to the concrete surface and 2 inches inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor as directed by the Owner.

3.12 SETTING BASE PLATES AND BEARING PLATES

A. After being properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates shall be set to the proper line and elevation with damp-pack bedding mortar, except where nonshrink grout is indicated. The thickness of the mortar or grout shall be approximately 1/24 the width of the plate, but not less than 3/4 inch. Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed.

1. Damp-Pack Bedding Mortar

Damp-pack bedding mortar shall consist of 1 part cement and 2-1/2 parts fine aggregate having water content such that a mass of mortar tightly squeezed in the hand will retain its shape but will crumble when disturbed. The space between the top of the concrete and bottom of the bearing plate or base shall be packed with the bedding mortar by tamping or ramming with a bar or rod until it is completely filled.

2. Nonshrink Grout

Nonshrink grout shall be a ready-mixed material requiring only the addition of water. Water content shall be the minimum that will provide a flowable mixture and completely fill the space to be grouted without segregation, bleeding, or reduction of strength.

3. Mixing and Placing of Nonshrink Grout

Mixing and placing shall be in conformance with the material manufacturer's instructions and as specified therein. Ingredients shall be thoroughly dry-mixed before adding water. After adding water, the batch shall be mixed for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Grout not used within 30 minutes after mixing shall be discarded. The space between the top of the concrete or machinery-bearing surface and the plate shall be filled solid with the grout. Forms shall be of wood or other equally suitable material for completely retaining the grout on all sides and on top and shall be removed after the grout has set. The placed grout shall be carefully worked by rodding or other means to eliminate voids; however, overworking and breakdown of the initial set shall be avoided. Grout shall not be retempered or subjected to vibration from any source. Where clearances are unusually small, placement shall be under pressure with a grout pump. Temperature of the grout, and of surfaces receiving the grout, shall be maintained at 65 to 85 degrees F until after setting.

B. Treatment of Exposed Surfaces

1. For metal-oxidizing nonshrink grout, exposed surfaces shall be cut back 1 inch and immediately covered with a parge coat of mortar consisting of 1 part portland cement and 2-1/2 parts fine aggregate by weight, with sufficient water to make a plastic mixture. The parge coat shall have a smooth finish. For other mortars or grouts, exposed surfaces shall have a smooth-dense finish and be left untreated. Curing shall comply with paragraph CURING AND PROTECTION.

3.13 TESTING AND INSPECTION FOR QUALITY CONTROL

A. Unless indicated otherwise, the Contractor will perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required before concrete placement. When, in the opinion of the Owner, the concreting operation is out of control, concrete placement shall cease and the operation shall be corrected. Materials may be subjected to check testing by the Owner from samples obtained at the manufacturer, at transfer points, or at the project site. The contractor shall be responsible for providing ASTM C 94 batch ticket information to the Owner for all concrete used on the project.

1. Concrete Mixture

a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two tests for air content will be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production.

Additional tests shall be made when excessive variation in workability is reported by the Owner. Tests shall be made in accordance with ASTM C 231 for normal weight concrete. When a single test result shows the air content to be outside the specified limits a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch.

b. Air Content Corrective Action. Whenever tests for percent air fall outside the specified range, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment.

c. Slump Testing. In addition to slump tests which shall be made when test specimens are fabricated, at least four slump tests shall be made on randomly selected batches in accordance with ASTM C 143 for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the Owner.

d. Slump Corrective Action. Whenever slump is shown to be outside the specified limits, an adjustment shall immediately be made in the batch weights of water and fine aggregate. Water may be added to the mixer on site only to the extent that the approved mix design water cement ratio is not exceeded.

e. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064. The temperature shall be reported along with the compressive strength data.

f. Strength Specimens. At least one set of test specimens shall be made, for compressive or flexural strength as appropriate, on each different concrete mixture placed during the day for each 20 cubic yards or portion thereof of that concrete mixture placed each day. Additional sets of test specimens shall be made when the mixture proportions are changed or when low strengths have been detected. A set of test specimens for concrete with a 28-day specified strength per paragraph Strength Requirements in PART 1 shall consist of six specimens, two to be tested at 7 days, two at 28 days, and two at 56 days, if required. Test specimens shall be molded and cured in accordance with ASTM

C 31 and tested in accordance with ASTM C 39 for test cylinders. Acceptance test results will be the average strength of two specimens tested at 28 days. The strength of concrete will be considered satisfactory so long as the average of the acceptance test results equals or exceeds the specified compressive strength, f'c, and no individual test result falls below f'c by more than 500 psi.

B. Inspection Before Placing

1. Foundations, construction joints, forms, and embedded items shall be inspected by the Contractor in sufficient time prior to each concrete placement in order to certify to the Owner that they are ready to receive concrete. The results of each inspection shall be reported in writing and field verified by the Owner. The Owner shall field verify prior to concrete placement.

C. Placing

1. The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Owner, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any quantity of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

D. Curing Inspection

The contractor shall perform curing inspections as follows:

1. Moist Curing Inspections. At least once each shift, and not less than twice per day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.

2. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by 1 day.

3. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, the Contractor shall estimate the quantity of compound used by measurement of the container and the area of concrete surface covered, shall compute the rate of coverage in square feet per gallon, and shall note whether or not coverage is uniform.

4. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

5. Sheet Curing Inspection. At least once each shift and once per day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.

6. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

E. Cold-Weather Protection

A. At least once each shift and once per day on non-work days, the contractor shall inspect all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported to the Owner.

End of Section

SECTION 03410

PRECAST CONCRETE WET WELL

PART 1 - GENERAL

1.01 SUMMARY

A. The work includes all labor, materials, tools, equipment, supplies, services; and related work for the construction of precast concrete wet well provided complete and ready for operations.

B. Related work specified elsewhere includes:

1. Section 03100 – Structural Concrete Formwork
2. Section 03200 – Concrete Reinforcement
3. Section 03300 – Cast in Place Concrete
4. Section 03931 – Concrete Protective Liner
5. Section 05500 – Miscellaneous Metal

1.02 REFERENCES

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

A. American Society for Testing and Materials (ASTM):
1. A615/A615M-06 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
2. C76-08 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
3. C150-05 - Portland Cement
4. C478-06a/C478M-06a - Precast Reinforced Concrete Manhole Sections
5. C857-95(2001) - Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
6. D698-00ae1 - Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

B. American Association of State Highway and Transportation Officials (AASHTO): M198-05 - Joints for Concrete Pipe, Manholes, and Precast Box Sections using Preformed Flexible Joint Sealants

1.03 SUBMITTALS

The following shall be submitted in accordance with Section 105 CONTROL OF WORK

A. Shop Drawings: Wet Well. Show size, dimensions, and location of walls, joints, reinforcing, sleeves, blockouts and dowels.

B. Manufacturers' Literature and Data: Submit the following as one package:
   1. Jointing Material.
   2. Wet Well

1.04 QUALITY ASSURANCE

A. Products Criteria: Precast Products shall be manufactured by suppliers with relevant Precast Concrete Institute Certifications.

PART 2 – PRODUCTS

2.01 WETWELL

A. Wet well shall be constructed of precast reinforced concrete rings or precast reinforced sections. The wet well shall be in accordance with Virginia Department of Transportation standard details for manholes and vaults, and the following:
   1. Precast Reinforced Concrete Rings: Rings or sections shall have an inside diameter as indicated on the drawings. Wall thickness shall conform to requirements of ASTM C76.
   2. Precast reinforced concrete. Concrete for precast sections shall have a minimum compressive strength of 4,000 psi at 28 days, ASTM A615, Grade 60 reinforcing steel, and conform to ASTM C857. Where required, shall be rated for AASHTO HS20-44 loading with 30 percent impact,
   3. All joints in the precast structure shall be tongue and groove. Flexible sealing compound shall be packaged in extruded preformed shape, sized to completely fill the joint between precast sections, and form permanently flexible watertight seal. The sealing compound shall be non-shrink and meet AASHTO M198.
   4. Concrete protective liner shall be in accordance with Section 03931.

PART 3 – EXECUTION

3.01 The Contractor shall comply with all OSHA confined space requirements when working within existing structures.

3.02 WET WELL

A. Install the wet well on the indicated compacted aggregate base course compacted to a minimum of 95 percent of the maximum density as determined by ASTM D698. Set precast section true and plumb. Seal all joints with preform flexible gasket material per 2.01A.3.

B. Set precast units level and plumb. Install sealant between all precast sections.

C. Openings for pipe penetrations shall be cast in place unless otherwise shown on the drawings. Seal openings with a flexible boot and grout or approved equal as shown on the drawings.

D. Install concrete protective liner per the manufacturer's recommendations.

E All pipe penetrations through the walls of the wet well shall be sealed water tight

3.03 Testing of Concrete Wet Well: No leakage with the wet well completely filled with water for duration of 4 hours.

End of Section

SECTION 03931

CONCRETE PROTECTIVE LINER

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: The work specified in this Section consists of providing and installing the concrete protective liner system.

B. Related Sections:

1. Section 03100 – Structural Concrete Formwork
2. Section 03300 – Cast in Place Structural Concrete
3. Section 03410 – Precast Concrete Wet Well
4. Section 05500 – Miscellaneous Metal

1.02 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.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 638	(2002) Standard Test Method for Tensile Properties of Plastics

1.03 SUBMITTALS

The following shall be submitted in accordance with Section 105 Control of Work.

A. Shop Drawings and Product Data: Submit completely dimensioned shop drawings, catalog cuts and such other data as required to provide complete descriptive information for the concrete protective liner and bonding agent if required.

B. Instructions: Submit instructions describing in detail all procedures for installation, forming, casting, curing, form removal, welding, holiday detection/testing and repairing the concrete protective liner.

C. Certificates: Submit certified records or reports of results of shop tests, with such records or reports containing a sworn statement that shop tests have been made as specified. In addition, provide manufacturer's sworn certification that the

concrete protective liner was manufactured in accordance with specified reference standards and to minimum specified criteria.

D. Product Experience and Test Data: Submit documentation for the concrete protective liner as follows:

1. Project information, reference, and contact information of at least five similar liner applications that have been in service for at least five years.

2. Certified test data documenting compliance with all applicable standards for HDPE/PVC liners for applications in an acid environment.

E. Certificates: All personnel associated with the handling, installation, welding, and any other installation processes shall be certified by the manufacturer as trained and qualified to perform all operations in accordance with the requirements of the manufacturer and these contract documents. Submit training and qualification certificates for the concrete protective liner. Submit the warranty information for all the liner products.

F. Statements: Upon completion of the Work and before final acceptance, submit a statement of satisfactory installation signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract drawings and specifications and the manufacturer's prescribed installation instructions, procedures and techniques.

G. Liner Test Plan: Submit a test plan including: detailed descriptions of proposed testing procedures, list of test equipment, schedule of testing sequence, and certification of test gauge calibration. The Contractor is required to submit the results from all holiday testing.

H. Reports: Liner test data documenting holiday testing results, repairs and retest results.

I. Warranty: Manufacturer shall provide a warranty of one-year from the date of substantial completion.

1.04 QUALITY ASSURANCE

A. The concrete protective liner shall be of the same material and manufacturer throughout the entire coated area including all patches and welds for all lined products.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle and store the concrete protective liner and the associated

materials specified herein, in a manner recommended by the respective manufacturers to prevent damage and defects.

B. Thoroughly inspect the liner and appurtenances for damage/defects prior to installations. Damaged or defective materials shall be replaced at no additional cost to the Owner.

C. Store the concrete protective liner in an area protected from the weather (including sunlight) and free from dust or other abrasive materials. Do not store items on top or underneath the liner sheets.

PART 2 - PRODUCTS

2.01 CONCRETE PROTECTIVE LINER

A. General

1. The liner system shall be Amer-Plate T-Lock (PVC Liner) as manufactured by Ameron Protective Linings Division, the Sure Grip Concrete Protective Liner (HDPE Liner) as manufactured by AGRU, or approved equal. The liner being of a light color.

2. The liner shall be a cast-in-place system providing a watertight and gas tight seal. Where required for pre-cast structures, the liner shall be installed at the time of manufacture. Spray on liner systems will not be allowed. The concrete protective liner may be pre-cast into the concrete structure where available; otherwise, the liner shall be cast-in-place.

3. All PVC liners shall contain not less than 99 percent, by weight of poly vinyl chloride resin. Copolymer resins will not be allowed. The minimum allowable PVC liner thickness shall be 1/12th of an inch.

4. The minimum allowable HDPE liner thickness shall be 3 mm.

B. Anchoring Mechanism

The liner shall be secured to the concrete (pre-cast or cast-in-place) by anchors that are of the same material as the liner and are integrally extruded with the liner sheet. The anchors shall be a minimum of 9 mm in height and shall have a separation of no less than 2-1/2 inches on center.

C. Joining Liner Sections

Each joint between liner sheet sections shall be extrusion welded with strips of the same material as the liner, to provide a water and gas tight system.

D. Bonding Agent

When required by the liner manufacturer, the liner shall be coated with a bonding agent to ensure sufficient bond to the concrete. The bonding agent shall be specified and installed in strict accordance to the liner manufacturer's instructions and guidelines.

E. Performance

The liner material shall have a minimum tensile strength of 2,200 psi in accordance with ASTM A 638. The liner shall be able to withstand continuous exposure to an atmosphere of 20% sulfuric acid (liquid) and 20% hydrogen sulfide (gas) with no detrimental effects. The liner shall have a good impact resistance, be flexible and capable of withstanding normal elongation from concrete settling without any evidence of cracks, cleavages or any other defects that may affect the performance of the liner.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect each sheet and welding strip to ensure the product is free from any defects.

B. Inspect the formwork and form materials to ensure compatibility with the liner installation.

C. Remove rejected products from the project site and replace with new products at no increase in Contract price.

3.02 PREPARATION

A. Prepare the formwork, liner and all appurtenances for application in strict accordance with the manufacturer's instructions and guidelines.

3.03 INSTALLATIONS

A. The installation of the liner system shall be in strict accordance with the manufacturer's instructions and guidelines.

B. Protect the liner from UV exposure at all times.

C. When required, the liner shall be heated to a specific temperature for installation during periods of cold temperatures.

D. Liner Installation

Liner Installation for Cast-in-Place Concrete: The liner shall be securely fastened to the formwork during the installation to prevent any movement in the liner during the pouring and vibrating of the concrete. The concrete shall be poured and vibrated in accordance with specification SECTION 03300, CAST-IN-PLACE STRUCTURAL CONCRETE. The liner shall be installed so as to minimize the number of seams and so the anchoring devices are located at a maximum of 1-1/2 inches from the edge of the sheet.

Liner Installation for Precast Concrete: Liner shall be installed at the time of manufacture for all precast sections to receive lining. The liner shall be installed by the manufacturer and repaired as required at the time of installation in accordance with the manufacturer's instructions. Installation of the liner on precast concrete sections at the time of installation at the pump station site will not be allowed.

E. A water stop shall be installed at all areas where the liner terminates and is immediately adjacent to unlined concrete, wall penetrations, hatches, etc. Water stop shall also be utilized at all post installation liner penetrations for mounting of equipment and/or appurtenances.

F. The Contractor shall use caution when removing the forms from the liner. Any damage to the liner or concrete as a result of the form removal shall be repaired or replaced at the expense of the Contractor.

G. All holes resulting from the liner installation shall be patched and all seams in the liner sheets shall be welded to ensure a water and gas tight seal in accordance with the manufacturer's guidelines and instructions. All areas requiring repair or welding shall be free of loose concrete, mortar or other debris.

3.04 TESTING

A. Once the liner installation is complete, the Contractor shall perform high voltage spark holiday testing in the presence of the Owner with testing device approved by the liner manufacturer. Any areas of the liner that fail the testing procedures shall be repaired before the liner is accepted. Once the liner is repaired, it shall be re-tested. This procedure shall continue until the entire liner passes all testing requirements. The costs associated with the testing, repair, and re-testing of the liner shall be borne by the Contractor.

B. All welds and patches shall be physically tested by a nondestructive probing method and a pull test as recommended by the manufacturer.

3.05 WARRANTY

A. The liner manufacturer shall warranty all materials and workmanship against defects for a period of one year from the date of acceptance in accordance with these contract documents.

END OF SECTION

SECTION 04200

MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. The work includes all labor, materials, tools, equipment, supplies, services; and related work for the construction of masonry, including brick, block and concrete masonry unit construction, provided complete and ready for operations.

B. Related work specified elsewhere includes:
1. Section 03300 – Cast-In-Place Structural Concrete
2. Section 05500 – Miscellaneous Metal
3. Section 06100 – Rough Carpentry
4. Section 06200 – Finish Carpentry
5. Section 07920 – Joint Sealants
6. Section 08120 – Fiberglass Reinforced Plastic Doors And Frames
7. Section 09900 – Painting
8. Section 14534 – Trolley and Manual Hoist

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. ACI INTERNATIONAL (ACI)
1. ACI SP-66 (1994) ACI Detailing Manual

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM A 82 - (1994) Steel Wire, Plain, for Concrete Reinforcement
2. ASTM A 153 - (1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
3. ASTM A 615 - (1995) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
4. ASTM C 55 - (1995) Concrete Building Brick
5. ASTM C 62 - (1995) Building Brick (Solid Masonry Units Made from Clay or Shale)
6. ASTM C 67 - (1994) Sampling and Testing Brick and Structural Clay Tile
7. ASTM C 90 - (1995) Loadbearing Concrete Masonry Units
8. ASTM C 91 - (1995) Masonry Cement
9. ASTM C 126 - (1994) Ceramic Glazed Structural Clay Facing Tile, Facing

Brick, and Solid Masonry Units

10. ASTM C 129 - (1995) Nonloadbearing Concrete Masonry Units
11. ASTM C 140 - (1995a) Sampling and Testing Concrete Masonry Units
12. ASTM C 216 - (1995) Facing Brick (Solid Masonry Units Made from Clay or Shale)
13. ASTM C 270 - (1995) Mortar for Unit Masonry
14. ASTM C 476 - (1991) Grout for Masonry
15. ASTM C 494 - (1992) Chemical Admixtures for Concrete
16. ASTM C 516 - (1996) Vermiculite Loose Fill Thermal Insulation
17. ASTM C 578 - (1992) Rigid, Cellular Polystyrene Thermal Insulation
18. ASTM C 641 - (1982; R 1991) Staining Materials in Lightweight Concrete Aggregates
19. ASTM C 652 - (1994) Hollow Brick (Hollow Masonry Units Made From Clay or Shale)
20. ASTM C 744 – (1995) Prefaced Concrete and Calcium Silicate Masonry Units
21. ASTM C 780 - (1994) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
22. ASTM C 1019 - (1989a; R 1993) Sampling and Testing Grout
23. ASTM C 1072 - (1994) Measurement of Masonry Flexural Bond Strength
24. ASTM C 1289 - (1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
25. ASTM D 41 – (1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
26. ASTM D 449 – (1989; R 1994) Asphalt Primer Used in Dampproofing and Waterproofing
27. ASTM D 2000 - (1990; R 1994) Rubber Products in Automotive Applications
28. ASTM D 2240 - (1991) Rubber Property - Durometer Hardness
29. ASTM D 2287 - (1992) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
30. ASTM E 119 - (1995a) Fire Tests of Building Construction and Materials
31. ASTM E 447 - (1992b) Compressive Strength of Masonry Prisms

1.03 SUBMITTALS

A. The following shall be submitted in accordance with Section 105 CONTROL OF WORK.

1. Data

Clay or Shale Brick, Concrete Brick, Concrete Masonry Units, Rigid Insulation

Manufacturer's descriptive data

2. Statements

Cold Weather Installation.

Cold weather construction procedures.

3. Reports

Efflorescence Test, Masonry Cement. Fire-rated CMU.

Test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project.

4. Certificates

Clay or Shale Brick. Concrete Brick. Concrete Masonry Units (CMU). Anchors. Joint Reinforcement. Reinforcing Steel Bars and Rods. Masonry Cement. Mortar Coloring. Mortar Admixtures. Grout Admixtures.

Certificates of compliance stating that the materials meet the specified requirements.

5. Samples

Clay or Shale Brick - Color samples of three stretcher and header units and one unit for each type of special shape. Units shall show the full range of color and texture.

Mortar - Color samples of hardened mortar.

6. Sample Masonry Panels

After material samples are approved and prior to starting masonry work, sample masonry panels shall be constructed for each type and color of masonry required. At least 48 hours prior to constructing the sample panel or panels, the Contractor shall submit written notification to the Owner. Sample

panels may not be built in as part of the structure, but shall be located where directed. The Owner shall approve samples prior to the Contractor proceeding with masonry construction.

a. Configuration

Panels shall be L-shaped or otherwise configured to represent all of the wall elements. Panels shall be of the size necessary to demonstrate the acceptable level of workmanship for each type of masonry represented on the project. The minimum size of a straight panel or a leg of an L-shaped panel shall be 4 feet long by 4 feet high.

b. Composition

Panels shall show full color range, texture, and bond pattern of the masonry work. The Contractor's method for mortar joint tooling; and cleaning of masonry work shall be demonstrated during the construction of the panels. Installation or application procedures for anchors, wall ties, insulation, flashing, and weep holes shall be shown in the sample panels. The panels shall contain a masonry bonded corner that includes a bond beam corner.

c. Construction Method

Where anchored veneer walls are required, the Contractor shall demonstrate and receive approval for the method of construction; i.e., either bring up the two wythes together or separately, with the insulation and appropriate ties placed within the specified tolerances across the cavity. Temporary provisions shall be demonstrated to preclude mortar or grout droppings in the cavity and to provide a clear open air space of the dimensions shown on the drawings. Where masonry is to be grouted, the Contractor shall demonstrate and receive approval on the method that will be used to bring up the masonry wythes; support the reinforcing bars; and grout cells, bond beams, lintels, and collar joints using the requirements specified herein.

d. Usage

The completed panels shall be used as the standard of workmanship or the type of masonry represented. Masonry work shall not commence until the sample panel for that type of masonry construction has been completed and approved. Panels shall be protected from the weather and construction operations until the

masonry work has been completed and approved.

1.04 DELIVERY, HANDLING, AND STORAGE

A. Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material.

1. Masonry Units

Concrete masonry units shall be covered or protected from inclement weather and shall conform to the moisture content as specified in ASTM C 90 when delivered to the jobsite. Prefabricated lintels shall be marked on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

2. Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

3. Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Owner's approval.

2.02 CLAY OR SHALE BRICK

A. Color range and texture of clay or shale brick shall be as indicated and shall conform to the approved sample. Type FBS Grade SW shall be used for brick in all exterior work. Brick shall be tested for efflorescence. Clay or shale brick units shall be

delivered factory-blended to provide a uniform appearance and color range in the completed wall. Brick style shall be Colonial.

1. Solid Clay or Shale Brick

Solid clay or shale shall conform to ASTM C216. Brick size shall be oversized Colonial and the nominal size of the brick used shall be Engineered Modular size, (3-1/5 thick, 4 inches wide, and 8 inches long). Minimum compressive strength of the brick shall be 3000 psi. Color and texture to be approved by Owner.

2.03 CONCRETE BRICK

A. Concrete brick shall conform to ASTM C 55, Type I, Grade S. Concrete brick may be used where necessary for filling out in concrete masonry unit construction.

2.04 CONCRETE MASONRY UNITS (CMU)

A. Hollow and solid concrete masonry units shall conform to ASTM C 90, Type I, Lightweight. Cement shall have a low alkali content and be of one brand.

1. Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

2. Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners. Radius of the bullnose shall be 1 inch. Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

2.05 MORTAR

A. Mortar shall be Type S in accordance with the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate; when masonry cement ASTM C 91 is used the

maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Evaluation of performance shall be based on ASTM C 780 and ASTM C 1072. Cement shall have a low alkali content and be of one brand. Maximum air content shall be 12%, Aggregates shall be from one source.

1. Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494, Type C.

2. Coloring

Mortar coloring shall be added to the mortar used for exposed masonry surfaces to produce a uniform color as approved by the Owner. Mortar coloring shall not exceed 3 percent of the weight of cement for carbon black and ten percent of the weight of cement for all other pigments. Mortar coloring shall be chemically inert, of finely ground lime-proof pigment, and furnished in accurately pre-measured and packaged units that can be added to a measured amount of cement.

2.06 GROUT

A. Grout shall conform to ASTM C 476. Cement used in grout shall have a low alkali content. Grout shall have a 28 day compressive strength of 2500 psi. Grout slump shall be between 8 and 10 inches. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements.

1. Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

2.07 ANCHORS, TIES, AND BAR POSITIONERS

A. Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A 153, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A 82. Anchors and ties shall be sized to provide a minimum of 5/8 inch mortar cover from either face.

1. Wall Ties

Wall ties shall be rectangular-shaped or Z-shaped fabricated of 3/16-inch diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 4 inches wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 3/16-inch diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of ½ inch eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 1/16 inch. The pintle and eye elements shall be formed so that both can be in the same plane.

2. Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

2.08 JOINT REINFORCEMENT

A. Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A 82, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A 153, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder or truss type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 5/8-inch cover from either face. The distance between crosswires shall not exceed 16 inches. Joint reinforcement for straight runs shall be furnished in flat sections not less than 10 feet long. Joint reinforcement shall be provided with factory formed corners and intersections..

2.09 REINFORCING STEEL BARS AND RODS

A. Reinforcing steel bars and rods shall conform to ASTM A 615, Grade 60.

2.10 INSULATION

A. Rigid Board-Type Insulation

1. Rigid board-type insulation shall be extruded polystyrene, polyurethane, or polyisocyanurate. Polystyrene shall conform to ASTM C 578. Polyurethane

or polyisocyanurate shall conform to ASTM C 1289, Type I, Class 2, faced with aluminum foil on both sides of the foam. The insulation shall be a standard product and shall be marked with not less than the manufacturer's trademark or name, the specification number, the permeance and R-values.

a. Insulation Thickness and Air Space

The cavity space shall allow for a maximum insulation thickness 1 inch, and a minimum air space of 3/4 inch.

b. Aged R-Value

The insulation shall provide a minimum aged R-value of 11 for the overall thickness. The aged R-value shall be determined at 75 degrees F in accordance with the appropriate referenced specification. The stated R-value of the insulation shall be certified by an independent testing laboratory or certified by an independent Registered Professional Engineer if tests are conducted in the manufacturer's laboratory.

c. Insulation Adhesive

Insulation adhesive shall be specifically prepared to adhere the insulation to the masonry and, where applicable, to the thru-wall flashing. The adhesive shall not deleteriously affect the insulation, and shall have a record of satisfactory and proven performance for the conditions under which to be used.

2.11 DAMPPROOFING

A. Asphalt Primer

Asphalt primer shall conform to ASTM D41. Dry film thickness of 15 mil.

B. Asphalt

Liquid asphalt shall conform to ASTM D449. It shall be a minimum of 40 mils thick, free of toxic solvents and not containing asbestos. Once applied and cured, it shall be capable of retaining adhesion and will not re-emulsify when in contact with moisture and will not settle or slide detrimentally once applied.

2.12 SINGLE WYTHE MASONRY DRAINAGE SYSTEM

A. .1"thick by 10" high – high density Polyethylene (HDP).
B. Continuous bottom strip 3" high minimum (HDP).

2.13 FLASHING

A. Metals
1. Stainless steel Sheet: ASTM A 167, Type 316.

B. Through Wall Sheet Metal Flashing
1. Fabricate material from the following metal,
    a. Stainless Steel: 0.0156 inch thick.
    b. Fabricate through wall flashing embedded in masonry with ribs formed in a dovetail pattern or a sawtooth pattern at 3 inch intervals along length of flashing to provide a 3 way integral mortar bond and weep-hole drainage.

C. Reglets
1. General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated.
2. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
3. Flexible Flashing retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where drawings show reglet without metal counterflashing.
4. Counterflashing Wind Restraint Clips; Provide clips to be installed before counterflashing lower edge.
    1. Stainless Steel, 0.0187 inch thick.

PART 3 - EXECUTION

3.01 ENVIRONMENTAL REQUIREMENTS

A. Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 99 degrees F in the shade. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 4 feet ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

B. Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 40 degrees F, a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

1. Preparation

   Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

   a. Air Temperature 40 to 32 Degrees F. Sand or mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F.

   b. Air Temperature 32 to 25 Degrees F. Sand and mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing.

   c. Air Temperature 25 to 20 Degrees F. Sand and mixing water shall be heated to provide mortar temperatures between 40 degrees F and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 15 mph.

   d. Air Temperature 20 Degrees F and below. Suspend masonry work if temperatures are below 20 degrees F.

2. Completed Masonry and Masonry Not Being Worked On

   a. Mean daily air temperature 40 degrees F to 32 degrees F. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.

   b. Mean daily air temperature 32 degrees F to 25 degrees F. Masonry shall be completely covered with weather-resistant membrane for 24 hours.

   c. Mean Daily Air Temperature 25 Degrees F to 20 Degrees F. Masonry shall be completely covered with insulating blankets or equally

protected for 24 hours.

d. Mean Daily Temperature 20 Degrees F and Below. Masonry temperature shall be maintained above 32 degrees F for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.02 LAYING MASONRY UNITS

Brick units shall be laid in a running bond pattern. CMU shall be laid in running bond. Facing courses shall be level with back-up courses; unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus 1/2 inch. Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be free from chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Masonry drainage system shall be provided to prevent mortar from filling weep holes at base of brick wall. Install drainage system tight behind weeps in outside brick weeps. In double wythe construction, the inner wythe may be brought up not more than 6 inches ahead of the outer wythe. Collar joints shall be filled with mortar or grout during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by more than 8 inches.

A. Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 1/8 inch. Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

B. Forms and Shores

Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

C. Concrete Masonry Units

Units in starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

D. Clay or Shale Brick Units

Brick facing shall be laid with the better face exposed. Brick shall be laid in the indicated patterns with each course bonded at corners, unless otherwise indicated. Molded brick shall be laid with the frog side down. Brick that is cored, recessed, or has other deformations may be used in sills, treads, soldier courses, except where deformations will be exposed to view.

1. Wetting of Units

Wetting of clay, shale brick, or hollow brick units having an initial rate of absorption of more than 1 gram per minute per square inch of bed surface shall be in conformance with ASTM C 67. The method of wetting shall ensure that each unit is nearly saturated but surface dry when laid.

2. Solid Units

Bed, head, and collar joints shall be completely filled with mortar.

3. Hollow Units

Hollow units shall be laid as specified for concrete masonry units.

E. Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, masonry shall be laid within

the tolerances provided in TABLE II (plus or minus unless otherwise noted).

F. Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

TABLE II TOLERANCES	
Variation from the plumb in the lines, and surfaces of columns, walls and arises	
In adjacent masonry units	1/8 inch
In 10 feet	1/4 inch
In 20 feet	3/8 inch
Variations from the plumb for external corners, expansion joints, and other conspicuous lines	
In 20 feet	1/4 inch
Variations from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines	
In 20 feet	1/4 inch
Variation from level for bed joints and top surfaces of bearing walls	
In 10 feet	1/4 inch
Variations from horizontal lines	
In 10 feet	1/4 inch
In 20 feet	3/8 inch
Variations in cross sectional dimensions of columns and in thickness of walls	
Minus	1/4 inch
Plus	1/2 inch

G. Jointing

Joints shall be tooled when the mortar is thumb-print hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

1. Tooled Joints

   Joints shall be tooled slightly concave. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

2. Door and Window Frame Joints

   On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

H. Joint Widths

Joint widths shall be as follows:

1. Concrete Masonry Units

   Concrete masonry units shall have 3/8 inch joints.

2. Brick

   Brick joint widths shall be the difference between the actual and nominal dimensions of the brick in either height or length.

I Flashing

1. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installations instructions, and SMACNA's "Architectural Sheet Metal manual." Anchor units of work securely and place by methods indicate, providing for thermal expansion of metal unit; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.
2. Install exposed sheet metal work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated with

exposed edges and folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3. Roof Edge Flashings: Secure metal flashings at roof edges according to FM Loss Prevention Data Sheet 1-49 for specified wind zone.
4. Install reglets to receive counterflashing according to the following requirements:
    a. Where reglets are shown in concrete, furnish reglets for installation under Divisions 3 Section "Cast in Place Concrete."
    b. Where reglets are shown in masonry, furnish reglets for installation under Divisions 4 Section "Masonry."
5. Counterflashings: Coordinate installation of counter flashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, wedges and sealant, interlocking folding seam, or rivets and sealant. Lap counterflashing joints a minimum of 2 inches and bed with sealant.
6. Roof Penetration Flashing: Coordinate roof penetration flashing installation with roofing and installation of items penetrating roof. Install flashing as follows:
    a. Turn flashing down inside vent piping, being careful not to block vent piping with flashing.
    b. Seal and clamp flashing to pipes penetrating roof, other than lead flashing on vent piping.

J. Embedded Items

Spaces around built-in items shall be filled with mortar. Openings around flush-mount electrical outlet boxes in wet locations shall be pointed with mortar. Anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in shall be embedded as the masonry work progresses. Anchors, ties and joint reinforcement shall be fully embedded in the mortar. Cells receiving anchor bolts and cells of the first course below bearing plates shall be filled with grout.

K. Unfinished Work

Unfinished work shall be stepped back for joining with new work. Toothing may be resorted to only when specifically approved by the Owner. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

L. Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry

walls shall be anchored or tied together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

3.03 ANCHORED VENEER CONSTRUCTION

The inner and outer wythes shall be completely separated by a continuous airspace as shown on the drawings. Both the inner and the outer wythes shall be laid up together. When both wythes are not brought up together, through-wall flashings shall be protected from damage until they are fully enclosed in the wall. The airspace between the wythes shall be kept clear and free of mortar droppings by temporary wood strips laid on the wall ties and carefully lifted out before placing the next row of ties. A coarse gravel or drainage material shall be placed behind the weep holes in the cavity to a minimum depth of 4 inches of coarse aggregate or 10 inches of drainage material to keep mortar droppings from plugging the weep holes.

3.04 WEEP HOLES

Weep holes shall be provided not more than 24 inches on centers in mortar joints of the exterior wythe above wall flashing, over foundations, bond beams, and any other horizontal interruptions of the cavity. Weep holes shall be formed by placing short lengths of well-greased No. 10, 5/16 inch nominal diameter, braided cotton sash cord in the mortar and withdrawing the cords after the wall has been completed. Cord will be cut flush with outside of brick masonry. Other approved methods may be used for providing weep holes. Weep holes will be kept free of mortar and other obstructions.

3.05 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Contractor shall provide all water required for the work. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture that will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours after mixing shall be discarded.

3.06 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating that might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 2 inches of tops of walls.

A. Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 1/2 inch shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

B. Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

3.07 JOINT REINFORCEMENT

Joint reinforcement shall be installed at 16 inches on center or as indicated. Reinforcement shall be lapped not less than 6 inches. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 5/8- inch cover to either face of the unit.

3.08 PLACING GROUT

Cells containing reinforcing bars shall be filled with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open-end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

A. Vertical Grout Barriers for Fully Grouted Walls

Grout barriers shall be provided not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

B. Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

C. Grout Holes and Cleanouts

1. Grout Holes

Grouting holes shall be provided in in-place overhead construction. Holes shall be located over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Additional openings spaced not more than 16 inches on centers shall be provided where grouting of all hollow unit masonry is indicated. Openings shall not be less than 4 inches in diameter or 3 by 4 inches in horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

2. Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet. Where all cells are to be grouted, cleanout courses shall be constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of 32 inches where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 3 by 4 inch openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls that will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

D. Grouting Equipment

1. Grout Pumps

Pumping through aluminum tubes will not be permitted. Pumps shall be operated to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, waste materials and debris shall be removed from the equipment, and disposed of outside the masonry.

2. Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.

E. Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout shall not be placed in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

1. Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

2. High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 1/4 inch into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which

will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 4 feet in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 12 to 18 inches into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (feet) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2)	
			Multiwythe Masonry (3)	Hollow-unit Masonry
1	Fine	Low Lift	3/4	1-1/2 x 2
5	Fine	Low Lift	2	2 x 3
8	Fine	High Lift	2	2 x 3
12	Fine	High Lift	2-1/2	2-1/2 x 3

24	Fine	High Lift	3	3 x 3
1	Coarse	Low Lift	1-1/2	1-1/2 x 3
5	Coarse	Low Lift	2	2-1/2 x 3
8	Coarse	High Lift	2	3 x 3
12	Coarse	High Lift	2-1/2	3 x 3
24	Coarse	High Lift	3	3 x 4

Notes:

(1) The actual grout space or cell dimension must be larger than the sum of the following items:

a) The required minimum dimensions of total clear areas given in the table above;

b) The width of any mortar projections within the space;

c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.

(2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.

(3) For grouting spaces between masonry wythes.

(4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.09 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 1/2 inch shall be maintained between reinforcement and interior faces of units.

3.10 SHELF ANGLES

Shelf angles shall be adjusted as required to keep the masonry level and at the proper elevation. Shelf angles shall be galvanized. Shelf angles shall be provided in sections not longer than 10 feet and installed with a ¼-inch gap between sections. Shelf angles shall be mitered and welded at building corners with each angle not shorter than 4 feet, unless limited by wall configuration.

3.11 LINTELS

All openings greater than 12 inches shall be provided with a lintel.

A. Masonry Lintels

Masonry lintels shall be prefabricated with precast concrete unless otherwise directed by the owner. Lintels shall be reinforced with a minimum of two No. 4 bars in the bottom and top unless otherwise indicated on the drawings. Concrete for the lintels shall attain a 28 day compressive strength of 4000 psi in accordance with Section 03300 of the specifications.

B. Steel Lintels

Steel lintels shall be hot dipped galvanized and as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel lintels shall have a minimum bearing length of 8 inches unless otherwise indicated on the drawings. Steel lintels shall comply with the requirements of Section 05500 Miscellaneous Metal.

3.12 SILLS AND COPINGS

Sills and copings shall be set in a full bed of mortar with faces plumb and true.

3.13 INSULATION

Anchored veneer walls shall be insulated, where shown, by installing board-type insulation on the cavity side of the inner wythe. Board type insulation shall be applied directly to the masonry or thru-wall flashing with adhesive. Insulation shall be neatly fitted between obstructions without impaling of insulation on ties or anchors. The insulation shall be applied in parallel courses with vertical joints breaking midway over the course below and shall be applied in moderate contact with adjoining units without forcing, and shall be cut to fit neatly against adjoining surfaces.

3.14 DAMPPROOFING

The exterior face of concrete masonry units backing exterior wall shall be dampproofed before installation of board and bottom siding. The surfaces shall receive a sprayed coat of asphalt primer applied at the rate of one gallon per 100 square feet (15 mil), allowed to dry thoroughly, and shall then receive two sprayed coats of bituminous coating, each applied 20 mils thick for a total thickness of 40 mils. The coating shall completely cover and thoroughly bond with wall surfaces. Do not apply dampproofing during temperature below 40 degrees F. Continue dampproofing from top of footing to top of cavity wall.

Control joints in cavity wall CMU shall be caulked prior to dampproofing.

3.15 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashings shall be completely removed from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

A. Concrete Masonry Unit and Concrete Brick Surfaces

Exposed concrete masonry unit and concrete brick surfaces shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

B. Clay or Shale Brick Surfaces

Exposed clay or shale brick masonry surfaces shall be cleaned as necessary to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. After cleaning, the sample panel of similar material shall be examined for discoloration or stain as a result of cleaning. If the sample panel is discolored or stained, the method of cleaning shall be changed to assure that the masonry surfaces in the structure will not be adversely affected. The exposed masonry surfaces shall be water-soaked and then cleaned with a solution proportioned 1/2 cup trisodium phosphate and 1/2 cup laundry detergent to one gallon of water or cleaned with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay products manufacturer. The solution shall be applied with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence shall be removed in conformance with the brick manufacturer's recommendations.

3.16 BEARING PLATES

Bearing plates for beams, and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Bedding mortar and non-shrink grout shall be as specified in Section 03300 "Cast-in-place Structural Concrete". Provide anchors as indicated on the drawings.

3.17 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with non-staining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof system. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

3.18 EFFLORESCENCE TEST

The Contractor shall provide laboratory tests for brick exposed to weather. Brick samples will be tested for efflorescence. Tests shall be scheduled far enough in advance of starting masonry work to permit retesting if necessary. Sampling and testing shall conform to the applicable provisions of ASTM C 67. Units meeting the definition of "effloresced" will be subjected to rejection.

End of Section

SECTION 05500

MISCELLANEOUS METAL

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Metal fabrications include items made from iron, steel, aluminum, or other metal shapes, plates, bars, strips, tubes, pipes and castings that are not specified elsewhere.

B. Extent of metal fabrications is indicated on the drawings or as required to complete the work.

C. The work includes all labor, materials, tools, equipment, supplies, services; and related work for the construction necessary provided complete and ready for operations.

D. Related work specified elsewhere includes:

1. Section 03300 – Cast-In-Place Structural Concrete
2. Section 03410 – Precast Concrete Wet Well
3. Section 04200 – Masonry
4. Section 06100 – Rough Carpentry
5. Section 06200 – Finish Carpentry
6. Section 07920 – Joint Sealants
7. Section 09900 – Painting
8. Section 14534 – Trolley and Manual Hoist

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 INSTITUTE OF STEEL CONSTRUCTION (AISC)
1. AISC ASD Manual - (1989) Manual of Steel Construction Allowable Stress Design
2. AISC LRFD Vol II - (1995) Manual of Steel Construction Load & Resistance Factor Design, Vol II: Structural Members, Specifications & Codes

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM A48 - (2000) Gray Iron Castings
2. ASTM A 53 - (2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

3. ASTM A123 - (2001) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

4. ASTM A276 - (2000) Stainless Steel Bars and Shapes
5. ASTM A 325 - (2002) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
6. ASTM A467 - (2001) Machine and Coil Chain
7. ASTM A 500 - (2001) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
8. ASTM A 563 - (2000) Carbon and Alloy Steel Nuts
9. ASTM B584 - (2000) Copper Alloy Sand Castings for General Applications
10. ASTM A 992 - (2002) Steel for Structural Shapes for Use in Building Framing
11. ASTM B 26 - (2001) Aluminum-Alloy Sand Castings
12. ASTM B221 - (2000) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
13. ASTM B308 - (2000) Aluminum-Alloy 6061-T6 Standard Structural Profiles
14. ASTM A354 - (2001) Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners
15. ASTM B 429 - (2000) Aluminum-Alloy Extruded Structural Pipe and Tube
16. ASTM D707 -(1998) Cellulose Acetate Butyrate Molding and Extrusion Compounds
17. ASTM D3935 (2002) Polycarbonate (PC) Unfilled and Reinforced Material
18. ASTM F 436 - (2000) Hardened Steel Washers
19. ASTM F 844 - (2000) Washers, Steel, Plain (Flat), Unhardened for General Use

C. AMERICAN WELDING SOCIETY (AWS)
1. AWS A2.4 - (1993) Standard Symbols for Welding, Brazing and Nondestructive Examination
2. AWS D1.1 - (1996) Structural Welding Code – Steel

D. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. ANSI/NAAMM AMP 521 - (1995) Pipe Railing System Manual

1.03 TYPES OF WORK

Types of work in this section include metal fabrication for:

A. Miscellaneous framing and supports

B. Miscellaneous castings
   1. Fasteners

C. Miscellaneous metal fabrications.

D. Ladders

1.04 SHOP ASSEMBLY

A. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.05 SUBMITTALS

The following shall be submitted in accordance with Section 105 CONTROL OF WORK.

A. Product Data: Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.

B. Shop Drawings: Submit shop drawings for fabrication and erection of miscellaneous metal fabrications including but not limited to ladders, railings, lintels, rain diverters, access hatches and safety posts. Include plans, elevations and details of sections and connections, indicate material thickness, type, grade, and class; dimensions; and erection details. Drawings shall include catalog cuts, manufacturer's descriptive data and installation instructions. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others

C. Installation Instructions: Ceiling Access, Access Hatches and Safety Grate Fall Protection.

D. Warranty: Submit manufacturer's standard written warranty for each access hatch.

PART 2 - PRODUCTS

2.01 FERROUS METALS

A. Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled names and roughness.

B. Steel Shapes: ASTM A992

C. Steel Plates and Bars: ASTM A 36. (Hot Dipped Galvanized)

D. Steel Tubing: Cold-formed, ASTM A 500; or hot-rolled, ASTM A 501.

E. Steel Pipes: ASTM A 53, Type E or S, Grade B, weight class STD (Standard)

F. Gray Iron Castings: ASTM A 48, Class 30.

G. Bolts: ASTM A 325, Type 1 The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications

H. Nuts: ASTM A 563, Grade and Style for applicable ASTM bolt standard specified.

I. Washers: ASTM F 436, ASTM F 844

J. Anchor Bolts: ASTM A 276 Type 316.

K. Galvanized steel guard: Posts and rails shall be galvanized steel pipe.

L. Safety chains shall be stainless welded steel, proof coil chain tested in accordance with ASTM A 467, Class CS. Safety chains shall be straight link style, 3/16-inch diameter, minimum 12 links per foot and with bolt type snap hooks on each end. Eyebolts for attachment of chains shall be galvanized 3/8-inch bolt with 3/4-inch eye. Two chains shall be furnished for each guarded opening. Provide safety chains at top of stair.

M. Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work - ASTM A 36 or ASTM A276 Type 316 as indicated.

N. Provide ASTM 354 Type 316 stainless steel fasteners for all exterior and interior work unless otherwise shown or specified

2.02 ALUMINUM METALS

A. Miscellaneous Aluminum:

1.	Plate and Sheet	ASTM B 209	6061-T6	T6510 Alloy.
2.	Extruded shapes	ASTM B 221	6061–T6	T6510 Alloy
3.	Castings	ASTM B 108		214 Alloy

B. Aluminum Bar Gratings: ASTM B 221, alloy 6061-T6 for bearing and cross bars. Aluminum grating shall be designed in accordance with NAAMM MBG 531 to meet the indicated load requirements. Provide for a minimum live load of 100 psf on all grating. Edges shall be banded with bars 1/4 inch less in height than bearing bars for grating sizes above 3/4 inch. Banding bars shall be flush with the top of bearing grating. Frames shall be of welded aluminum construction finished to match the grating. Use stainless steel or aluminum fasteners. Grating will be Mill Finish.

C. Exterior Wet Well Access Hatch

1. Provide manufacturer pre-assembled, single and double leaf aluminum access hatch cover as indicated on drawings. The hatches shall be reinforced to support minimum live load of 300 pounds per square foot (psf) with a maximum deflection of $1/150^{th}$ of the span. Operation of the covers shall be smooth and easy with controlled operation throughout the entire arc of opening and closing regardless of temperature. The covers shall be ¼" thick corrosion resistant diamond aluminum plate. The channel frames shall be ¼" extruded aluminum with bend down anchor tabs around the perimeter. The channels shall include a 1-1/2" drain coupling located in the front center of the channel frame. The channels shall include a 1-1/2" drain coupling located in the front center of the channel frame for routing channel moisture to the sump, wet well or bottom slab. A continuous EPDM gasket shall be mechanically attached to the entire perimeter of each cover. Factory finish shall be mill finish aluminum with bituminous coating applied to the exterior of the frame.

2. The lifting mechanisms shall feature a sufficient number of compression spring operators enclosed in telescoping tubes to provide smooth, easy and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing. The springs shall have a corrosion resistant electrocoated acrylic finish. Telescoping tubes shall be constructed of a reinforced nylon 6/6 based engineered composite material. The tubes shall be aligned to prevent accumulation of moisture, grit and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe fastened to a formed ¼" gusset support plate.

3. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the cover and the latch release shall be protected by a flush, gasketed removable screw plug. Hinges shall be heavy forged aluminum with ¼" diameter 316 stainless steel pin that pivot such that the cover does not protrude into the channel frame in any position. The cover shall be equipped with a hold down arm that automatically locks the cover in the open position. A 316 stainless steel

snap lock with fixed handle shall be mounted on the underside of the cover. Provide Jumbo recessed Lock Box in accordance with Owner standard and approval, with two keys per lock. Provide locking hasp suitable for a heavy-duty pad lock. All hardware shall be stainless steel.

4. The wet well hatch cover manufacturer shall warranty the pre-assembled hatch and all hardware against defects in material and workmanship for a period of 10-years.

D. Safety Grate Fall Protection:

1. The wet well access hatch shall have a permanently installed fall through prevention grate system. When closed, the system shall allow visibility below it. The system shall be a *Double Safety Grate* as manufactured by U.S.F. Fabrication, or approved equal.

2. The fall through prevention system shall be grate consisting of two leafs made of 6061-T6 aluminum that are hinged on the same side of the hatch. The grate shall be designed to withstand a minimum pedestrian load of 300 lbs. per square foot. The grate openings shall be 4" x 6" to allow both visual inspection and limited accessibility for maintenance purposes when the grate is closed. The leafs of the grate will pivot on aluminum hinge devices with 316 SS hardware that permit them to rotate upward 90 degrees and automatically lock in place. Aluminum pull rods will be attached to the grate's leafs so the operator is positioned with the grate between him and the hatch's opening whenever he raises a leaf. Each grate leaf will have a rod made from 316 SS that automatically engages to secure the leaf in its open position, and can be lifted upward to permit the grate leaf to close. The hatch cover will not be able to shut until the grate is closed--thereby insuring the grate is in position when the next operator opens the hatch cover. The grate shall have an OSHA safety yellow finish to increase visual awareness of the safety hazard.

3. Installation of the fall through prevention system shall be in accordance with the instructions provided by the manufacturer. The complete grate assembly shall be warranted against defects in material and workmanship for a period of 10 years.

E. Aluminum Ladders: shall be complete with structural or formed rails, rungs and necessary bolts and other fastenings as indicated. Ladders, brackets and hardware shall be constructed of welded aluminum, rails shall be 3/4 inch by 2 inches minimum spaced a minimum of 18 inches apart. Rungs shall be (3/4) inches in diameter and have a non-slip surface. Standoffs shall offset the ladder 7 inches from the wall. The ladder assembly shall be rated for a minimum of 500 pounds.

PART 3 - EXECUTION

3.01 FABRICATION, GENERAL

A. Workmanship: Use materials of size and thickness indicated, or if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of work.

B. Fabrication and assembly shall be done in the shop to the greatest extent possible.

C. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners whenever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flathead (countersunk) screws or bolts.

E. Provide for anchorage of type indicated, coordinated with supported structure. Fabricate and space anchoring devices to provide adequate support for intended use.

F. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

H. Provide miscellaneous steel framing and supports that are not a part of structural steel framework, as required to complete work.

I. Where dissimilar metals are in contact, where aluminum is in contact with concrete, mortar, masonry, or absorptive materials subject to wetting, the surfaces shall be protected with two coats of aluminum pigmented bituminous paint.

3.02 FIELD MEASUREMENTS

A. Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.03 TOUCH-UP PAINTING

Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paints, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

End of Section

SECTION 06100

ROUGH CARPENTRY

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 rough carpentry including, framing members, roof sheathing, blocking, bracing and timber pedestrian guard provided complete and ready for operations.

B. Related work specified elsewhere includes:

1. Section 03300 – Cast-In-Place Structural Concrete
2. Section 04200 – Masonry
3. Section 05500 – Miscellaneous Metal
4. Section 06200 – Finish Carpentry
5. Section 07311 – Roofing, Strip Shingles
6. Section 07920 – Joint Sealants
7. Section 08120 – Fiberglass Reinforced Plastic Doors And Frames
8. Section 08700 – Builder's Hardware
9. Section 09900 – Painting
10. Section 14534 – Trolley and Manual Hoist

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 FOREST AND PAPER ASSOCIATION (AFPA)
1. AFPA-T901 - (1991; Supple 1993; Addenda Apr 95) National Design Specification for Wood Construction
2. AFPA T11-WCD1 - (1988) Manual for Wood Frame Construction

B. AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)
1. AITC-01 - (1994) Timber Construction Manual

C. APA-THE ENGINEERED WOOD ASSOCIATION (APA)
1. APA E445 - (1991; Rev Jan 1996) Performance Standards and Policies for Structural-Use Panels
2. APA EWS T300 - (1997) Glulam Connection Details
3. APA V450 - (1994; Rev Apr 1996) Source List - Adhesives for APA Glued

Floor System

D. AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)
   1. AWPA C1 - (1996) All Timber Products – Preservative Treatment by Pressure Processes

E. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
   1. ASTM A 307 - (1994) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
   2. ASTM C 518 - (1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties By Means of the Heat Flow Meter Apparatus
   3. ASTM C 665 - (1994) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
   4. ASTM E 84 - (1996a) Surface Burning Characteristics of Building Materials
   5. ASTM F 547 - (1977; R 1990) Definitions of Terms Relating to Nails for Use with Wood and Wood-Base Materials

F. DEPARTMENT OF COMMERCE (DOC)
   1. DOC PS 1 - (1996) Voluntary Product Standard - Construction and Industrial Plywood
   2. DOC PS 2 - (1992) Performance Standards for Wood-Based Structural-Use Panels

1.03 SUBMITTALS

The following shall be submitted in accordance with Section 105 CONTROL OF WORK.

A. Certificates

Grading and Marking.

Manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material not normally grade marked meet the specified requirements. Certificate of Inspection for grade marked material by an American Lumber Standards Committee (ALSC) recognized inspection agency prior to shipment.

1.04 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 - PRODUCTS

2.01 LUMBER AND SHEATHING

A. Grading and Marking

1. Lumber Products

Solid sawn and finger-jointed lumber shall bear an authorized grade stamp or grade mark recognized by ALSC, or an ALSC recognized certification stamp, mark, or hammer brand. Surfaces that are to be exposed to view shall not bear grade marks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

3. Plywood and other Sheathing Products

Materials shall bear the grade mark or other identifying marks indicating grades of material and rules or standards under which produced, including requirements for qualifications and authority of the inspection organization. Except for plywood and structural-use panels, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be exposed to view shall not bear grade marks or other types of identifying marks.

B. Sizes

Lumber and material sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Unless otherwise specified, sizes indicated are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

C. Moisture Content

1. At the time lumber and other materials are delivered and when installed in the work their moisture content shall be as follows:

a. Treated and Untreated Lumber Except Roof Planking: 4 inches or less, nominal thickness, 19 percent maximum. 5 inches or more, nominal thickness, 23 percent maximum in a 3 inch perimeter of the timber cross-section.

b. Materials Other Than Lumber: In accordance with standard under which product is produced.

D. Structural Wood Members

Species and grades shall be as listed in AFPA-T901. Structural lumber used in fabrication of trusses shall be Southern Pine, No. 2 grade or better, shall have allowable design values of 1500 psi in bending; 825 psi in tension parallel to the grain; 565 psi in compression perpendicular to the grain; 1650 psi in compression parallel to the grain; 90 psi in horizontal shear; and a modulus of elasticity of 1,600,000 psi. Design of members and fastenings shall conform to AITC-01. Other stress graded or dimensioned items such as blocking, carriages, and studs shall be standard or No. 2 grade. Members in contact with concrete or masonry shall be preservative treated in accordance with AWPA C1

E. Plywood

Plywood shall conform to DOC PS 1, APA E445 or DOC PS 2; Grade C-D with exterior glue. Sheathing for roof shall have a span rating of 16/O or greater for supports 16 inches on center and a span rating of 24/O or greater for supports at 24 inches on center.

F. Structural-Use Panels

Panels shall meet the qualification requirements of APA E445 or DOC PS 2 for rated sheathing, Exposure 1 or Structural I rated sheathing, Exposure 1. Sheathing for roofs shall have a span rating of 16/0 or greater for supports16 inches on center and shall have a span rating of 24/0 or greater for supports 24 inches on center.

G. Wood

Lumber that is cupped, warped, or run-off shall not be used for framing, but may be used for blocking and temporary uses. Species and grade shall be SPIB-1001, Southern Pine, No. 2.

H. Miscellaneous Wood Members

1. Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be SPIB - 1001, Southern Pine, No. 2. Sizes shall be as follows unless otherwise shown:

Member	Size (inch)
Bridging	1 x 3 or 1 x 4 for use between members 2 x 12 and smaller; 2 x 4 for use between members larger than 2 x 12.
Corner bracing	1 x 4.
Furring	1 x 3.
Nailing strips	1 x 3 or 1 x 4 when used as shingle base or interior finish, otherwise 2 inch stock.

2. Sill Plates

Sill plates shall be standard or number 2 grade.

3. Blocking

Blocking shall be standard or number 2 grade.

2.02 ACCESSORIES AND NAILS

A. Markings shall identify both the strength grade and the manufacturer. Accessories and nails shall conform to the following:

1. Anchor Bolts

ASTM A 307 (galvanized), size as indicated, complete with nuts and washers.

2. Bolts: Lag, Toggle, and Miscellaneous Bolts and Screws (galvanized)

Type, size, and finish best suited for intended use. Finish options include zinc compounds, cadmium, and aluminum paint impregnated finishes.

3. Clip Angles (galvanized)

Steel, 3/16 inch thick, size best suited for intended use; or zinc-coated steel or iron commercial clips designed for connecting wood members.

4. Expansion Shields, (galvanized)

Type and size best suited for intended use.

5. Joist Hangers, (galvanized)

Steel or iron, zinc-coated, size to fit members where used, sufficient strength to develop the full strength of supported member, complete with any special nails required.

6. Nails (galvanized)

ASTM F 547, size and type best suited for purpose. For sheathing, length of nails shall be sufficient to extend 1 inch into supports. In general, 8-penny or larger nails shall be used for nailing through 1 inch thick lumber and for toe nailing 2 inch thick lumber; 16-penny or larger nails shall be used for nailing through 2 inch thick lumber. Nails used with treated lumber and sheathing and subjected to exposure to moisture shall be galvanized. Nailing shall be in accordance with the recommended nailing schedule contained in AFPA T11-WCD1. Where detailed nailing requirements are not specified, nail size and spacing shall be sufficient to develop an adequate strength for the connection. The connection's strength shall be verified against the nail capacity tables in AFPA-T901. Reasonable judgment backed by experience shall ensure that the designed connection will not cause the wood to split. Split wood shall be removed and replaced. Corners shall be tied. If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.

2.03 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown. R-values shall be determined at 75 degrees F in accordance with ASTM C 518. Insulation shall contain the highest practicable percentage of recovered material which has been recovered or diverted from solid waste, but not including material reused in a manufacturing process. Where two materials have the same price and performance, the one containing the higher recovered material content shall be provided. Insulation shall be the standard product of a manufacturer and factory marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Materials containing more than one percent asbestos will not be allowed.

Glass fiber batts and rolls shall conform to ASTM C 665, Type II kraft faced insulation, Class A, having a UL rating of 25 and a smoke developed rating of 150 or less when tested in accordance with ASTM E 84. Insulation shall have a 10 mil thick, puncture resistant woven-glass cloth with vinyl facing on one side. Width and length shall suit construction conditions.

PART 3 - EXECUTION

3.01 INSTALLATION OF FRAMING

A. General

Members shall be closely fitted, accurately set to required lines and levels, and rigidly secured in place. All work shall be in accordance with the recommendations in the Virginia Uniform Statewide Building code, adopted May 1, 2008 and the International Building Code, 2006 unless noted otherwise on the plans.

B. Structural Members

Members shall be adequately braced before erection. Members shall be aligned and all connections completed before removal of bracing. Individually wrapped members shall be unwrapped only after adequate protection by a roof or other cover has been provided.

C. Roof Framing or Rafters

Tops of supports or rafters shall form a true plane. Ridge, and hip members shall be of depth equal to cut on rafters where practicable, but in no case less than depth of rafters. Hips, and ridges shall be straight and true intersections of roof planes. Necessary crickets and watersheds shall be formed. Rafters, except hip rafters, shall be bolted by angles. Rafters shall be toe-nailed to ridge, or hip members. Rafters shall be braced to prevent movement until permanent bracing, decking or sheathing is installed. Hip rafters shall be secured to wall plates by clip angles. Openings in roof shall be framed with headers and trimmers. Unless otherwise indicated, headers carrying more than two rafters and trimmers supporting headers carrying more than one rafter shall be double. Hip rafters longer than the available lumber shall be butt jointed and scabbed.

3.02 INSTALLATION OF SHEATHING

Sheathing shall be applied with edges 1/8 inch apart at side and end joints, and nailed at supported edges at 4 inches on center and at intermediate supports 8 inches on center unless otherwise shown. Nailing of edges shall be 3/8 inch from the edges. Roof sheathing shall be applied with long dimension at right angles to supports, end joints made over supports, and end joints staggered.

3.03 INSTALLATION OF MISCELLANEOUS WOOD MEMBERS

A. Bridging and Bracing

Wood bridging and bracing shall have ends accurately bevel-cut to afford firm

contact and shall be nailed at each end with two nails. Metal bridging shall be installed as recommended by the manufacturer. The lower ends of bridging shall be driven up tight and secured after subflooring or roof sheathing has been laid and partition framing installed.

B. Blocking

Blocking shall be provided as necessary for application of siding, sheathing, subflooring, wallboard, and other materials or building items, and to provide firestopping. Blocking shall be cut to fit between framing members and rigidly nailed thereto.

C. Nailers and Nailing Strips

Nailers and nailing strips shall be provided as necessary for the attachment of finish materials. Nailers used in conjunction with roof deck installation shall be installed flush with the roof deck system. Stacked nailers shall be assembled with spikes or nails spaced not more than 18 inches on center and staggered. Beginning and ending nails shall not be more than 6 inches for nailer end. Ends of stacked nailers shall be offset approximately 12 inches in long runs and alternated at corners. Anchors shall extend through the entire thickness of the nailer. Strips shall be run in lengths as long as practicable, butt jointed, cut into wood framing members when necessary, and rigidly secured in place.

3.04 INSTALLATION OF TIMBER CONNECTORS

Installation of timber connectors shall conform to applicable requirements of AFPA-T901.

3.05 INSTALLATION OF INSULATION

Insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work. For thermal insulation the actual installed thickness shall provide the thermal resistance R-values shown. Insulation shall be installed on the weather side of such items as electrical boxes and water lines. Unless otherwise specified, installation shall be in accordance with the manufacturer's recommendation.

End of Section

SECTION 06200

FINISH CARPENTRY

PART 1- GENERAL

1.01 SUMMARY

A. The work includes all labor, materials, tools, equipment, supplies, services; and related work for the construction of finish carpentry including trim, soffits, molding, aluminum wrap, provided complete and ready for operations.

B. Related work specified elsewhere includes:

1. Section 03300 – Cast-In-Place Structural Concrete
2. Section 04200 – Masonry
3. Section 05500 – Miscellaneous Metal
4. Section 06100 – Rough Carpentry
5. Section 07311 – Roofing, Strip Shingles
6. Section 07920 – Joint Sealants
7. Section 08120 – Fiberglass Reinforced Plastic Doors And Frames
8. Section 08700 – Builder's Hardware
9. Section 09900 – Painting
10. Section 14534 – Trolley and Manual Hoist

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 SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM F 547 - (1977; R 1990) Definitions of Terms Relating to Nails for Use with Wood and Wood-Base Materials
2. ASTM D 245 – Standard Practice for Establishing Structural Grades and Related Allowable Properties for Visually Graded Lumber.

B. AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)
1. AWPA M4 - (1995) Standard for the Care of Preservative-Treated Wood Products

C. DEPARTMENT OF COMMERCE (DOC)
1. DOC PS 1 - (1996) Voluntary Product Standard - Construction and Industrial Plywood

D. WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA)
   1. WMMPA WM 6 - (1987) Industry Standard for Non-Pressure Treating of Wood Millwork

E. ASTM D245-06 – Standard practice for establishing structural grades and related allowable properties for visually graded lumber.

1.03 SUBMITTALS

The following shall be submitted in accordance with Section 105 – Control of Work.

A. Data

1. Wood Items
2. Vinyl and Aluminum Trim. Submit manufacturer's product description indicating material types, thicknesses, color and installation details.

1.04 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 - PRODUCTS

2.01 WOOD ITEMS AND TRIM

A. Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood, structural-use panels, and lumber, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

B. Sizes and Patterns

Lumber sizes and patterns shall conform to rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Sizes and patterns for materials other than lumber shall conform to requirements of the rules or standards under which produced. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

C. Moisture Content

The maximum moisture content of untreated trim shall be 15 percent at the time of delivery to the jobsite and when installed. Moisture content of all other material shall be in accordance with the standard under which the product is produced.

D. Preservative Treatment

Exterior wood molding and millwork within 18 inches of soil, in contact with water or concrete shall be preservative-treated in accordance with WMMPA WM 6. Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil.

E. Plywood Ceilings

Plywood ceilings shall be DOC PS 1,Grade B, exterior type, 5/8 inch thick.

F. Fascias and Trim

Trim, including fascias, soffits and moldings, shall be as shown on the drawings.

G. Moldings

Moldings shall be of the pattern indicated and shall be of a grade compatible with the finish specified.

2.02 NAILS

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. Length of nails shall be sufficient to extend 1-1/2 inches into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

PART 3 - EXECUTION

3.01 SOFFITS

Panels shall be applied with edges at joints spaced in accordance with manufacturer's instructions and with all edges backed with framing members. Panels shall be nailed 3/8 inch from edges at 6 inches on center and at intermediate supports at 12 inches on center or as recommended by the manufacturer. Panels shall be installed using the maximum practical lengths.

3.02 FASCIAS AND EXTERIOR TRIM

Exposed surfaces and square edges shall be machine sanded, caulked, and constructed to exclude water. Joints of built-up items, in addition to nailing, shall be glued as necessary for weather-resistant construction. End joints in built-up members shall be well distributed. Joints in flat work shall be shouldered. Backs of wide-faced miters shall be held together with metal rings and glue. Fascias and other flat members shall be in maximum practicable lengths. Cornices shall be braced, blocked, and rigidly anchored for support and protection of vertical joints.

END OF SECTION

SECTION 07150

EXTERIOR WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. The work includes all labor, materials, tools, equipment, supplies, services; and related work for the bituminous based waterproofing of below grade exterior concrete surfaces provided complete and ready for operations.

B. Related work specified elsewhere includes:

1. Section 03300 – Cast in Place Structural Concrete
2. Section 03410 – Precast Concrete Wet Well

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 SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM D 4541 – Pull-Off Strength of Coatings
2. ASTM D 412 – Tensile Strength
3. ASTM D 522 – Mandrel Bend Flexibility
4. ASTM D 4060 – Abrasion Resistance Using the Taber Abraser
5. ASTM D 570 – Water Absorption
6. ASTM D E96 – Water Vapor Transmission
7. ASTM D 490 – Standard Specification for Road Tar

1.03 SUBMITTALS

The following shall be submitted in accordance with Section 105 - Control of Work.

A. Product Data - Manufacturer's product data and installation instructions for each material and product used.

B. Manufacturer's Material Safety Data Sheets

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications: The manufacturer shall be a company with at least five years experience and regularly engaged in the manufacture of products specified herein. The manufacturer shall have an ISO 9001 certified quality

system.

B. Installer's qualifications: The contractor shall be qualified to perform the work specified by reason of experience.

1.05 DELIVERY AND STORAGE OF MATERIALS

A. Deliver products in original packaging, labeled with product identification, manufacturer, batch number and shelf life.

B. Store products in a dry area with temperature maintained between 50 and 85 degrees F. Protect from direct sunlight. Protect from freezing.

C. Handle products in accordance with manufacturer's printed recommendations.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Exterior Waterproofing: Bituminous/coal tar epoxy:

1. Exterior Waterproofing shall be Cooper Black No. 733 Protective Coating manufactured by Coopers Creek Chemical Corporation, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF BITUMINOUS/COAL TAR EPOXY WATERPROOFING

A. Examine substrates and conditions under which materials will be installed. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Coordinate installation with adjacent work to ensure proper sequence of construction.

C. Surface Preparation: Comply with manufacturer's printed instructions and the following.

1. Allow new concrete to cure for 28 days.
2. Remove loose and deteriorated materials using high pressure water- or sand-blasting or mechanical wire brushing.
3. Clean surfaces of bond inhibiting materials including mildew, dust, dirt, laitance and standing water.

D. Application: Comply with manufacturer's printed instructions and the following.

1. Apply when ambient and surface temperatures are 40 degrees F and rising

and are expected to remain above 40 degrees F for 24 hours following placement.

2. Do not apply in freezing conditions or during precipitation.
3. Comply with manufacturer's guides for hot and cold weather application.
4. Do not bridge expansion, control or isolation joints.
5. Minimum application thickness: 16 mils.
6. Allow to dry a minimum of 48 hours before recoating.
7. Protect from rain until completely dry.
8. Do not overcoat with solvent based materials.

E. Cleaning: Remove excess material before material cures. If material has cured, remove using mechanical methods that will not damage substrate.

END OF SECTION

SECTION 07311

ROOFING, STRIP SHINGLES

PART 1 - GENERAL

1.01 SUMMARY

A. The work includes all labor, materials, tools, equipment, supplies, services; and related work for the construction strip shingle roofing including shingles, nails, ridge vent and rain diverter, provided complete and ready for operations.

B. Related work specified elsewhere includes:

1. Section 04200 – Masonry
2. Section 05500 – Miscellaneous Metal
3. Section 06100 – Rough Carpentry
4. Section 06200 – Finish Carpentry
5. Section 07920 – Joint Sealants

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 SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM D 1970 - (1990; R 1994) Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
2. ASTM D 3018 - (1990; R 1994) Class A Asphalt Shingles Surfaced With Mineral Granules
3. ASTM D 3161 - (1995) Wind-Resistance of Asphalt Shingles (Fan-Induced Method)
4. ASTM D 3462 - (1993a) Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules
5. ASTM F 1667 - (2000) Standard Specification for Driven Fasteners: Nails, Spikes, and Staples

B NATIONAL FIRE PROTECTION ASSOCIATION

1. NFPA 211 - (1996) Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances

1.03 SUBMITTALS

The following shall be submitted in accordance with Section 105 CONTROL OF WORK.

A. Data - Manufacturer's catalog data, description of roofing system including underlayment, shingles, fasteners, flashing, ridge vent, and rain diverters.

B. Manufacturer's instructions, annotated or supplemented by the Contractor to indicate configuration and method for installing the underlayment, shingles, and flashing, and for waterproofing of joints where flashings change direction. The number, spacing and orientation of fasteners shall be specified.

C. Samples - Finishes.

Samples of materials and products requiring color or finish selection.

D. Manufacturer warranties.

1.04 DELIVERY AND STORAGE OF MATERIALS

Materials shall be delivered in manufacturer's unopened bundles and containers with the manufacturer's brand and name marked clearly thereon. Shingles shall be stored in accordance with manufacturer's printed instructions. Roll goods shall be stored on end in an upright position. Immediately before laying, roofing felt shall be stored for 24 hours in an area maintained at a temperature not lower than 50 degrees F.

1.05 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided. Provide 25-year warranty for roofing materials.

PART 2 - PRODUCTS

2.01 MATERIALS

Materials shall conform to the following requirements:

A. Metal Drip Edges and Flashings

Metal drip edges and flashings shall be minimum 20 gauge anodized aluminum or copper. Aluminum color shall be as determined by the owner.

B. Underlayment

Modified bitumen; ASTM D 1970.

C. Nails

Nails shall be in accordance with ASTM F 1667. Use galvanized common nails except at the following: use galvanized roofing nails for underlayment and shingles, use aluminum nails for fastening aluminum material, and copper nails for fastening copper material.

D. Shingles

Shingles shall be approximately 12 by 36 inches in dimension and three-tab trip design. Shingles shall have self-sealing adhesive strips and shall meet a wind velocity rating of 60 mph plus or minus 5 percent in accordance with ASTM D 3161. Shingles shall be fungus resistant. Glass felt shingles shall comply with ASTM D 3018 and ASTM D 3462 Type I, Class A and shall weigh not less than 240 lbs. per square. Provide with 25 year warranty. Shingle color shall be as approved by the Owner.

E. Rain diverters

20 gauge prefinished copper or anodized aluminum, color as determined by the owner.

F. Ridge Vent:

Nailable, designed for shingle overlay. Ridgemaster Plus by Mid-America Building Products Corporation (800) 521-8486 or approved equal. Color as approved by Owner.

PART 3 - EXECUTION

3.01 PREPARATION OF SURFACES

The construction of any section of roof decking shall be completed before roofing work is started. Roof surfaces shall be smooth, firm, dry, and free from dust, moisture, loose boards, large cracks, and projecting ends that might damage the roofing. Vents and other projections through roofs shall be properly flashed and secured in position, and projecting nails shall be driven firmly home.

3.02 APPLICATION OF ROOFING

A. Flashings

Metal flashings shall be 20 gauge minimum. Metal flashings shall be provided at the intersections of roofs and adjoining walls and at projections through the deck such as vent stacks. Valley flashing shall be rolled aluminum sheet. No breaks in flashing will be allowed.

B. Metal Drip Edges

Metal drip edges shall be provided along the eaves and rakes. The metal drip edge shall be applied directly over the underlayment along the rakes and directly on the wood deck at the eaves. Metal drip edges shall extend back from the edge of the deck not less than 3 inches and shall be secured with compatible nails spaced not more than 10 inches on center along the inner edge. Place a bead of sealant/caulk between sheathing and drip edges.

C. Underlayment

Before any shingles are applied, two layers of asphalt-saturated-felt underlayment shall be applied to the roof deck sheathing.

D. Shingles

Shingles shall be applied in accordance with the manufacturer's printed instructions as they appear on the bundle wrapping. Mix the shingles from multiple bundles to achieve a uniform color finish. Use a chalk line layout to maintain straight lines. Contractor shall not use toe boards on shingles.

E. Rain Diverters, Ridge Vents and Chimneys

Install in accordance with the manufacturer's printed instructions.

End of Section

SECTION 07920

JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. The work includes all labor, materials, tools, equipment, supplies, services; and related work for the construction of joint sealants, provided complete and ready for operations.

B. Related work specified elsewhere includes:

1. Section 03300 – Cast-In-Place Structural Concrete
2. Section 04200 – Masonry
3. Section 05500 – Miscellaneous Metal
4. Section 06100 – Rough Carpentry
5. Section 06200 – Finish Carpentry
6. Section 07311 – Roofing, Strip Shingles
7. Section 08120 – Fiberglass Reinforced Plastic Doors And Frames
8. Section 09900 – Painting

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 the basic designation only.

A. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM C 920 (1998) Elastomeric Joint Sealants

1.03 SUBMITTALS

The following shall be submitted in accordance with Section 105 CONTROL OF WORK.

Product Data – Manufacturer's product data for the following:

Sealants
Primers
Bond breakers
Backstops

Data for the sealants shall include shelf life, recommended cleaning solvents, manufacture date, batch no., and installation instructions.

1.04 DELIVERY AND STORAGE

Deliver materials to the job site in unopened manufacturers' external shipping containers, with brand names, date of manufacture, color, and material designation clearly marked thereon. Elastomeric sealant containers shall be labeled to identify type, class, grade, and use. Carefully handle and store materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 100 F degrees or less than 0 degrees F.

1.05 ENVIRONMENTAL CONDITIONS

The ambient temperature shall be within the limits of 40 and 100 degrees F when sealant is applied.

PART 2 - PRODUCTS

2.01 SEALANTS

Provide sealant that has been tested and found suitable for the substrates to which it will be applied.

A. Interior Sealant

ASTM C 920, Type S or M, Grade NS, Class 12.5, Clear, Use NT. Provide at:

1. Small voids between walls or partitions and door frames, built-in or surface-mounted equipment and fixtures, and similar items.
2. Perimeter of frames at doors, louvers and access panels which adjoin exposed interior concrete and masonry surfaces
3. Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.

B. Exterior Sealant

For joints in vertical surfaces, provide ASTM C 920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C 920, Type S or M, Grade P, Class 25, Use T, color to match adjacent surfaces. Provide at:

1. Joints and recesses formed where frames and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.
2. Masonry joints where shelf angles and steel lintels occur.
3. Voids where items pass through exterior walls.
4. Metal reglets, where flashing is inserted into masonry joints.
5. Metal-to-metal joints where sealant is indicated or specified.

6. Joints between ends of gravel stops, fascias, and adjacent walls.
7. Joint between drip edge and sheathing.
8. Joint between flashing and masonry.

C. Floor Joint Sealant

ASTM C 920, Type S or M, Grade P, Class 25, Use T.

2.02 PRIMERS

Provide a nonstaining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

2.03 BOND BREAKERS

Provide open celled polyethylene foam rod sized for the joint. Backer rod shall be installed before sealant.

2.04 BACKSTOPS

Provide glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Backstop material shall be compatible with sealant. Do not use oakum or other types of absorptive materials as backstops.

2.05 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer.

PART 3- EXECUTION

3.01 SURFACE PREPARATION

Surfaces shall be clean, dry to the touch, and free from dirt, frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. When resealing an existing joint, remove existing caulk or sealant prior to applying new sealant.

A. Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue-free solvent.

B. Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. Use non-staining solvents for removing protective coatings and final cleaning of aluminum or bronze surfaces.

3.02 SEALANT PREPARATION

Do not add liquids, solvents, or powders to the sealant. Mix multi-component elastomeric sealants in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Joint Width-To-Depth Ratios

1. Acceptable Ratios:

	Joint Width	Joint Depth (Minimum)	Joint Depth (Maximum)
For metal, glass, or other nonporous surfaces:	1/4 inch (minimum)	1/4 inch	1/4 inch
	over 1/4 inch	½ of width	width
For wood, concrete, masonry,	1/4 inch (minimum)	1/4 inch	1/4 inch
	Over 1/2 inch to 2 inches	1/2 inch	5/8 inch
	Over 2 inches (As recommended by sealant manufacturer)	As recommended by sealant manufacturer	As recommended by sealant manufacturer

2. Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided for wood, concrete, or masonry, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work.

B. Backstops

Install backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide a joint of the depth specified. Install backstops in the following locations:

1. Where indicated.

2. Where backstop is not indicated but joint cavities exceed the acceptable maximum depths specified in paragraph entitled, "Joint Width-to-Depth Ratios."

C. Primer

Immediately prior to application of the sealant, clean out loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's instructions. Do not apply primer to exposed finish surfaces.

D. Bond Breaker

Provide bond breakers to the back or bottom of joint cavities, as recommended by the sealant manufacturer for each type of joint and sealant used, to prevent sealant from adhering to these surfaces. Carefully apply the bond breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond breaker.

E. Sealants

Provide a sealant compatible with the material(s) to which it is applied. Do not use a sealant that has exceeded shelf life or has jelled and can not be discharged in a continuous flow from the gun. Apply the sealant in accordance with the manufacturer's instructions with a gun having a nozzle that fits the joint width. Force sealant into joints to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Sealant shall be uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply sealant, and tool smooth as specified.

3.04 PROTECTION AND CLEANING

A. Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

B. Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

1. Masonry and Other Porous Surfaces: Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as

recommended by the sealant manufacturer. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding.

2. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent-moistened cloth.

End of Section

SECTION 08120

FIBERGLASS REINFORCED PLASTIC DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. The work includes all labor, materials, tools, equipment, supplies, services; and related work for the construction of doors, provided complete and ready for operations.

B. Related work specified elsewhere includes:

1. Section 03300 – Cast-In-Place Structural Concrete
2. Section 04200 – Masonry
3. Section 05500 – Miscellaneous Metal
4. Section 07920 – Joint Sealants
5. Section 08700 – Builders Hardware
6. Section 09900 – Painting

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 SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM E 84 - Surface Burning Characteristics of Building Materials
2. ASTM D 635 - Self Extinguishing Materials
3. ASTM E 283 - Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
4. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
5. ASTM E 331 - Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

1.03 SUBMITTALS

The following shall be submitted in accordance with Section 105 CONTROL OF WORK.

A. Data

Fiberglass Doors and Frames.

Manufacturer's descriptive data and catalog cuts including air-infiltration data.

B. Drawings

Fiberglass Doors and Frames.

A schedule showing the location of each door shall be included with the drawings. Drawings showing elevations of each door and frame type, details and method of anchorage, details of construction, location and installation of hardware, shape and thickness of materials, and details of joints and connections.

C. Instructions

Installation and cleaning.

Manufacturer's installation instructions and cleaning instructions.

D. Samples

Finishes.

Samples of the integral gel coat color finish.

1.04 DELIVERY AND STORAGE

Materials delivered to the site shall be inspected for damage, and shall be unloaded with a minimum of handling. Storage shall be in a dry location with adequate ventilation, free from dust, water, and other contaminants, and which permits easy access for inspecting and handling. Materials shall be neatly stored on the floor, properly stacked on nonabsorptive strips or wood platforms. Doors and frames shall not be covered with tarps, polyethylene film, or similar coverings.

1.05 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

1.06 SYSTEM DESCRIPTION

Swing-type fiberglass doors and frames, of size and design shown on the drawings, shall be provided where indicated. Doors shall be furnished complete with frames, and other accessories indicated and specified.

1.07 PERFORMANCE REQUIREMENTS

A. Wind Load Performance

Doors and frames shall be of sufficient strength to withstand a design wind load of 30 pounds per square foot of supported area with a deflection of not more than 1/175 times the length of the member. Doors shall be tested in accordance with ASTM E 330 at a pressure not less than 1.5 times the design load.

B. Water Penetration Performance

Frames and doors shall have no water penetration when tested in accordance with ASTM E 331 at a pressure of 8 psf.

PART 2 - PRODUCTS

2.01 FIBERGLASS DOORS AND FRAMES

Door shall be made of fiberglass reinforced plastic (FRP) using resins tailored to the specific corrosive environment and have a fiberglass content of 25% by weight. The doors shall be flush construction, having no seams or cracks. All mortises shall be molded in at the factory. The doors shall be 1-3/4" thick with a 15 mil (plus or minus 3 mils) color gelcoat and have an R-factor of 12. Secondary painting over pultrusions to achieve color is not acceptable. Doors shall be as manufactured by Chem-Pruf, Brownsville TX (800)444-6924 or approved equal.

A. Stiles and Rails

Shall be constructed starting from the outside toward the inside, of a 15-20 mil gel coat of the color specified followed by a matrix of at least three layers of 1.5 ounce per square foot of fiberglass mat. The stile and rail shall be molded in one continuous piece to a U-shaped configuration and to the exact dimensions of the door. In this manner there will be no miter joints or disparate materials used to form the one-piece stile and rail. Pultrusions will not be acceptable for stiles and rails.

B. Door Plates

Shall be molded in one continuous piece, starting with a 15-20 mil gel coat of the color specified, integrally molded with at least two layers of 1.5 ounce per square foot fiberglass mat and layer of 16 ounce per square yard undirectional glass roving.

C. Reinforcement

Adequate reinforcing and compression members shall be used to accommodate surface hinges, closers, locksets, kickplates, push or pull plates. When engineering considerations dictate, mild steel shall be buried in the fiberglass matrix to provide enhanced screw holding power. In no case should screws be used into fiberglass matrix to provide holding for hinges, locks or closers or any structured attachment.

Thru-bolting is recommended for attachment of hinges and closers. When thru-bolting is to occur, a compression member shall be located to provide memory and resistance to the torquing of thru-bolts.

All voids between the door plates shall be completely filled with the equivalent of 4-6 pounds expanded polyurethane foam, having a flame spread of 25 or less per ASTM E-84.

D. Flame Spread

All reinforcing resins shall contain a halogenated additive or co-reactant plus Antimony Trioxide to achieve a flame spread of 25 or less per ASTM E 84 and shall be self-extinguishing per ASTM D 635.

E. Color

The color of the door or frame shall be integrally molded as the part is made. Color shall be as approved by the Owner.

2.02 FRAMES

Frames shall be similar to the doors in construction and materials except the frames shall be solid fiberglass. The stop and frame shall be molded in one piece. The frame shall be integrally gelcoated to the specified color when molded. Mortises shall be molded in. It is not permitted to rout in mortises or remove any material from the head or jambs, to provide mortises. Frames shall be 2" profile at jambs and 4"at head.

Reinforcement for mounting hinges, closers, etc. shall be of mild steel plates strategically located and buried in the resin-glass matrix so they will not be exposed to the elements.

The jamb shall be flat on the backside (against the opening) and uniform in thickness so as to provide a solid, uniform surface against the wall opening. No wood blocks or spacers are permitted.

2.03 HARDWARE

All hardware where applicable (hinges, closers, etc.) shall be installed at the door manufacturing plant. The hardware manufacturer's warranty shall be included with the hardware installation.

2.04 WEATHERSTRIPPING

Weatherstripping shall be continuous type recommended by the door manufacturer, and shall be provided on head and jamb of exterior doors. Weatherstripping for bottom of doors shall be continuous bottom brush type sweep. Weatherstripping shall be easily replaced without special tools, and shall be adjustable at meeting stiles of pairs of doors. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

PART 3 - EXECUTION

3.01 INSTALLATION

Installation shall be in strict compliance with manufacturer's written instructions using non-corrosive materials and methods.

Frames and framing members shall be accurately set in position to receive doors. Frames shall be plumb, square, level, and in alignment, and securely anchored to adjacent construction as per manufacturers recommendations. Anchorage to masonry will be by Stainless steel Flat head screws as recommended by manufacturer of door or as provided by Crete Flex (#14-10 x 3-1/4" Flat Head Phillips).

Joints between frame and adjacent wall construction shall be sealed as per the manufacturer's recommendations and as specified herein. Doors shall be accurately hung with proper clearances, and adjusted to operate properly. Protective coverings if provided shall be removed and the doors and frames shall be thoroughly cleaned with a mild soap and water mixture per the manufacturer's instructions.

End of Section

SECTION 08700

BUILDER'S HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. The work includes all labor, materials, tools, equipment, supplies, services; and related work for the construction of door hardware, provided complete and ready for operations.

B. Related work specified elsewhere includes:

1. Section 08120 – Fiberglass Reinforced Plastic Doors And Frames
2. Section 09900 – Painting

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 SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM E 283 - (1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen

B. BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)
1. BHMA ANSI/BHMA A156.1 - (1988) Butts and Hinges
2. BHMA ANSI/BHMA A156.2 - (1989) Bored and Preassembled Locks and Latches
3. BHMA ANSI/BHMA A156.4 - (1992) Door Controls - Closers
4. BHMA ANSI/BHMA A156.5 - (1992) Auxiliary Locks & Associated Products
5. BHMA ANSI/BHMA A156.7 - (1988) Template Hinge Dimensions
6. BHMA ANSI/BHMA A156.13 - (1994) Mortise Locks & Latches
7. BHMA ANSI/BHMA A156.18 - (1993) Materials and Finishes

C. DOOR AND HARDWARE INSTITUTE (DHI)
1. DHI-A115.IG - (1994) Installation Guide for Doors and Hardware
2. DHI A115-W - (Varies) Wood Door Hardware Standards (Incl All5-W1 thru A115-W9)
3. DHI-03 - (1989) Keying Systems and Nomenclature

1.03 SUBMITTALS

The following shall be submitted in accordance with Section 105 CONTROL OF WORK.

A. Data

Hardware and Accessories.

Manufacturer's descriptive data, technical literature, catalog cuts, and installation instructions. Spare parts data after approval of the detail drawings, and not later than 1 month prior to the date of substantial completion. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

B. Schedules

Hardware Schedule.

Hardware schedule listing all items to be furnished. The schedule shall include for each item: the quantities; manufacturer's name and catalog numbers; the ANSI number specified, sizes; detail information or catalog cuts; finishes; door and frame size and materials; location and hardware set identification cross-references to drawings; corresponding reference standard type number or function number from manufacturer's catalog if not covered by ANSI or BHMA; and list of abbreviations and template numbers.

C. Certificates

Hardware and Accessories.

The hardware manufacturer's certificates of compliance stating that the supplied material or hardware item meets specified requirements. Each certificate shall be signed by an official authorized to certify in behalf of the product manufacturer and shall identify quantity and date or dates of shipment or delivery to which the certificates apply. A statement that the proposed hardware items appear in BHMA-01, BHMA-02 and BHMA-03 directories of certified products may be submitted in lieu of certificates.

1.04 DELIVERY, STORAGE, AND HANDLING

Hardware shall be delivered to the project site pre-assembled by door supplier onto door and frame.

1.05 SPECIAL TOOLS

Special tools, such as those supplied by the manufacturer, unique wrenches, and dogging keys, shall be provided as required to adjust hardware items.

1.06 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

1.07 OPERATION AND MAINTENANCE MANUALS

Submit in accordance with Section 01781 OPERATION AND MAINTENANCE DATA/MANUAL.

PART 2 - PRODUCTS

2.01 GENERAL HARDWARE REQUIREMENTS

Hardware shall conform to the requirements specified herein and the HARDWARE SETS listing at the end of this section. Unless otherwise noted, all hardware shall be stainless steel. Hardware set numbers correspond to the set numbers shown on the drawings.

2.02 TEMPLATES

Requirements for hardware to be mounted on doors or frames shall be coordinated between hardware manufacturer and door or frame manufacturer by use of templates and other information to establish location, reinforcement required, size of holes, and similar details. Templates of hinges shall conform to BHMA ANSI/BHMA A156.7.

2.03 HINGES

Hinges shall conform to BHMA ANSI/BHMA A156.1. Hinges used on doors and frames shall also conform to BHMA ANSI/BHMA A156.7. Hinges shall be 5 knuckle full mortise polished steel. Except as otherwise specified, hinge sizes shall conform to the hinge manufacturer's printed recommendations. Hinges for reverse bevel doors with locks shall have stainless steel pins that are made non-removable by means such as a set screw in the barrel, or safety stud, when the door is in the closed position.

2.04 LOCKS AND LATCHES

To the maximum extent possible, locksets, latchsets and deadlocks shall be the products of a single manufacturer.

A. Mortise Lock and Latchsets

Mortise lock, latchsets, and strikes shall be series 1000 and shall conform to BHMA ANSI/BHMA A156.13, operational Grade 1. Mortise type locks and latches for doors 1-3/4 inches thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door. Mortise locks shall have armored fronts.

B. Bored Lock and Latchsets

Bored lock, latchsets, and strikes shall be series 4000 and shall conform to BHMA ANSI/BHMA A156.2, Grade 1. Bored type locks and latches for doors 1-3/8 inches thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door.

C. Lock Cylinders (Mortise, Rim and Bored)

Lock cylinders shall comply with BHMA ANSI/BHMA A156.5. Lock cylinder shall have not less than six pins. Cylinders shall have key removable type cores. The cylinders shall be compatible with the York County master key system, "Best" Lock of Richmond, VA. Contractor shall provide construction cores and keying. Owner shall provide the permanent core cylinders and keys.

D. Lock Trim

Lock trim shall be cast, forged, or heavy wrought construction of commercial plain design. In addition to meeting the test requirement of BHMA ANSI/BHMA A156.2 or BHMA ANSI/BHMA A156.13, knobs, lever handles, roses, and escutcheons shall be 0.050 inch thick, if unreinforced. If reinforced, the outer shell shall be 0.035 inch thick and the combined thickness shall be 0.070 inch except that knob shanks shall be 0.060 inch thick. Knob diameter shall be 2-1/8 to 2-1/4 inches. Lever handles shall be of plain design with ends returned to no more than 1/2 inch from the door face.

2.05 MISCELLANEOUS

A. Bottom Door Sweep

Door bottom sweep shall be brush type with fiberglass housing.

B. Aluminum Housed Type Weatherseals

Weatherseals of the type indicated shall consist of extruded aluminum retainers not less than 0.07 inch wall thickness with vinyl, neoprene, silicone rubber, polyurethane or vinyl brush inserts. Aluminum shall be clear (natural) anodized. Weatherseal material shall be of an industrial/commercial grade. Seals shall remain functional

through all weather and temperature conditions. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.07 FASTENINGS

Fastenings of proper type, size, quantity, and finish shall be supplied with each article of hardware. Machine screws and expansion shields shall be used for attaching hardware to concrete or masonry. Fastenings shall be stainless steel. Sex bolts, through bolts, or machine screws and grommet nuts, where used on reverse-bevel exterior doors equipped with half-surface or full-surface hinges, shall employ one-way screws or other approved tamper-proof screws. Screws for the jamb leaf of half-mortise and full-surface hinges attached to frames shall be one-way or other approved tamper-proof type.

2.08 FINISHES

Matte Finish.

PART 3 - EXECUTION

3.01 APPLICATION

Hardware shall be located in accordance with DHI-04 and DHI-05, except that deadlocks shall be mounted 48 inches above finish floor. When approved, slight variations in locations or dimensions will be permitted. Application shall be in accordance with DHI-A115.IG or DHI A115-W. Door control devices for exterior doors such as closers and holders, shall be attached to doors with thru bolts and nuts or sex bolts. Alternate fastening methods may be approved by the Owner when manufacturers' documentation is submitted to verify that the fastening devices and door reinforcements are adequate to resist wind induced stresses. Door-closing devices shall be installed and adjusted in accordance with the templates and printed instructions supplied by the manufacturer of the devices. Insofar as practicable doors shall have the closer mounted on the room side of the door.

3.02 HARDWARE SETS

HW-1

Door No. 101

1 EA Door
2 PR Hinge FM Stan CB 1960 4.5 x 4.5 NRP US32D
1 EA Cylindrical Lockset (8K) with stainless steel chassis meeting ANSI A 156.2 series 4000, Grade 1. 837 D4C 53 626
3 FT 5IN Door Sweep-Fiberglass C.P. 1 with Neoprene Seal
1 EA Doorstop, Exterior
1 EA Hold Open Latch
Lockset and keyway to function with County of York master key system
(Best Lock System – Richmond, VA)

End of Section

SECTION 09900

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 03300 – Cast-In-Place Structural Concrete
2. Section 04200 – Masonry
3. Section 05500 – Miscellaneous Metal
4. Section 06100 – Rough Carpentry
5. Section 06200 – Finish Carpentry
6. Section 07311 – Roofing, Strip Shingles
7. Section 08120 – Fiberglass Reinforced Plastic 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 prepararation.

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

Surface	First Coat	Second Coat	Third Coat
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)	AcrylicEmulsion 4 mils MDFT	Acrylic Emulsion 4 mils MDFT	None

INTERIOR PAINTING SCHEDULE

Surface	First Coat	Second Coat	Third Coat
Concrete masonry units	Waterborne Acrylic Epoxy Filler 60-80 ft^2/gal	Waterborne Acrylic Epoxy - Gloss 4 mils MDFT	None
Concrete	Waterborne Acrylic Epoxy Filler 60-80 ft^2/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	Polyamine Epoxy 6 mils
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 14534

TROLLEY AND MANUAL HOIST

PART 1 - GENERAL

1.01 SUMMARY

A. The contractor shall furnish all labor materials, tools, equipment supplies and services; and shall perform all work necessary for the provision and installation of trolleys and manual hoists.

B. Related work specified elsewhere includes:

1. Section 04200 – Masonry
2. Section 05500 – Miscellaneous Metals
3. Section 07920 – Joint Sealants
4. Section 09900 – Painting

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 the basic designation only.

A. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
1. ANSI/ASME HST-3M - (1991) Manually Lever Operated Chain Hoists

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1. ASTM A 275/A 275M - (1995) Magnetic Particle Examination of Steel Forgings

C. MONORAIL MANUFACTURERS ASSOCIATION, INC. (MMA)
1. MMA MH27.1 - (1981) Underhung Cranes and Monorail Systems

1.03 SUBMITTALS

The following shall be submitted in accordance with Section 105 "CONTROL OF WORK.

A. Shop Drawings

Submit product and equipment data for the following products:

1. Hoist
2. Trolley
3. Load Chain

4. Pump Harness

B. Factory Test Reports

Hook and hook nut magnetic-particle tests.

C. Certificates

Manual hoist load chain.

Submit factory certification of load chain rated capacity.

D. Operation and Maintenance Manuals

Hoist and trolley.

E. Operational Inspection and Load Testing Results

1.05 VERIFICATION OF DIMENSIONS

The Contractor shall verify all building dimensions that relate to fabrication of the trolley and hoist system, and shall notify the Owner of any discrepancy before the order to the manufacturer is finalized.

PART 2 - PRODUCTS

2.01 FABRICATION AND CONSTRUCTION

Provide manual hoist and trolley, ANSI/ASME HST-3M, trolley suspension. Trolley and wheels shall be suitable for operation on the steel beam provided, and shall have not less than four wheels.

A. Capacity

The hoist and trolley shall have a minimum rated capacity of 2000 pounds.

B. Hook Lift

The operating range of the system shall be sufficient to install and remove equipment from the wet well including traversing the wet well top slab and unloading/loading the pump from/on a maintenance vehicle. Hook range shall allow for lifting the pump 36 inches clear of the top slab.

C. Hooks

Shall be of the safety type with hook nuts keyed to hook shanks by means of a setscrew installed in a plane parallel to the longitudinal axis of the hook shank, or by any other similar easily removable securing device. All hook components shall be magnetic-particle inspected over the entire area in accordance with ASTM A 275/A 275M. The acceptance standard shall be one of no defects. A defect is defined as a linear indication revealed by magnetic-particle inspection that is greater than 1/8 inch long whose length is equal to or is greater than three times its width.

D. Trolley

Shall be designed to operate from the track beam section furnished under this contract.

E. Load Chain

High strength steel links, flexible; minimum safety factor of 5 to 1 based on ratio of minimum chain breaking load to the calculated load on the chain when the hoist is assumed loaded to rated capacity. Certification from hoist manufacturer of provided chain's breaking strength shall be submitted to Owner and approved prior to final acceptance of hoist. Do not paint or coat the load chain. Length of load chain shall be sufficient to provide specified hook range.

F. Load Hooks and Load Hook Components

Forged steel; complete with spring-loaded steel throat opening safety device. The hook shall be carried on suitably sealed or shielded anti-friction thrust bearings and shall swivel freely through 360 degrees rotation with full load without twisting chain.

1. Disassembly. Hook and hook nut shall be capable of complete disassembly that enables access to all surfaces of the hook, including shank and hook nut for inspection purposes. Provision shall be made for the hook nut, or other hook-to-block fastener, to be keyed to hook shank by means of a set screw or similar, easily removable, securing device.

2. Capacity: Load capacity shall be 2000 pounds with a 5 to 1 safety factor.

G. Chain Container
Provide chain bucket attached to the hoist of adequate size to properly store the chain.

F. Acceptable Manufacturers: Columbus McKinnon, Yale, and Harrington.

2.02 IDENTIFICATION PLATES

Provide identification plates of noncorrosive metal. Information and data on the plates shall include, in clearly legible permanent lettering, the manufacturer's name, model number, capacity rating, and other essential information.

2.03 PAINTING OF SYSTEM

Provide manufacturer's standard painting or shop painting of components specified in this section. Do not paint, coat, or galvanize load chain, hook nut, or load chain sheave.

PART 3 - EXECUTION

3.01 ERECTION AND INSTALLATION

The Contractor shall erect and install the hoist and trolley system in accordance with manufacturers written instructions, MMA MH27.1, and the contract drawings.

3.02 FIELD INSPECTION AND TESTS

Operational Inspection and Load Tests

Upon completion, and before final acceptance, the hoist, trolley, and lifting beam shall be given the rated load test specified in ASME/ANSI B30.11, carrying 125 percent (plus 5 percent, minus 0 percent) of the rated capacity, and with the units spaced to obtain maximum possible loads in the beam. Hoists shall hold a static, as well as control a dynamic, 125 percent rated load. The systems shall be thoroughly tested in service to determine that each component of the system operates as specified, is properly installed and adjusted, and is free from defects in material, manufacture, installation, and workmanship. The Contractor shall furnish test loads, operating personnel, instruments, and all other necessary apparatus at no additional cost to the Owner. The test and final adjustments of the equipment will be completed in the presence of the Owner. The Contractor shall rectify any deficiencies found and completely retest work affected by such deficiencies.

End of Section

SECTION 15100

SUBMERSIBLE PUMPING EQUIPMENT

PART 1 - GENERAL

1.01 WORK INCLUDED:

The work includes provision of two (2) wet-pit submersible, centrifugal type sewage pumps complete with motors and pump retrieval system.

1.02 RELATED WORK SPECIFIED ELSEWHERE INCLUDES:

1. Section 03100 - Cast-In-Place Structural Concrete
2. Section 03410 – Precast Concrete Wet Well
3. Section 05500 – Miscellaneous Metals
4. Section 09900 - Painting
5. Section 16425 – Pump Control System

1.03 REFERENCES

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.

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABEMA)

ABEMA Std 9	(1990) Load Ratings and Fatigue Life for Ball Bearings
ABEMA Std 11	(1990) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 153	(1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 48	(1994, AE 1) Standard Specification for Gray Iron Castings

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1993; Rev 1; Rev 2) Motors and Generators

1.04 SUBMITTALS

The following shall be submitted in accordance with Section 105 Control of Work:

A. Product Data

1. 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
c. Electrical motor data
d. Control drawing and data
e. Detailed installation instructions
f. Technical manuals
g. Parts list
h. Manufacturer's warranty
i. Manufacturer's equipment storage recommendations
j. 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. The certified quality assurance record shall be provided on the manufacturer's letterhead and signed by an authorized agent of the manufacturer.

2. Submersible Pump Harness

Manufacturer's catalog data, dimensioned drawings, installation instructions, operating instructions and certificate of load rated capacity for load bearing components.

3. 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.

4. Spare Parts

Provide spare parts data for each different item of material and equipment specified. 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. Instructions

Sewage Pump System. Diagrams, instructions, and other sheets proposed for posting.

D. Operation and Maintenance Manuals in accordance with Section 01781:

Sewage Pump System. Operation manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operation manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout, simplified wiring and control diagrams of the system as installed, manufacturer's completed operational and acceptance testing reports, and certified pump curves.

E. Warranty

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.

1.05 DELIVERY AND STORAGE

Pumps shall be protected against corrosion at the factory 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.

1.06 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Owner of any discrepancy before performing the work.

PART 2 - PRODUCTS

2.01 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

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, reasonably convenient to the site.

A. Nameplates

Each pump shall have the manufacturer's name, address, type or style, model or serial number, impeller size, capacity and head rating, frame and bearing numbers, catalog number, and other pertinent data embossed on a stainless steel data plate secured to the pump.

B. Equipment Guards

Projecting setscrews, keys, and rotating parts so located that any person may come in close proximity thereto shall be enclosed or guarded.

C. Spare Parts and Special Tools

Provide spare parts and special tools in accordance with Paragraph 2.04.

D. Electric Motors: shall conform to NEMA MG 1.

E. Pump Control System: shall be in accordance with Section 16425.

F. Bolts, Nuts, Anchors, and Washers

Bolts, nuts, anchors, and washers shall be stainless steel in accordance with ASTM A 193.

2.02 SEWAGE PUMP AND APPURTENANCES

A. General:

Furnish three (3) Submersible Pumps, two (2) to be installed with one (1) being a spare. The Submersible Pumping Units shall conform to all applicable requirements of NEMA, NEC, SWPA and Hydraulic Institute. For purposes of this specification, the revision and/or version of the referenced standards in effect on the date of the bid shall apply.

The Submersible Pumping Units specified shall be the products of reputable manufacturers who have been regularly engaged in the design, manufacture and furnishing of Submersible Waste Water Pumps and Motors for at least five (5) years. The manufacturer of the pump shall assume full responsibility for the compatibility of the supplied components with the application. The motor and pump shall be manufactured by one company providing sole source responsibility for the warranty of the unit.

The Submersible Pumping Units shall be self contained, integral pump/motor units designed to operate at continuous full load in a partially or completely submerged condition without the need for any external cooling devices such as water jackets. The air-filled motor shall be cooled by an adequately sized motor frame which shall conform to the latest applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall meet the latest design standards of a Totally Enclosed Non-Ventilated NEMA frame motor. Heat transfer shall be accomplished by convection through the stator-housing wall to the surrounding media. Designs which incorporate cooling jackets and in particular, designs which rely on circulation of the pumped sewage or externally sourced water for cooling will not be allowed.

The nameplate ratings of the motor shall be 40° C ambient temperature environment and have a 1.15 service factor. The pump motors shall be designed to withstand 150 feet of static pressure. All motors shall be furnished and certified per IEEE 117 with Class F rated insulation materials or better. All motors not having IEEE 117 certified insulation systems shall be considered not acceptable. Insulation materials rated lower than Class F (i.e. Class B or A) are specifically prohibited.

The Submersible Pumping Units shall be complete with all accessories, controls and appurtenances as shown in the plans and specified herein or as required for a

complete operating system. The design shall be such that the pumping units will be automatically connected to the discharge piping when lowered into place on the discharge connection. The pump shall be easily removable for inspection or service without the need for removal of nuts, bolts or other fasteners and without the need for personnel to enter the wet-well. Each pump shall be fitted with a stainless steel chain 3-feet in length of adequate strength and length to aide in the lifting of the pump. The chain will not serve as the means for lifting.

B. Operating Characteristics:

Sewage pumps shall be submersible, non-clog, single-suction, centrifugal wastewater pumps with the ability to meet the following existing operating characteristics:

1. Pump Service: raw sewage.

2. Peak Design Operating Point: 334 gpm @ 118 feet TDH, 3,500 rpm, 56% efficiency, 14.1 feet NPSHr

3. Alternate Operating Points on curve:

   a. 200 gpm @ 142 feet TDH, 3,500 rpm, 43% efficiency, 13 feet NPSHr

   b. 463 gpm @ 94 feet TDH, 3,500 rpm, 59% efficiency, 17.7 NPSHr

4. Shut-Off Head: 200 feet TDH

5. Impeller: 167mm

6. Motor Size: 23 horsepower, 3,500 rpm, 200V three phase.

7. Rotation: Per drawings.

8. Discharge Size: 4-inch.

9. Maximum Sphere Size: 3-inch.

C. Bearings and Lubrication

Bearings shall be specifically selected to carry all radial and axial loads imposed by the pump and motor.

Bearings shall be rated to provide a minimum L_{10} Bearing Life of 50,000 hours at any design operating point within plus or minus 40% of best efficiency flow point (BEP) of the pump performance curve. Bearing selection shall limit the bearing temperature rise to a maximum of 60° C under full load operation.

All bearings shall be permanently lubricated with a premium moisture resistant grease containing rust inhibitors and shall be suitable for operation over a temperature range of –25° C to +120° C. The bearings shall not require any additional or periodic lubrication. All bearings shall be commercially available from third party sources other than the pump/motor manufacturer.

D. Shaft Seals

Two independent, tandem mounted, mechanical seals shall be provided in the oil filled housing to isolate and protect the air-filled motor from the pumped media. The oil level shall not require constant monitoring and shall be suitable for a minimum of two (2) years service under specified operating conditions before requiring replacement for normal maintenance. The oil reservoir shall act as a barrier to trap moisture and provide sufficient time for a planned shutdown in the event of an outer seal failure. The inner mechanical seal shall be constructed with a solid block carbon rotating seal face and a solid block silicon carbide stationary seal face. The outer mechanical seal shall be constructed with a solid block silicon carbide stationary rotating seal face and a solid block silicon carbide stationary face. All other metal seal components of both inner and outer seals shall be AISI 316 stainless steel. All elastomers of both inner and outer seals shall be of Viton® material.

The outer mechanical seal shall be located in a recessed housing outside the main flow path of the pump to avoid damage. Mechanical seals that employ sprayed or laminated seal faces shall neither be considered equal, nor shall they be acceptable. Mechanical seals shall be readily and commercially available from the third party sources other than the pump and motor manufacturer, their agents, dealers and/or distributors. Mechanical Seals shall be Type 21 or approved equivalent.

E. Moisture Detection System

A single probe moisture sensing system shall be provided to detect the entrance of moisture and provide an alarm. The moisture detection system shall be designed to detect the entrance of moisture in the stator and lower oil seal housing. The use of single probe or float switch type sensor systems shall not be acceptable. The moisture sensing probe leads shall terminate in a sensing device located in the control panel, which shall provide an alarm in the event of moisture intrusion. The sensing device, if not specifically ordered from the pump manufacturer, shall be approved by the pump/motor manufacturer.

F. Cable Entry System

The power and control cable entry system shall be designed to provide a positive, leak-free seal to prevent liquid from entering the air fill motor housing. The design shall incorporate provisions which prevent moisture from wicking through the cable

assembly in the event the cable jacket has been punctured. All cable shall be type SEOW-A and U.L. listed for the intended submersible service.

The power and control cable entry into the lead connection chamber shall be epoxy encapsulated for positive moisture sealing. All conductor leads shall terminate at a terminal board that is permanently cast into the epoxy sealed cable entry area. The motor and control leads shall be easily connected and serviced on the side of terminal board. A Buna-N cable grommet or a strain relief fitting shall be provided in addition to the epoxy sealed leads. Compression type grommet fittings employed as the primary sealing system shall neither be considered equal nor shall they be acceptable. Separate power and control cables shall be provided to prevent false sensor warnings.

G. Materials of Construction - Motor

The submersible motor enclosure including frame, end brackets, flanges and cap assembly shall be constructed of close-grained cast iron, ASTM A-48, Class 30 or better. The top end bracket shall be fitted with a lifting bail and shall be capable of supporting four (4) times the combined weight of the pump and motor. All mating fits on the motor frame shall have rabbit joints with large overlap as well as o-ring sales to provide for a watertight seal. O-rings shall be Buna-N.

The one-piece motor/pump shaft shall be constructed of AISI 416 stainless steel and shall be precision machined to ensure proper tolerances at all contact points. The entire rotating assembly shall be designed with sufficient rigidity for minimal shaft deflection at extreme pump operating conditions.

The motor rotor shall be of squirrel-cage design and constructed of die cast aluminum, fabricated copper or their respective alloys. The rotor shall have an interference fit to the shaft and the rotating assembly shall be dynamically balanced to ISO 1940, G.6.3. Balance weight, if required, shall be secured to the rotor resistance ring or rotor fins. Machine screws or nuts and bolts used to attach balance weights are specifically prohibited.

H. Electrical

The submersible motors shall successfully operate under power supply variations per NEMA MG1-14.30. Motors shall be NEMA Design B with torque and starting current in accordance with NEMA MG-12.

The submersible motors shall be of an air-filled, high efficiency design and shall be suitable for continuous full load operation. The motor construction shall be of explosion proof, TENV-TEXP design and capable of being certified for use in Class I, Division 1, Groups C & D hazardous locations by Factory Mutual Research Corp. (F.M.). Motors shall be capable of withstanding up to 15 starts per hour and shall

have a minimum 1.15 Service Factor at 40° C ambient temperature. Motor to be designed for use with variable frequency drive.

Stators shall be solid copper wound and shall be press fitted into the stator housing for the true positive alignment and efficient heat transfer. The motor insulation system shall be Class F minimum, utilizing materials and insulation systems evaluated and certified with IEEE 117 classification test. The entire wound stator assembly shall receive a minimum of two (2) coats of insulating varnish utilizing a dip and bake process.

Three (3) normally-closed, automatic-reset thermostats connected in series shall be embedded in adjoining phases of the stator windings. The thermostats shall be connected to safely shut down the motor upon opening.

I. Materials of Construction - Pump

The pump casing, impeller, motor housing, and stationary base elbow shall be manufactured of close-grained cast iron, ASTM A48, Class 30, and shall be of sufficient thickness to withstand all operating pressures and mechanical stresses. The pump casing shall be of the volute design, of one piece construction, having centerline discharge to minimize clogging or flow interference, and to provide the proper weight distribution for use with a pump retrieval disconnect system.

The pump casing shall have an integrally cast hand hole supplied with a hand hole cover. The hand hole cover shall be constructed of the same materials as the pump casing and shall have surfaces which match the internal casing contours to minimize turbulence and localized wear.

Hydrostatically test each casing to 1.5 times the design head or 1.25 times the shutoff head, whichever is greater. Volute sized at all points to pass solids which can pass through the impeller and internally finish to provide smooth unobstructed flow. Provide a clean out opening with removable cover, having its interior surface matching the volute contour, allowing access to the interior of the impeller.

Casing Connections: ANSI 125-pound flat face flange suction and discharge connections. Drill and tap the casing for draining, venting, and a pressure gauge. Provide casing with eye bolts, lifting lugs or equivalent.

The impeller shall be of a multi-vaned, enclosed design and shall have large passages to provide smooth flow transition and unimpeded passage of large spherical solids. All impellers shall be statically and dynamically balanced to ISO 1940, G.6.3. The impeller shall be constructed of close-grained cast iron, ASTM A48, Class 30. The impeller shall be capable of passing a 3" spherical solid.

A replaceable 400 Series stainless steel wear ring shall be provided on the impeller inlet to reduce the effects of abrasive wear and provide the ability to renew the running clearance. The suction plate shall contain a replaceable 400 Series stainless steel wear ring to match the impeller wear ring.

All external casting surfaces of the pump/motor coming into contact with the pumped liquid shall have a surface cleanliness equal to that of a SSPC-SP6 process prior to being factory protected by one (1) coat of an environmentally-safe machinery enamel coating with a high solids content.

J. Sliding Guide Bracket and Rail System

The pump slide bracket shall be of heavy duty construction, of sparkless design, and shall be constructed of cast iron.

The base discharge elbow shall meet the slide bracket by method of a three point, wedged engagement that is uniquely designed to match the volute flange to the stationary elbow to eliminate head losses. The discharge elbow shall be designed to carry the full weight of the pump, motor, and discharge piping.

Rail system shall be EL dual rail system. Guide rail mounting brackets shall be furnished to stabilize the guide rails for installation in deep wet wells. Brackets shall be spaced a proper intervals to provide rigidity and parallelism. The brackets shall be designed to fit exactly into the pipes for which they were designed. Adjustable and/or flexible brackets designed to fit a variety of guide rail pipe sizes shall note be acceptable. Mounting brackets shall be of stainless steel construction.

K. Flush Valve

One pump (as indicated on the drawings) shall be equipped with an automatic flush valve.

L. Shop Tests:

Pumps shall be shop tested and six (6) certified copies of curves derived from such tests shall be furnished for approval prior to shipment. Performance cases shall be proved tight by hydrostatic test to 150 psi.

M. Manufacture:

Sewage pumps shall be NP3153.181 SH as manufactured by Flygt, no exceptions.

2.04 SPARE PARTS

Proved the following spare parts for each pump provided (packaged and labeled for storage):

A. One set upper and lower bearings.

B. One set upper and lower shaft seals.

C. One set of O-rings or gaskets for replacement of bearings and seals.

D. One set impeller wear rings.

Special Tools:

One set of special tools required for normal operation and maintenance shall be provided.

3. EXECUTION:

3.01 INSTALLATION

A. Pumping equipment and appurtenances shall be installed in the position indicated and in accordance with the manufacturer's written instructions. All appurtenances required for a complete and operating pumping system shall be provided, including such items as piping, conduit, valves, wall sleeves, wall pipes, concrete foundations, anchors, grouting, pumps, drivers, power supply, and controls. Two (2) copies of the installation instructions shall be made available to the Owner prior to equipment installation.

B. Pumps and motors shall be thoroughly cleaned, primed, and given two finish coats of paint at the factory in accordance with the recommendations of the manufacturer. Field painting required for ferrous surfaces not finished at the factory is specified in Section 09900, " Painting".

3.02 PUMP TESTING

The pumps shall be hydrostatically tested at the manufacturer's plant prior to shipment. The test pressure shall be within the limits set forth by the Hydraulic Institute. Certified copies of the test results shall be submitted to the design engineer upon request.

Each completed and assembled motor shall receive a routine factory test.

The pumps shall be performance tested and the manufacturer's plant prior to shipment. The performance shall be within the limits set forth by the Hydraulic Institute. Certified curves shall be submitted to the Owner.

As a minimum, each finished pump shall be performance tested for total dynamic head, capacity, efficiency and power requirements at six (6) operating points plus shut-off head

for the selected impeller diameter, of which, the design capacity operating point shall be included.

After installation, a Field Test shall be performed by the installer on each completed Submersible Pump System. The pump manufacturer's authorized representative shall be present for the field test. The test shall demonstrate to the satisfaction of the Owner that the equipment meets all specified performance criteria, is properly installed and anchored, and operates smoothly throughout the specified speed range without exceeding the full load amperage rating of the motor or excessive motor heating. Additionally, the Submersible Pumps shall operate within the acceptable field vibration limits as established by the Hydraulic Institute for this class of equipment at all speeds and loads within the operating range specified herein.

3.03 MANUFACTURER'S REPRESENTATIVE

The Contractor shall provide the services of a factory trained representative of the sewage pump manufacturer to assist in installation, startup and testing of the pumps. Services shall be in accordance with the requirements of Section 01650 System Start-up and Acceptance Testing.

End of Section

SECTION 15400

PLUMBING SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide new plumbing systems, complete and ready for operation. Plumbing systems including manufacturer's products shall be in accordance with the required and advisory provisions of the ICC IPC. Plumbing systems include piping less than 5 feet outside of building walls. Piping beyond 5 feet outside of building walls including connections to existing exterior distribution systems are per Sections 200 and 801.

1.02 REFERENCES

Drawings and General Provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections apply to this Section.

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.

A. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
   1. ANSI A 117.1, (1998) Accessible and Usable Buildings and Facilities
   2. ANSI B 16.18, (1994) Cast Copper Alloy Solder Joint Pressure Fittings
   3. ANSI B 16.22, (1998) Wrought Copper And Copper Alloy Solder-Joint Pressure Fittings
   4. ANSI B 16.26, (1988) Cast Copper Alloy Fittings For Flared Copper Tubes

B. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (INTERNATIONAL)
   1. ASME/ANSI B 16.22, (1998) Wrought Copper And Copper Alloy Solder-Joint Pressure Fittings
   2. ASME/ANSI B 16.26, (1988) Cast Copper Allow Fittings For Flared Copper Tubes
   3. ASME 112.21.1M, (1998) Floor Drains

C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
   1. ASTM A 53, (1997) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
   2. ASTM B 32, (1996) Solder Metal
   3. ASTM B 42, (1996) Seamless Copper Pipe, Standard Sizes
   4. ASTM B 88, (1996) Seamless Copper Water Tube

5. ASTM D 1784, (1999ae1) Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
6. ASTM D 2241, (2000) Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
7. ASTM D 2467, (2001) Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
8. ASTM D 2564, (1996a) Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
9. ASTM D 2665, (1997A) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
10. ASTM F 441/F 441M, (1997) Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

D. AMERICAN WATER WORKS ASSOCIATION (AWWA)
1. AWWA C 651, (1992) Disinfecting Water Mains

E. MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
1. MSS-SP 58, (1993) Pipe Hangers and Supports - Materials, Design and Manufacture
2. MSS-SP 69, (1996) Pipe Hangers and Supports - Selection and Application
3. MSS-SP 80, (1997) Bronze Gate, Globe, Angle and Check Valves

F. UNDERWRITERS LABORATORIES (UL)
1. UL 94, (2001) Tests For Flammability Of Plastic Materials For Parts In Devices And Appliances

1.03 RELATED DOCUMENTS

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

1.04 SUBMITTALS

Submit the following manufacturer's catalog data in accordance with Section 105 - Control of Work.

A. Manufacturer's Catalog Data:
1. Fixtures (hose bib, sink, faucet)
2. Water service pipe and fittings
3. Water service valves
4. Water service pipe hangers, clamps, and supports
5. Reduced Pressure Zone Backflow Preventer

6. Water Heater

B. Operation and Maintenance Manuals

1. Water heaters

C. Posted Operating Instruction

1. Water heaters

1.05 QUALITY ASSURANCE

Plumbing systems including fixtures, equipment, materials, installation, and workmanship shall be in accordance with the International Plumbing Code except as modified herein. In the International Plumbing Code referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for the word "should" wherever it appears.

PART 2 – PRODUCTS

2.01 FIXTURES, FITTINGS, ACCESSORIES, AND SUPPLIES

Provide control-stop valves in each supply to each fixture. The finish of fittings, accessories, and supplies exposed to view shall be chromium-plated. Zincalloy or plastic handles will not be permitted for faucets and valves. Model numbers provided are to indicate desired quality and style, others will be considered if approved equal.

A. Hot Water Heater: Whirlpool Model E1F6USO17V (6 gal.).

B. Expansion Tank: Amtrol Model ST-5 (2 gal.).

C. Hose Bib: Woodford Model No. 24, anti-siphon vacuum breaker protected wall faucet.

D. Lavatory: Per drawings.

2.02 DOMESTIC WATER HEATER (ELECTRIC STORAGE TANK TYPE)

A. UL 174, electric water heaters, glass-lined steel tanks, high efficiency type insulated with polyurethane foam insulation, replaceable anodes, conforming to ASHRAE 90A requirements, with adjustable range thermostat to allow hot water settings between 110 and 160 degrees F of size and capacity as shown on the drawings. Provide posted operating instructions for water heaters.

B. Furnish and install a drain pan under water heater. Drain pan shall be not les than 1-1/2" deep and shall be of sufficient size and shape to receive all dripping or condensate from the tank or water heater. The pan shall be drained by an indirect

waste pipe having a minimum diameter of 1 inch or the outlet diameter of the required relief valve whichever is larger. The pan drain shall be connected to the lavatory drain piping.

2.03 DRAIN, WASTE, AND VENT (DWV) PIPE AND FITTINGS

Fittings shall be long radius fittings, except fittings in vent piping may be short radius fittings. Minimum size piping shall be 2 inches for buried piping and 1.5 inches for aboveground piping, except where indicated otherwise on the drawings.

A. Buried Piping, Plastic Pipe, Fittings, and Solvent Cement

Provide piping up to but not more than 6 inches aboveground or floor slab on grade.

1. Polyvinyl Chloride (PVC) System: ASTM D 2665

B. Aboveground Piping – Plastic Pipe, Fittings, and Solvent Cement

1. Polyvinyl Chloride (PVC) System: ASTM D 2665

2.04 DOMESTIC WATER PIPING

A. Buried Piping and Aboveground Interior Piping
Copper Tubing: ASTM B 88, Type L or M for aboveground piping, Type K for buried piping, with ANSI B16.18 or ASME/ANSI B16.22 solder joint fittings; or with ASME/ANSI B16.26 flared joint fittings. Provide ASTM B 42 copper pipe nipples with threaded end connections. Provide ASTM B 32, 95-5 tin-antimony solder, or provide Plumbing Code approved lead-free solder. Provide copper tubing for pipe sizes 4 inches or smaller.

B. Water Valves: Provide valves suitable for minimum of 125 psig and minimum of 180 degrees F hot water. Valves shall have threaded end connections with a union on all but one side of the valve, or solder end connections for connections between bronze valves and copper tubing. Ball valves may be provided in lieu of gate valves. Provide blue finish and red finish on handwheels for valves in cold domestic water piping and hot domestic water piping, respectively.

1. Gate Valves: MSS SP-80, Class 125.

2. Hose Bibbs: Provide angle type copper alloy hose bibb with lockshield and removable handwheel or tee-handle. Inlet shall have internal threads. Outlet shall have 0.75 inch external hose threads. Hose bib shall be equipped with internal vacuum breaker – backflow preventer components. Furnish proof that each make, model/design, and size of vacuum breaker -

backflow preventer valve being furnished for the project is approved by and has a current "Certificate of Approval" from the local code. Listing of the particular make, model/design, and size in the current local code will be acceptable as the required proof.

D. Dielectric Connections: Provide at connections between copper and ferrous metal piping materials. ASTM F 441/F 441M, Schedule 80, CPVC threaded pipe nipples, 4 inch minimum length, may be provided for dielectric connections in pipe sizes 2 inches and smaller.

2.05 MISCELLANEOUS PIPING MATERIALS

A. Escutcheon Plates: Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide chromium-plated or polished stainless steel finish on copper alloy plates in finished spaces. Provide paint finish on metal in unfinished spaces.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation of plumbing systems including fixtures, equipment, materials, and workmanship shall be in accordance with the International Plumbing Code, except as modified herein. Plastic piping shall not penetrate firewalls or fire floors and shall be used on one side of firewalls and fire floors not closer than 6 inches to the penetration.

B. Threaded Connections: Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread paste, pipe cement and oil, or PTFE powder and oil; apply only on male threads. Provide exposed ferrous pipe threads with one coat of primer applied to a minimum dry film thickness of 1.0 mil. Do not thread metal pipe into plastic piping.

C. Solder End Valves: Remove stems and washers and other items subject to damage by heat during installation. Reassemble valve after soldering is completed. Valves without heat sensitive parts do not require disassembly but shall be opened at least two turns during soldering.

D. Pipe Supports (Hangers):

1. Maximum Spacing Between Supports:

a. Vertical Piping: Support metal piping at each floor, but at not more than 10 foot intervals, with pipe riser clamps or offset pipe

clamps. Support plastic piping at each floor and at no more than five-foot intervals.

b. Horizontal Piping: Support ferrous piping at 5-foot intervals and at changes in direction. Support plastic piping at 4-foot intervals and support plastic piping at each change of direction. Support steel piping and copper tubing as follows:

MAXIMUM SPACING (FEET)

Nominal Pipe Size (Inches)	**One and Under**	**1.25**	**1.5**	**2**
Copper Tube	6	7	8	8

E. Installation of Pipe Sleeves: Provide pipe sleeves where piping passes through walls or floors. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls or floors. Provide not less than 0.25-inch space between exterior of piping or pipe insulation and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal at both ends of the sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. Seal both ends of penetrations through fire walls and fire floors to maintain fire resistive integrity with UL listed fill, void, or cavity material. Extend sleeves in floor slabs 3 inches above the finished floor, except sleeves are not required where DWV piping passes through concrete floor slabs located on grade.

3.02 FIELD QUALITY CONTROL

A. Inspections: Prior to initial operation, inspect piping system for compliance with drawings, specifications, and manufacturer's submittals.

B. Field Testing: Before final acceptance of the work, test each system as in service to demonstrate compliance with the contract requirements. Perform the following tests in addition to the tests specified in the Plumbing Code, except as modified herein. Correct defects in the work provided by the Contractor, and repeat tests until work is in compliance with contract requirements. Furnish water, electricity, instruments, connecting devices, and personnel for performing tests.

1. Domestic Water Piping: Before applying insulation, hydrostatically test each piping system at not less than 100 psig with no leakage or reduction in gage pressure for 2 hours.

2. Backflow Preventer Test Report: Backflow preventer shall be tested by a locally approved and certified backflow assembly tester. A copy of the test report shall be provided to the Owner's Representative prior to placing the domestic water system into operation, or no later than 5 days after the test.

3.03 DISINFECTION

Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million (ppm) of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 to 0.5 ppm, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplied by nonpotable water is not required. Disposal of chlorinated water shall be in a legal manner and not discharged into waters of the Commonwealth or United States.

END OF SECTION

SECTION 16010

ELECTRICAL BASIC REQUIREMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. Scope: Extent of electrical work covered by this Section is specified in all other sections of Division 16, the drawings, schedules and by requirements of this Section.

B. Refer to the Contract, and Division 16 sections for additional electrical requirements including:

1. Summary of the work.
2. Project Coordination.
3. Definitions and Standards.
4. Submittals.
5. Schedules and Reports.
6. Temporary Facilities.
7. Products.
8. Testing and Final Acceptance.
9. Project Closeout.

C. The word provide, as used hereinafter, shall be defined to mean the furnishing of all labor, materials, equipment and services necessary for the work described.

1.02 QUALITY ASSURANCE

A. Labels and Listings: Materials, appliances and equipment provided shall meet the requirements of the Underwriters Laboratories, Inc. (UL), Electrical Testing Laboratories (ETL) and other standards organizations.

B. National Fire Protection Association (NFPA): All work provided under this Contract shall meet the requirements of NFPA 70, "National Electrical Code", latest edition.

C. Current Models:

1. Manufactured items furnished shall be the current, cataloged product of the manufacturer. No more than 12 months old.
2. Replacement parts shall be available.

D. There shall be a permanent service organization maintained or trained by the manufacturer to provide satisfactory service.

E. Experience: Manufactured items shall have been installed and used without modifications, renovation or repair, on other projects for not less than three (3) years prior to the date of bid opening for this project.

1.03 SHOP DRAWINGS AND ENGINEERING DATA

A. Complete shop drawings and engineering data on equipment and materials to be used in the work of this Section shall be submitted for the Owner's approval in accordance with the General Provisions.

B. The submittals shall be properly identified and referenced as to the applicable specification paragraph heading or drawing number which applies, and shall establish that each item meets the requirements of the specifications with regard to dimension, arrangement and other pertinent characteristics. Individual items within each submittal shall be marked accordingly.

C. Submittal data shall be in the form of shop drawings for major and specially constructed equipment and catalog or other engineering data on items normally considered as stock items.

D. Submittals shall include complete wiring diagrams, performance curves, installation instructions and all other applicable information necessary to the proper installation of the equipment.

E. The shop drawings and submittal data will be reviewed only for conformance with the project design concept and compliance with information in the Contract Documents. The checking of dimensions and quantity of materials shall remain the responsibility of the Contractor.

F. The Contractor shall notify the Owner of any deviations from the requirements of the contract or intent of the contract documents in accordance with the General Provisions.

G. If variations and/or deviations are not marked on submittal, the Contractor will not be relieved of responsibility for furnishing equipment and executing work in strict accordance with Contract Documents, even though shop drawings have been approved.

H. In checking shop drawings, the Owner will make every effort to detect and correct errors, omissions and inaccuracies; the reviewer's failure to detect errors, omissions and inaccuracies shall not relieve the Contractor of responsibility for proper and complete installation in accordance with intent Contract Documents.

I. As a minimum the following shall be submitted for approval:

1. Panelboards and Circuit Breakers,
2. Light Fixtures, Lenses, and Mounting Equipment,
3. Wiring Devices and Plates,
4. Pump Control Panel
5. Control and Monitoring Equipment
6. Standby Generator
7. Automatic Transfer Switches
8. RTU
9. Name Plates
10. Others as required by the respective specification section

1.04 STORAGE AND HANDLING

A. Storage: Materials stored at the project site which become soiled with construction dirt, concrete, paint, etc. shall be washed, cleaned and dried or removed from the project site and replaced with new. Do not install soiled material.

B. Cleaning: Clean and wipe the interior of conduit, pullboxes and panelboard backboxes, soiled by masonry trades, before proceeding with wiring.

C. Do not install damaged, broken or marred material or products, replace with new, unless otherwise approved by the Owner in writing.

1.05 LABELS AND NAMEPLATES

A. Manufacturer's Nameplates: Nameplates on manufactured items shall be aluminum or type 304 stainless steel sheet, not less than 20 USG, secured to the manufactured item, with nameplate data engraved or punched to form a non-erasable record of equipment data.

B. Field Installation: Field-installed nameplates shall be as per Section 16195, "Electrical Identification".

1.06 TEMPORARY FACILITIES

A. The Contractor is responsible for all temporary facilities as required during construction as set forth in Section 107 of the General Provisions.

1.07 SIZING

A. Capacity: Provide equipment and material of sizes, capacities, horsepowers, power ratings and dimensions indicated on the drawings, in the schedules and as specified.

B. Fit and Clearance: Equipment and material of greater or larger power dimensions, capacity and ratings may be furnished provided such proposed equipment is approved in writing and feeders, circuit breakers, conduit, motors, bases and equipment spaces are increased by the Contractor at no additional cost, to the contract cost.

1.08 COORDINATION

A. Coordinate electrical work with that of other trades so that:

1. Interference between general construction, mechanical, electrical, structural and other specialty trades is avoided.

2. Maintain clearances and advise other trades of clearance requirements for operation, repair, removal and testing of electrical equipment.

3. All electrical materials and equipment shall be kept as close as possible to ceiling, walls, and columns to occupy the minimum amount of space.

4. Furnish and install all offsets, fittings and similar items necessary to accomplish the requirements of coordination, without additional expense.

5. Coordinate electrical requirements for equipment provided by Mechanical Contractors to assure proper compatibility with equipment provided.

B. Other divisions of these specifications and drawings shall be carefully examined to determine the requirements of the project as a whole and to determine interconnecting points between the various trades. All such interconnections shall be properly made and with due regard for correct arrangements suited to the equipment or material concerned.

C. Provide power wiring and final power connections to equipment installed by other trades which requires electrical power. Other trades will supply power characteristics and roughing-in data to ensure the proper power wiring of their equipment.

D. Provide disconnect switches for equipment of other trades when required, and specifically for motors which are out of sight of their controllers, unless switches are provided integrally mounted on the equipment.

E. All control wiring for other trades will be performed under another division of these specifications unless otherwise noted. Control wiring shall be considered as that wiring, low or high voltage, which is required for devices such as pushbuttons, thermostats, valves and control switches for starters, interlocking of starters and any other wiring required by similar control devices and is not included in this division, except as noted.

1.09 CODES, PERMITS AND FEES

All work performed and all material installed under this Division shall conform to the latest editions of the VUSBC including the latest effective edition of NFPA No. 70 (NEC) and other applicable standards of the NFPA and all laws, ordinances and all governing authorities. The Contractor shall procure and pay for all licenses, permits, fees, etc., necessary to install and complete the work.

1.10 MANUFACTURER'S RECOMMENDATIONS

Where installation procedures or any part thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.

PART 2 – PRODUCTS

2.01 MATERIALS AND WORKMANSHIP

A. It is the intent of these specifications to establish quality standards for all material and equipment incorporated in the work of this division. All materials and equipment installed hereunder shall be new and shall be the best of each respective kind and type. Proper care shall be exercised in handling all materials and equipment herein specified so as not to injure or mar finished surfaces and to insure that the work is acceptable in every respect upon completion.

B. The installation shall be as indicated on the drawings and in accordance with the manufacturer's recommendations as approved by the Owner. The installation shall be accomplished by workmen skilled in their respective trades.

C. No products shall contain asbestos or other hazardous substances.

D. As far as practicable, use a common manufacturer for similar products. These products are to be selected to maximize component interchange ability.

E. Provide all necessary accessories and appurtenances required for a complete installation even if not called out specifically on the drawings or indicated herein.

PART 3 – EXECUTION

3.01 INTENT OF DRAWINGS

A. The drawings are diagrammatic, intending to show general runs and locations of equipment and specialties, and not necessarily showing all required offsets, etc. Carefully study the various runs of conduit and make such adjustments in exact routing as may be necessary to fit conduits into space available and to avoid conflict with other trades.

B. Arrange equipment substantially as shown on the Drawings. Make deviations only where necessary to avoid interference. Check equipment size against available space prior to shipment to avoid interference.

3.02 PAINTING AND FINISHING

Damage and Touch-Up: Repair all marred or damaged factory painted finishes with materials and procedures to match original factory finish and as specified in Section 09900.

3.03 WIRING FOR SPECIAL EQUIPMENT

Provide all wiring, outlets and connections for connecting all equipment. All outlets and connections shall be verified and coordinated with equipment manufacturer's roughing-in drawings before installation and all adjustments shall be made to satisfy the manufacturer's requirements. All equipment shall be connected and ready for use.

3.04 MOTOR, EQUIPMENT AND APPARATUS CONNECTIONS

A. Provide all necessary electric power connections and disconnect switches as required for all equipment requiring such connections. This Contractor shall coordinate his work with roughing-in drawings provided by manufacturer or Party furnishing equipment.

B. All motors shall conform to the latest applicable NEMA standards for type, size and duty, as specifically applied. All motors shall be suitable for operation on 60 cycles a.c. and with voltage and other characteristics as specified in other Divisions of these Specifications.

C. Motor controller furnished shall conform to the latest applicable NEMA standards for type, size and duty as specifically applied. Magnetic controllers shall provide thermal overload protection in each line not to exceed 125 percent of the motor full load current rating and shall be provided with a manual reset type pushbutton on outside of housing. Magnetic starters shall be equipped with 115 volt holding coils, control transformers having 115 volt fused secondaries and necessary number of auxiliary contacts.

D. Magnetic controllers shall provide under voltage protection when used with momentary contact control devices and under voltage release when used with maintained-contact control devices. Manual type controllers shall provide thermal overload protection not to exceed values listed above, plus the actual current drawn by auxiliary controls and shall be approved for group fusing when more than one motor is served by the same branch circuit.

E. Install control and alarm wiring for all equipment, mechanical and electrical, in accordance with Section 16 Specifications. Before installing control circuits, ensure that controls and wiring diagrams are in accordance with those furnished with the equipment. Make any changes required due to different equipment, more up-to-date controls or safety devices, so that the equipment operates as required. Control voltage shall not exceed 120 volts unless indicated otherwise on the Drawings.

F. When equipment is supplied with electrical requirements other than those specified or shown on the Drawings, associated electrical devices and circuitry of the correct sizes and ratings shall be provided.

3.05 CUTTING AND PATCHING

A. Cutting: Provide cutting, channeling, chasing and drilling of floors, walls, partitions, ceilings and other surfaces necessary for installation of electrical work. All cutting shall be performed by skilled mechanics of the trades involved.

B. Patching: Repair cut surfaces to match adjacent surfaces.

3.06 CLOSING OF OPENINGS

A. Firestopping: Unused slots, sleeves and other penetrations in floors, walls or other general construction shall be closed and sealed with an approved firestopping material per UL 1479.

B. Conduit: The annulus between exposed conduit and walls or floors in finished spaces shall be filled, sealed, and painted to match adjacent surfaces.

C. Future Slots: Identify unused sleeves and slots for future use by permanently anchored brass nameplates identifying size and purpose of the covered slot.

3.07 SYSTEM TEST

A. Prior to final site visitation, field testing and acceptance testing, the Contractor shall conduct an operating test of the complete electrical system. System shall test free from grounds, shorts and other faults. All connections as possible shall be

thoroughly checked for positive mechanical and electrical connection and continuity. All equipment shall be demonstrated to operate in accordance with the requirements set forth in these specifications and shown on the drawings.

B. Perform all tests in the presence of the Owner or his duly authorized representative. The Contractor shall furnish all personnel and test instruments for use in the test.

3.08 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall provide the Owner with operation and maintenance manuals in accordance with Section 01781. In addition to the requirements of Section 01781, the binder shall be labeled and indexed as follows:

B. The material included in the operation and maintenance manual tabs shall have included:

1. Approved shop drawings with model numbers including:
   a. Light fixtures
   b. Receptacles
   c. Switches
   d. Panelboards
   e. Wire and cables
   f. Conduit, raceways, and pathways

2. The following shall be included if applicable to this project:
   a. All Test Reports
   b. All warranty information

C. Separate operation and maintenance manuals including shop drawings and diagrams to be included shall be as follows:

1. Pump Control Panel
2. Generators, automatic transfer switches and associated equipment

3.09 RECORD DRAWINGS (AS-BUILTS)

A. The Contractor shall maintain and deliver Record Drawings in accordance with the requirements of the General Provisions.

B. The Contractor shall maintain at the job site one set of blue line or black line prints of the drawings approved by the Owner. The Contractor shall record thereon all changes in the location, sizing, and arrangement that may be made for any reason in the work during the course of construction including Addenda and Change Orders work so as to reflect the installation "as-built". Upon completion

of the project, "as-built" drawings shall be prepared and submitted to the Owner in accordance with the requirements of the General Provisions.

3.10 FINAL SITE VISITATION

When the work on the entire project has been completed and is ready for final review, a visit will be made by the Owner or his duly authorized representative, at which time the Contractor shall demonstrate that the requirements of the Contract have been carried out and that the system has been adjusted and operates in accordance therewith.

3.11 GUARANTEE

Contractor shall warrant and guarantee all work in accordance with the General Provisions and as may be further specified herein.

End of Section

SECTION 16020

UTILITY SERVICE AND SERVICE ENTRANCE

PART 1 – GENERAL

1.01 SCOPE

Work required under this heading covers the equipment necessary to provide power for all loads for a complete working installation.

1.02 ELECTRICAL SERVICE

A. Electrical service shall be as shown on the drawings and as specified herein.

B. All service work shall be coordinated with the local Power Company and National Electrical Code.

C. Electrical service will be 208Y/120V, three phase, 4-wire.

D. Verify complete electrical service installation with Power Company before start up.

E. If required, the Contractor shall coordinate with Dominion Virginia Power regarding the location of the pad mounted transformer and prefabricated bases. The Contractor shall provide finish grade for power company work.

F. Make application with electrical utility company for electric service in a manner to permit utility company to provide service prior to completion of work under this contract.

G. Complete and file all forms required by the electric utility company in connection with application for electric service. Pay for all required licenses, permits, fees, etc. necessary to obtain electric service. Power Company charges required to perform work to provide service to the facility will be paid directly by the Owner and will not be part of this contract.

H. Provide underground raceways and conductors from utility company transformer to main service equipment.

I. Install sealable meter compartment furnished by Dominion Virginia Power.

J. Furnish and install interconnecting raceway between metering transformers and revenue meter. Install all equipment in conformity with utility company's requirements.

PART 2 – PRODUCTS

Not applicable.

PART 3 – EXECUTION

Not applicable.

End of Section

SECTION 16035

ELECTRICAL TESTING AND PLACING IN SERVICE

PART 1 – GENERAL

1.01 WORK INCLUDED

A. The Contractor shall perform electrical testing in the presence of the Owner prior to Operational Testing and Substantial Completion Testing.

B. Provide all material, equipment, labor and technical supervision to perform and complete the electrical acceptance test in accordance with the requirements of this Section for equipment furnished by the Contractor. Notify Owner at least seven days in advance of tests.

C. Perform tests on the following equipment:

1. Grounding.
2. Power cables, 600 volts and lower.
3. Rotating equipment.
4. Panelboards
5. As required by other specification sections

D. Perform electrical testing as required by other Divisions 16 specifications for specific equipment including:

1. Section 15100 – Submersible Pumping Equipment
2. Section 16120 – Wire and Cables
3. Section 16135 – Wiring Devices
4. Section 16231 – Packaged Engine Generator System
5. Section 16425 – Pump Control System
6. Section 16450 – Secondary Grounding
7. Section 16470 – Panelboards
8. Section 16900 – Remote Terminal Unit

1.02 QUALITY ASSURANCE

A. Final acceptance will depend upon successful completion of specified testing.

B. Perform all tests in accordance with manufacturer's recommendations. Should manufacturer's recommendations conflict with these specifications, notify Owner. Do not proceed with tests until directed by the Owner.

C. Material or equipment failing tests shall be repaired or replaced at the Contractor's expense.

D. The Contractor shall be responsible for all test and test records. Testing shall be performed by or under the immediate supervision of the Contractor, and in the presence of the Owner or owner's representative.

E. Inspect the equipment prior to energizing.

F. The Contractor shall coordinate with certified manufacturer's representatives for those items specified as requiring representation during start up and testing.

1.03 SUBMITTALS

Submit the following:

A. Electrical Testing Reports

Results of testing shall be fully documented including dates of testing, equipment utilized, person performing tests, tests made, comparative acceptable test results and reference standards, actual test results, corrections made and results of retesting for each piece of equipment or component tested. Submit test results neatly bound and organized in three ring binders with divider pages separating each set of tests, a complete table of contents, and listing of testing equipment including calibration certifications.

B. Certificates

The contractor shall provide a written certification that the electrical testing was completed successfully, all deficiencies corrected, and initially deficient equipment and or components were retested successfully.

C. The Contractor shall provide the Owner with one copy of the building regulation certificate of inspections, including any failing inspections.

PART 2 – PRODUCTS

2.01 TESTING DEVICES

The Contractor shall employ all testing devices and personnel trained in their use, required for testing as specified herein.

PART 3 – EXECUTION

3.01 TESTING AND MEASUREMENTS

A. Measure and record secondary voltages at all panelboards

B. Each power and convenience outlet shall be subjected to tests for polarity, open wiring and continuous ground.

3.02 GROUND SYSTEM TESTING

Upon completion of installation of the electrical grounding and bonding systems, test the existing ground resistance with a ground resistance tester. Where tests show resistance-to-ground is over 10 ohms, take appropriate action to reduce the resistance to 10 ohms, or less, by driving additional ground rods. Then retest to demonstrate compliance.

3.03 CABLE CONTINUITY AND PHASE IDENTIFICATION

Check cable continuity and phase identification.

3.04 FEEDER INSULATION RESISTANCE TESTING

A. All current carrying phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. This shall be done with a 500 volt megger. The procedures listed below shall be followed:

B. Minimum readings shall be one million (1,000,000) or more ohms for #6 wire and smaller, 250,000 ohms or more for #4 wire or larger, between conductors and between conductor and the grounding conductor.

C. After all fixtures, devices and equipment are installed and all connections are installed and all connections completed to each panel, the contractor shall disconnect the neutral feeder conductor from the neutral bar and take a megger reading between the neutral bar and the grounded enclosure. If this reading is less than 250,000 ohms, the Contractor shall disconnect the branch circuit neutral wires from this neutral bar. The Contractor shall then test each one separately to the panel and until the low readings are found. The Contractor shall correct troubles, reconnect and retest until at least 250,000 ohms from the neutral bar the grounded panel can be achieved with only the neutral feeder disconnected.

D. The Contractor shall send a letter to the Owner certifying that the above has been done and tabulating the megger readings for each panel. This shall be submitted at least four (4) days prior to final inspection.

E. At final inspection, the Contractor shall furnish a megger and show the Owner that the panels comply with the above requirements. He shall also furnish a hook-on type ammeter and voltage readings as directed by the representatives.

3.05 DOCUMENTATION

A. All tests specified shall be completely documented indicating time of day, date, temperature and all pertinent test information.

B. All required documentation of readings indicated above shall be submitted to the Owner prior to, and as one of the pre-requisites for, Operational Testing and Substantial Completion Testing.

End of Section

SECTION 16110

RACEWAYS

PART 1 – GENERAL

1.01 SUMMARY

A. Scope: Extent of raceway work is indicated on the drawings, by the requirements of this Section, and Section 16010, "Electrical Basic Requirements".

B. Types: Types of raceways in this Section include the following:

1. Flexible steel conduit.
2. Rigid Galvanized Steel Conduit
3. Liquid-tight flexible metal conduit.
4. Rigid metal conduit.
5. Wireway.
6. Plastic / PVC

1.02 QUALITY ASSURANCE

A. National Fire Protection Association (NFPA): Comply with NFPA 70, "National Electrical Code", for application, size, location and installation of each type of raceway used.

B. Provide products specified in conformance with the indicated standards.

1.03 SUBMITTALS

Product Data: Submit manufacturer's data for each type of raceway.

HAZARDOUS LOCATIONS

Raceway in designated hazardous or explosion proof locations shall conform to NFPA 70 requirements for installation.

PART 2 – PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Each length of conduit shall bear the manufacturer's stamp and UL label.

2.02 METAL CONDUIT AND TUBING

A. Rigid steel conduit zinc coated shall conform to American National Standards Institute (ANSI) C80.2, "Rigid and Steel Conduit".

B. Flexible metal electrical conduit shall conform to UL 1, "Flexible Metal Conduit".

2.03 NONMETALLIC CONDUITS AND RACEWAYS

A. Electrical plastic conduit, PVC Type, shall conform to NEMA TC 2, "Conduit (EPC-40 and EPC-80)".

2.04 WIREWAYS

A. Provide in conformance with ANSI 870, "Wireways, Auxiliary Gutters, and Associated Fittings".

2.05 METAL AND PLASTIC CONDUIT AND RACEWAY FITTINGS

A. Fittings for conduit and outlet boxes shall conform to UL 514B, "Fittings for Conduit and Outlet Boxes".

B. PVC fittings for use with rigid PVC conduit and tubing shall conform to NEMA TC 3, "PVC Fittings for Use with Rigid PVC Conduit and Tubing".

PART 3 – EXECUTION

3.01 MINIMUM SIZE

Size conduit and raceway in accordance with NFPA 70 unless otherwise specified or shown on the drawings. Minimum size 1/2-inch for interior work and 1-inch for exterior work.

3.02 EQUIPMENT GROUND CONDUCTOR

Raceways sizes shall be adequate to include the circuit conductors, an equipment ground conductor and a neutral conductor in accordance with percentage of fill requirements by NFPA 70. Size all conduits supplying motors and associated control equipment to include grounding conductor sized per NFPA 70 whether or not shown on the drawings or specified.

3.03 CONDUIT

A. All conduit between VFD's and motors shall be rigid galvanized steel.

B. Rigid galvanized steel conduit buried in concrete shall be field coated with asphalt before installation.

C. Rigid galvanized steel conduit shall be plastic coated for slab transitions.

D. Exposed conduit shall be rigid galvanized steel.

E. Conduit encased within concrete may be Sch 80 PVC or rigid galvanized steel, unless required otherwise.

F. All conduit buried in earth shall be Sch 80 PVC.

3.04 FLEXIBLE METAL ELECTRICAL CONDUIT

A. Use in dry location.

B. Do not use in corrosive atmosphere or exterior locations.

C. Provide flexible conduits for connections to recessed ceiling fixtures, motors and other electrical equipment when it is subject to movement, vibration, misalignment, cramped quarters or where noise transmission is to be eliminated or reduced.

3.05 LIQUID-TIGHT FLEXIBLE STEEL CONDUIT

A. Use for exterior locations.

B. Sizes 1-1/4-inch and smaller, provide with continuous copper bonding conductor wound spirally between convolutions.

C. Sizes 1-1/2-inch and larger, provide with an internal grounding conductor and grounding bushings.

3.06 WIREWAYS, AUXILIARY GUTTERS

A. May be used to facilitate installation and future changes in wiring between panelboards, safety switches in close proximity to each other on same or adjacent walls or in same electrical equipment room or area, or as indicated.

B. Provide weatherproof enclosure where outdoors or subject to moisture and similar elements.

C. Use where shown on drawings or specified.

D. Shall be completely accessible.

3.07 RACEWAY FITTINGS, COUPLINGS AND CONNECTORS

A. Use fittings listed and approved for specific conduit or raceway system used.

B. For threaded rigid steel conduit do not use threadless or compression type fittings.

C. Bushing and connector shall be insulated type which maintains continuity of conduit grounding system. Insulating material shall be molded or locked into metallic body of the fitting. Bushing made entirely of nonmetallic material will not be allowed. Where concentric, eccentric or over- sized knockouts are encountered, a grounding-type insulated bushing shall be provided.

D. Provide flexible metal conduit fittings made of steel or malleable iron. They shall be insulated and one of the following types:

1. Wedge and screw type having an angular wedge fitting between the convolutions of the conduit.
2. Steel, multiple point type, for threading into internal wall of the conduit convolutions.
3. Liquid-tight flexible metal conduit shall incorporate a threaded grounding cone, a steel, nylon or equal plastic compression ring and a gland for tightening. Fitting shall be steel, or malleable iron with insulated throat, with male thread and locknut or male bushing with or without "O" ring seal.

E. Provide expansion fittings for all rigidly fastened conduits spanning a building expansion joint and if not otherwise provided, for all runs 1-1/2-inch or larger, exceeding 150 feet in length. Fittings shall be hot-dipped galvanized malleable iron with a packing ring to prevent entrance of water, a pressure ring, a grounding ring and a separate external copper bonding jumper.

F. Inferior material such as "pot metal" shall not be used for any type of fitting.

G. All locknuts shall be the bonding type with sharp edges for digging into the metal wall of an enclosure.

H. The use of "LB's" shall be limited where possible. Where necessary to use "LB's" sized above 2-inch, mogul units shall be installed.

3.08 GENERAL

A. Conduit runs shall be mechanically and electrically continuous from service entrance to all outlets. Each conduit shall enter and be securely connected to a cabinet, junction box, pull box or outlet by means of a locknut on the outside and

a bushing on the inside or by means of liquid-tight, threaded, self-locking, cold-weld type wedge adapter.

B. Conceal conduit unless indicated otherwise, within finished walls, ceilings, and floors. Raceways in dedicated mechanical or electrical rooms may be run exposed.

C. Level and square raceway runs.

D. Install horizontal raceway runs above water piping.

E. Complete installation of electrical raceways before starting installation of cables/wires within raceways.

F. Provide supports for raceways as specified elsewhere in Division 16.

G. Prevent foreign matter from entering raceways; use temporary closure protection.

H. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab, nor below the slab where the slab is a finished ceiling.

I. Make bends and offsets so the inside diameter is not effectively reduced.

J. Unless otherwise indicated keep the legs of a bend in the same plane and the straight legs of offsets parallel.

K. Install exposed raceways parallel and perpendicular to nearby surfaces or exposed structural members, and follow the surface contours.

L. Run exposed, parallel or banked raceways together.

M. Make bends in parallel or banked runs from the same center line so that the bends are parallel. Factory elbows may be used in banked runs where they can be installed parallel.

N. Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts so that the dished part is against the box. Use two locknuts, one inside and the other outside the box.

O. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder.

P. Where chase nipples are used, align the raceway and coupling square to the box and tighten the chase nipple so no threads are exposed. Running threads are not allowed.

Q. Install pull wires in all empty raceways. Use No. 14 AWG zinc-coated steel or plastic having not less than 200 pounds tensile strength. Leave not less than 12-inches of slack at each end of the pull wire.

R. Exposed horizontal runs, where permitted, shall be installed close to ceiling or ceiling beams. Conduits connected to wall outlets shall be run in such a manner that they will not cross water or waste pipes.

S. Conduits shall not be run through beams, except where clearly indicated on drawings or where permitted.

3.09 ADJUSTING AND CLEANING

A. Upon completion of installation of raceways, inspect interiors of raceways at all outlet, junction and pull boxes, remove burrs and obstructions.

B. Run a swab or mandrel to remove dirt and blockages. Raceways which are deformed and prevent the passage of a mandrel shall be replaced.

C. Remove dirt and construction debris from outlet, junction and pull boxes.

End of Section

SECTION 16120

WIRE AND CABLES

PART 1 – GENERAL

1.01 SUMMARY

A. Scope: Extent of electrical wire and cable work is indicated on the drawings and schedules, by the requirements of this Section, and Section 16010, "Electrical Basic Requirements" and Section 16035, "Testing and Placing in Service".

B. Types: Types of electrical wire, cable, and connectors specified in this Section include the following:

1. Copper conductors.
2. Tap type connectors.
3. Split-bolt connectors.
4. Wire nut connectors.

1.02 QUALITY ASSURANCE

A. American Society for Testing and Materials (ASTM): Comply with requirements of the following:

1. B 1 Standard Specification for Hard-Drawn Copper Wire
2. B 8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, MediumHard, or Soft

B. Electrical Testing Laboratories (ETL): Provide wiring, cabling and connector products which are ETL listed and labeled.

C. Institute of Electrical and Electronics Engineers (IEEE): Comply with the following standards which apply to wiring systems:

1. 82 Test Procedure for Impulse Voltage Tests on Insulated Conductors
2. 241 Recommended Practice for Electrical Power Systems in Commercial Buildings

D. NFPA: Comply with NFPA 70 requirements for construction, installation and color coding of electrical wire, cable and connections.

E. UL: Provide material conforming to the following standards:

1. 44 Rubber-Insulated Wires and Cables

2. 83 Thermoplastic-Insulated Wires and Cables
3. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
4. 854 Service-Entrance Cables

F. UL Labels: Provide wiring, cabling and connector products which are UL listed and labeled.

1.03 SUBMITTALS

Product Data: Submit manufacturer's data on electrical wire, cables, conductors, connectors and connector crimping tools.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver wire and cable packaged in factory-sealed containers, or wound on NEMA wire and cable reels.

B. Storage: Store wire and cable in a clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.

C. Handling: Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that resistance integrity of wires/cables is maintained.

1.05 HAZARDOUS LOCATIONS

Raceway in designated hazardous or explosion proof locations shall conform to NFPA 70 requirements for installation.

PART 2 - PRODUCTS

2.01 COPPER WIRE

A. Conductors:

1. Provide wire rated 600 V minimum of the single conductor annealed copper type.
2. Conductors #8 AWG and larger shall be Class B stranded.
3. Control wiring shall have stranded conductors.
4. The minimum conductor size for all power and lighting circuits shall be #12 AWG. The maximum conductor size allowed shall be #500 kcmil.
5. Control wiring shall be #14 AWG minimum.

B. Insulation:

1. The insulation type for interior wiring shall be dual-rated THHN/THWN or XHHW.

2.02 CABLE

Provide UL listed cables of sizes, ampacity, temperature ratings and insulating materials indicated on the drawings or in other sections of this specification.

2.03 CONNECTORS AND SPLICES

A. General: Provide UL listed metal connectors of sizes, ampacity, temperature ratings, materials, and classes required by NFPA 70 and NEMA standards for applications and services indicated.

B. Branch Circuits: For wires No. 10 AWG and smaller, provide solderless, insulated pressure cable type connectors, 600 V, of the compression or indent type or wire nut connectors. Temperature rating of connectors shall be at least equal to that of the wire on which they are used.

C. Copper Conductors: For No. 8 AWG and larger wire, provide socket head cap, hex screw, or bolt clamp type connectors, manufactured of high conductivity copper alloy or bronze castings. Select proper connector for each wire size. Cable sizes 250 kcmil and larger shall be retained in the connector by twin clamping elements.

2.04 INSULATING TAPE, PUTTY, RESIN AND SUPPORTS

A. Tape:

Provide plastic electrical insulating tape which is flame retardant, cold and weather resistant. Tape for use in areas subject to temperatures 30 degrees C. to 105 degrees C., or where the tape will be subjected to an oil splash, shall have a minimum thickness of 8.5 mils, and shall consist of an oil-resistant vinyl backing with an oil-resistant acrylic adhesive.

B. Materials:

1. Provide all insulating materials for splices and connections such as glass and synthetic tapes, putties, resins, splice cases, or compositions of the type approved for the particular use, location, voltage and temperature, and apply and install in an approved manner, all in accordance with the manufacturer's recommendations.
2. Supports: Provide cable supports of the wedge type which firmly clamp each individual cable and tighten due to the cable weight.

2.05 PROHIBITED PRODUCTS

The use of non-metallic sheathed cable Types NM to NMC, Metal Clad Cable (MC), armored bushed cable (BX) and armor-clad cable (AC) is prohibited.

PART 3 – EXECUTION

3.01 INSTALLATION OF WIRES AND CABLES

A. General: Install electrical wires, cables and wiring connectors in compliance with applicable requirements of NFPA 70, NEMA, UL and National Electrical Contractors Association (NECA) "Standard of Installation".

B. Conduit: Unless otherwise noted, install all wiring in rigid metal conduit, flexible metal conduit, and non-metallic conduit as indicated on the drawings or in the specifications, in conformance with NFPA 70.

C. Complete System: Provide wire, cables and connectors necessary for a complete installation from point of service connection to all receptacles, lighting fixtures, devices, utilization equipment and outlets for future extensions as indicated on the drawings, in schedules, and in the specification. Provide ample slack wire for connections.

D. Voltage Rating: Wire and cables for general wiring shall be rated for 600 volts minimum.

E. Minimum Size: Minimum branch circuit conductor size shall be No. 12 AWG. Where the length of a branch circuit homerun exceeds 50 feet for a 120 V circuit, or 125 feet for 277 V, the conductor size shall be No. 10 AWG.

F. Shelf Life: Wire and Cable manufactured more than 12 months prior to date of delivery to the site shall not be used.

G. Bundling: Neatly train all conductors located in branch circuit panelboards, signal cabinets, and signal control boards.

H. Feeder Identification: Securely fasten nonferrous identifying tags or pressure sensitive labels to all cables, feeders, and power circuits at termination of cables.

I. Tags or labels shall be stamped or printed to correspond with markings on drawings or marked so that feeder or cable may be readily identified.

J. If suspended type tags are provided, they shall be attached by approximately 55 pound test monofilament line or slip free plastic cable lacing units.

3.02 WIRE PULLING AND CABLE INSTALLATION

A. Raceways: Refer to Section 16110, "Raceways", for the preparation of raceways for wire and cables.

B. Equipment: Provide suitable installation equipment to prevent cutting and abrasion of conduits during the pulling of wires and cables.

C. Ropes used for pulling of conductors shall be made of polyethylene or other suitable nonmetallic material.

D. Metallic ropes shall not be used.

E. Pull conductors simultaneously where more than one is being installed in same raceway.

F. Use pulling compound or lubricant where necessary; compound shall not deteriorate conductor or insulation. Where polyethylene insulation is used and a pulling lubricant is required, the lubricant shall be certified by the manufacturer to be non-injurious to such insulation.

G. Lubricants shall conform to UL requirements applicable.

H. Pulling lines shall be attached to conductor cables by means of either woven basket grips or pulling eyes attached directly to the conductors. Rope hitches shall not be used.

I. Supports: Install cable supports for all vertical feeders in accordance with the applicable sections of the NFPA 70.

J. Splices: Keep conductor splices to a minimum. Splice wires and cables only in outlet boxes, junction boxes, pullboxes, manholes and handholes.

K. In the making of a splice, connectors shall be brought up securely upon the conductors such that all conductors are equally engaged, the insulation is not ruptured, no bare wires are exposed or have "backed off" due to the application of pressure and the connection will not loosen due to cycling or vibration, in order to insure an efficient splice.

L. The number, size and combinations of conductors permitted as listed on manufacturer's packaging of connector shall be strictly followed.

M. Connectors shall be fully insulated by a skirt, or taped to provide an insulation value at least equal to rating of wires being connected.

N. Connectors: Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values or comply with tightening torques specified in UL 486A and 486B.

O. Color Coding: Color code all secondary service, feeder and branch circuit conductors throughout the project secondary electrical system as follows:

208Y/120 Volts	Phase
Black	A
Red	B
Blue	C
White	Neutral
Green	Ground

P. The colors shall be factory-applied entire length of the conductors by one of the following methods except as noted and limited below:

1. Solid color compound.
2. Solid color coating.
3. Surface printing every 12 inches, maximum spacing of 18 inches.

Q. All branch circuit conductors Nos. 12 AWG and 10 AWG shall be solid color compound or solid color coating.

R. All sizes of conductors used for neutrals and equipment grounds shall be solid compound or solid color coating white, gray, or green, respectively.

S. All phase conductors No. 8 AWG and larger color coded with pressure sensitive tape shall have a background color other than white or green.

T. Color pressure-sensitive plastic tape shall be applied in half overlapping turns for a distance of six inches on all terminal points and in all boxes in which splices or taps are made. The last two laps of tape shall be applied with no tension to prevent possible unwinding.

U. Tape shall be 3/4-inch wide and colors shall be as specified.

V. Cable identification markings shall not be obliterated by taping and tape locations may be adjusted slightly to prevent obliteration of cable marking.

W. Power and control wiring shall be run in separate conduits. AC and DC control circuits shall be run in separate conduits.

3.03 FIELD QUALITY CONTROL

A. Tests: Feeders and branch circuit insulation shall be tested after installation, and before connection to fixtures and appliances.

1. Tests shall be performed with a 500-volt megger, and conductors shall test free from short-circuits and grounds.
2. Conductors shall be tested phase-to-phase and phase-to ground.
3. Furnish the instruments, materials, and labor required. Perform the tests in the presence of the Owner.
4. Test readings shall be recorded and delivered to the Owner.

B. Demonstration: Subsequent to wire and cable hookups, energize circuit and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

End of Section

SECTION 16130

ELECTRICAL BOXES AND FITTINGS

PART 1 – GENERAL

1.01 SUMMARY

A. Scope: This section covers electrical box and electrical fitting work for power, lighting, signal, communication, protection and auxiliary systems.

B. Types: Types of electrical boxes and fittings in this Section include the following:

1. Outlet boxes.
2. Junction boxes.
3. Pull boxes.
4. Splice Boxes.
5. Conduit bodies.
6. Bushings.
7. Locknuts.
8. Knockout closures.

1.02 QUALITY ASSURANCE

A. National Electrical Manufactures Association (NEMA): Conform to NEMA OS 1 "Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports", for sheet-steel outlet boxes, device boxes, covers and box supports. Conform to NEMA FB 1, "Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies"; for fittings, cast metal boxes and conduit bodies.

B. National Fire Protection Association (NFPA): Comply with NFPA 70, "National Electrical Code", for construction and installation of electrical wiring boxes and fittings.

C. Underwriters Laboratories, Inc. (UL): Provide electrical boxes and fittings which are UL-listed and labeled, and conform to UL 50, "Cabinets and Boxes", UL 514A, "Metallic Outlet Boxes", UL 514B, "Fittings for Conduit and Outlet Boxes", and UL 514C, "Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers".

1.03 SUBMITTALS

Product Data: Submit manufacturer's data on electrical boxes and fittings.

1.04 HAZARDOUS LOCATIONS

Raceway in designated hazardous or explosion proof locations shall conform to NFPA 70 requirements for installation.

PART 2 – PRODUCTS

2.01 GENERAL

A. Product Selection: Select boxes of types appropriate for each use and location.

1. Select covers for boxes of types appropriate for each use and location.
2. Provide gaskets for covers of boxes in damp locations or where immersion may occur.

B. Corrosion resistance: Provide galvanized or other approved corrosion resistant finish for all boxes, accessories and fittings.

2.02 FABRICATED MATERIALS

A. Interior Outlet Boxes: Provide deep drawn, galvanized steel, outlet boxes.
1. Masonry Walls: 4-inch tall x 2 1/8 – inch wide x 2 ½ - inch deep
2. General use: 4 – inch square by 2 1/8 – inch deep
3. Hung devices: 4 – inch square by 2 1/8 – inch deep rated for the load supported.
4. Two or More Ganged devices: 4 – inch tall x 2 ½ - inch deep by width as required.
5. Concrete Floor: 4 – inch tall x 2 ½ - inch deep by width as required or floor box as indicated on drawings
6. Exposed: 4 inch square by 2 1/8 – inch deep octagonal

B. Provide boxes of increased depth where required by the project. Coordinate spacing of outlet boxes in fire rated walls.

C. Construction with stamped knockouts in the back and sides.

D. Provide threaded screw holes with corrosion-resistant screws for securing box covers and wiring devices. Interior Outlet Box Accessories: Provide outlet box accessories as required for each installation, including covers, mounting brackets, hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and fulfilling requirements of individual wiring situations.

E. Weatherproof Outlet Boxes: Provide corrosion-resistant cast-metal weatherproof outlet boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit ends.

F. Junction and Pull Boxes: Provide galvanized sheet steel junction and pull boxes, with screw-on covers and of types, shapes and sizes, to suit each respective location and installation.

1. Provide welded seams and stainless steel nuts, bolts, screws and washers.
2. Conform to the applicable requirements of NFPA 70 and to UL 50 for boxes over 100 cubic inches volume, except as modified below.
3. Where necessary for boxes to provide a rigid assembly, provide integral structural steel bracing.

G. Conduit Bodies: Provide galvanized cast-metal conduit bodies, of types, shapes and sizes, to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws.

H. Bushings, Knockout Closures and Locknuts: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts, malleable iron conduit bushings and offset connectors of types and sizes to suit respective uses and installation.

PART 3 – EXECUTION

3.01 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS, GENERAL

A. Coordination: Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work, and with the work of other trades.

B. Weatherproof: Provide weatherproof outlets for all interior and exterior locations exposed to weather or moisture.

C. Knockout Caps: Provide knockout closures to cap unused knockout holes where blanks have been removed.

D. Anchoring: Support and fasten boxes securely.

E. Sizes: Provide boxes of sizes adequate to meet NFPA 70 volume requirements, but in no case smaller than sizes indicated.

3.02 INSTALLATION OF OUTLET BOXES

A. Coordination: Verify location of outlet boxes with other equipment.

B. Grounding: Provide each box to which a device is to be attached with a grounding terminal, consisting of either a green-colored washer-in-head machine screw, not smaller than No. 10-32, screwed into a tapped hole or a grounding bushing attached to one of the conduits.

C. Mounting Height: The "mounting height" of a wall-mounted outlet box is defined as the height from the finished floor to the horizontal center line of the cover plate for receptacles and top of the outlet box for switches.

D. Where mounting heights are not indicated or where heights and locations interfere with mechanical, architectural or structural features, install outlet boxes in an approved location, without additional cost.

E. Where a ceiling outlet and a dropped beam or other change in ceiling level are shown at the same location, place the outlet at least 9-inches from the finished edge of the beam or change in level, except as otherwise indicated.

F. Where mounting heights for switches mounted in masonry walls shall be 46 inches or top of coursing not to exceed 48 inches. Do not mount outlet box in the mortar joint.

G. Locate outlet boxes for switches and receptacles on columns or pilasters approximately four inches off the centers of the columns to allow for future installation of partitions.

H. Vertical Axis: Except as otherwise indicated, mount outlet boxes for switches with the long axis vertical.

1. Mount boxes for receptacles vertically.
2. Three or more gang boxes shall be mounted with the long axis horizontal.
3. Locate boxes, covers or device plates not to span different types of building finishes whether vertically or horizontally.

I. Ceilings: For outlets in ceilings where wiring is concealed, use outlet boxes 4-inches square by 1-1/2-inch deep, minimum.

J. Prohibited Work:

1. Do not use sectional (gangable) boxes.
2. Do not use device plates as covers for boxes in exposed locations.
3. Do not use round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections when fastened with locknut or bushing on rounded surface.

K. Protection: Protect outlet boxes to prevent entrance of debris. Thoroughly clean foreign material from boxes before conductors are installed.

L. Threaded Hubs: At the following locations use threaded hub type boxes with gasketed weatherproof covers:

1. Exterior locations.
2. Where installed on unfinished walls, columns or plasters. Cover gaskets may be omitted in dry locations.
3. Where exposed to moisture laden atmosphere.

3.03 PULL AND JUNCTION BOXES

A. Installation: For installation of junction and pull boxes, conform to NFPA 70 and the following:

1. For boxes exposed to rain or installed in wet locations use weatherproof type.
2. For boxes in main feeder conduit runs use sizes not smaller than 8-inches square by 4-inches deep.
3. Do not exceed 6 conductors entering and 6 leaving raceways in a single box.

B. Conductors in any pull or junction box including equipment grounding conductors shall not exceed:

Size of Conductors	Maximum No. Largest Conductors
No. #4/0 AWG	30
#250 MCM	20
#500 MCM	15

C. Supports: Provide in each box, including boxes above switchboards with sufficient clamps, grids, or devices to which cables are secured in neat and orderly fashion permitting ready identification and so that no cable will have an unsupported length of more than 30-inches.

D. Adjacent Boxes: Locate adjacent boxes a minimum of 2 feet from any other pull or junction box.

E. Flush Mount: Mount pull boxes concealed in nonaccessible walls or ceilings, with the covers flush with the finished wall or ceiling.

End of Section

SECTION 16135

WIRING DEVICES

PART 1 – GENERAL

1.01 SUMMARY

A. Scope: Extent of wiring device work is indicated on drawings and schedules, by requirements of this Section, and Section 16010, "Electrical Basic Requirements".

B. Types: Types of electrical wiring devices specified in this Section include the following:

1. Receptacles.
2. Ground-fault circuit interrupters.
3. Switches.
4. Wallplates.
5. Plugs and connectors.

C. Related Sections: Refer to other sections of Division 16 for the following:

1. Wire and Cables.
2 Boxes.

1.02 QUALITY ASSURANCE

Codes: Provide wiring devices conforming to the following:

A. American National Standards Institute (ANSI): Provide plugs and receptacle devices constructed in accordance with ANSI C73, "Attachment Plugs and Receptacles, Dimensions of".

B. Institute of Electrical and Electronics Engineers (IEEE): Construct and install wiring devices in accordance with requirements of IEEE 241, "Recommended Practice for Electric Power Systems in Commercial Buildings".

C. National Electrical Manufacturers Association (NEMA): Provide wiring devices constructed and configured in accordance with the requirements of:

1. WD 1 General Requirements for Wiring Devices.
2. WD 2 Semiconductor Dimmers for Incandescent Lamps.
3. WD 6 Wiring Devices - Dimensional Requirements.

D. National Fire Protection Association (NFPA): Comply with NFPA 70, "National

Electrical Code", as applicable to construction and installation of electrical wiring devices.

E. Underwriters Laboratories, Inc. (UL): Provide wiring devices which are UL listed and comply with the requirements of:

1. 20 General- Use Snap Switches.
2. 49 Attachment Plugs and Receptacles.
3. 514A Metallic Outlet Boxes.
4. 514B Fittings for Conduit and Outlet Boxes.
5. 514C Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
6. 943 Ground-Fault Circuit Interrupters.

1.03 SUBMITTALS

Submit manufacturer's data on electrical wiring devices.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Handle wiring devices carefully to prevent damage. Do not install damaged wiring devices, replace with new.

B. Storage: Store wiring devices in a clean and dry place. Protect from dirt, construction debris, and physical damage.

PART 2 – PRODUCTS

2.01 WIRING DEVICES

Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA WD 1.

2.02 RECEPTACLES

A. Duplex Receptacles: Provide specification grade duplex receptacles, 2-pole, 3-wire a grounding, with green hexagonal equipment ground screw, ground terminals and poles internally connected to mounting yoke, 20 A, 125 V, with metal plaster ears, design for side wiring with four captively held binding screws and provisions for back wiring from eight separate metal wiring clamps, with spring loaded, screw activated pressure plate, with NEMA configuration 5-20R unless otherwise indicated. Self-grounding or automatic type grounding receptacles are not acceptable in lieu of receptacles with separate grounding screw lugs and a direct, green insulated conductor connection to the equipment grounding system.

B. Single Receptacles: Provide specification grade single receptacles, 2-pole, 3-wire, grounding, with green hexagonal equipment ground screw, 20 A, 125 V, with metal plaster ears, design for side and back wiring with spring loaded, screw activated pressure plate, with NEMA configuration 5-20R unless otherwise indicated.

C. Ground Fault Interrupter: Provide termination type ground fault circuit interrupters, with duplex receptacles, capable of protecting connected receptacles on single circuit, and installed in an outlet box without adaptor. Provide grounding type UL rated Class A, Group 1, rated 20 A, 125 V, 60 Hz; solid-state ground fault sensing and signaling with 5 milliamperes ground fault trip level, equip with NEMA configuration 5-20R.

D. Weatherproof Receptacles: Provide in cast metal box with gasketed, weatherproof PVC cover plate and shall be listed as "raintight while in use".

2.03 SWITCHES

A. General: Provide specification grade switches with green hexagonal equipment ground screw, as indicated on the drawings conforming to NEMA WD 1 and to the following:

B. Snap Switches: Provide specification grade, general duty flush single pole toggle AC quiet switches, 20 A, 120-277 V, with mounting yoke insulated from mechanism, equip with plaster ears, switch handle and back or side-wired screw terminals. Provide captive or terminal type terminal screws not smaller than No. 8. Provide back-wired devices with separate access holes for wiring.

2.04 WIRING DEVICE ACCESSORIES

A. Wallplates: Provide wall plate for each switch, receptacle, and special purpose outlet. Do not use sectional gang plates. Provide multi-gang outlet plates for multi-gang boxes. Wall plates shall be in accordance with UL 514A, UL 514B, UL 514C, and as follows unless otherwise noted.

B. Cover plates for flush mounted wiring devices shall be stainless steel, standard size, single or ganged as shown on the drawings. Cover plate mounting screws shall be slotted head oval screws and shall match the finish and material of the plate, and shall be furnished with the plate by the plate manufacturer.

C. Switch and receptacle cover plates on exposed work shall be galvanized cast ferrous metal or Feraloy, standard size, and shall be single or ganged as indicated on the drawings.

D. Exterior mounted switch and receptacle plates, and those noted to be weatherproof, shall be gasketed weatherproof PVC cover plates, standard size, single or ganged as indicated on the drawings, and shall be listed as "raintight while in use".

PART 3 – EXECUTION

3.01 INSTALLATION OF WIRING DEVICES

A. General: Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NFPA 70 and NEMA "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements. Where not indicated, mount switch adjacent to latch jamb of door.

B. Coordination: Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.

C. Boxes: Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.

D. Receptacles: Install receptacles with centerline located 18-inches above the finished floor, unless otherwise noted or specified.

E. Work Sequence: Install wiring devices after wiring work is completed.

F. Switches: Install switches with centerline located 48 inches above finished floor unless otherwise noted or specified.

3.02 PROTECTION OF WALL PLATES AND RECEPTACLES

Upon installation of wall plates and receptacles, advise Owner's representative regarding proper and cautious use of convenience outlets. At time of substantial completion, replace those items, which have been damaged, including those burned and scored by faulty plugs.

3.03 GROUNDING

Provide equipment grounding connections for wiring devices, unless otherwise indicated.

3.04 TESTING

Test wiring devices for electrical continuity, and for short-circuits prior to energizing circuitry. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

End of Section

SECTION 16190

SUPPORTING DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. Scope: Provide support for all electrical items using supports, anchors, sleeves, seals, fastenings and other components. The extent of supporting devices is covered by this Section, the drawings and Section 16010, "Electrical Basic Requirements".

B. Types: Types of supports, anchors, sleeves, seals and fastenings specified in this Section include the following:

1. Clevis hangers.
2. Riser clamps.
3. C-clamps.
4. I-beam clamps.
5. One-hole conduit straps.
6. Two-hole conduit straps.
7. Round steel rods.
8. Lead expansion anchors.
9. Toggle bolts.
10. Wall and floor seals.

C. Equipment: Supports, sleeves, seals and fasteners furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other sections.

1.02 QUALITY ASSURANCE

A. National Fire Protection Association (NFPA): Comply with NFPA 70 as applicable to construction and installation of electrical supporting devices.

B. Underwriters Laboratories, Inc. (UL): Conform to UL listings and labeling.

PART 2 - PRODUCTS

A. PRODUCTS

B. General: Provide supporting devices with manufacturer's standard materials, designed and constructed in accordance with published product information, for a complete installation and as herein specified.

C. Corrosion Resistance: Provide all supports, support hardware and fasteners hot-dipped galvanized or cadmium plated.

D. For Raceway Supports: Provide manufacturer's standard supports including clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze, wall brackets and spring steel clamps.

E. Fasteners: Provide fasteners of types, sizes and materials indicated with the following construction features:

1. 1/2-inch lead expansion anchors approximately 38 pounds weight per 100 units.
2. 3/16-inch by 4-inch springhead toggle bolts approximately 5 pounds weight per 100 units.

F. Sleeves and Seals: Provide sleeves and seals, of types, sizes and materials indicated with the following features:

1. Smoke and fire stop seals shall have a UL fire rating of where installed in fire rated construction or as indicated.
2. Seal between sleeve and pipe where a fire rated seal is not required or specified. Weatherproof seals required for penetrations thru exterior walls. Seals capable of withstanding a corrosive environment and sulfide gases are required for penetrations into the wet well.
3. U-Channel Strut Systems: Provide U-channel strut system for mounting and supporting electrical equipment. Fabricate strut from 16-gauge hot-dip galvanized steel sheet, 9/16-inch diameter holes, 8-inches on center on top surface. Fittings shall mate with the U-channel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Compliance: Install hangers, sleeves, seals, U-channel supports and fasteners as indicated and in accordance with manufacturer's written instructions. Comply with requirements of NFPA 70 and American National Standards Institute (ANSI)/National Electrical Manufacturers Association (NEMA) for installation of supporting devices.

B. Coordination: Coordinate with other electrical work, including raceway and wiring work.

C. Raceway Supports:

1. Provide raceway support meeting the requirements of these specifications and NFPA 70. Conform to manufacturer's recommendations. For each support provide strength equal to the maximum weight of the present load plus all future raceways for which the support provides space, times a safety factor. Except as otherwise indicated, use a safety factor greater than four where necessary to provide a minimum safety allowance of 200 pounds. Provide additional support strength where required to prevent distortion of raceway during wire pulling.
2. Provide individual and multiple (trapeze) raceway hangers, and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly, and for securing hanger rods and conduits.
3. Arrange for grouping of parallel runs of horizontal raceways to be supported together on trapeze type hangers where possible.

D. Exposed conduits installed on the interior surface of exterior building walls shall be spaced off the wall surface a minimum of 1/4-inch using "clamp-backs" or strut.

E. Support individual horizontal conduits and EMT 1-1/2-inch size and smaller by either one-hole pipe straps or separate pipe hangers, use separate pipe hangers for larger sizes. Use steel fasteners that are specifically designed for supporting single conduits or EMT. Unless otherwise indicated, do not use wire as a means of support.

F. Except as otherwise indicated, space supports for metallic and non-metallic raceways in accordance with the requirements of this Section and the requirements of the NFPA 70.

G. Provide support for exposed or concealed raceway as close as practical to and not exceeding one foot from an unsupported box or access fitting. In horizontal runs a support at a box or access fitting may be omitted when the box or access fitting is independently supported and the raceway termination is not made with a close nipple or threadless box connector.

H. In vertical runs provide such support that the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports, with no weight load on raceway terminations or conductor terminals.

I. Miscellaneous Supports:

1. Provide supports for all miscellaneous electrical components as required to produce the same safety allowances as specified for raceway supports above. Provide metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, etc.

2. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support and to the extent necessary to prevent movement during wire installation; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type fastener not more than 24-inches from the box. When penetrating reinforced-concrete members, avoid cutting any reinforcing steel.

J. Cable Supports:

1. Install in strict compliance with manufacturer's instructions.
2. Spacing not to exceed NFPA 70 tabulation for spacing of conductor supports.
3. Allow adequate slack in conductors to prevent any stress on terminations. Take into consideration conductor thermal contraction.

K. Fasteners:

1. Unless otherwise indicated securely fasten all electrical items and their supporting hardware including, but not limited to, conduits, raceways, cables, cable trays, busways, cabinets, panelboards, wall-mounted transformers, boxes, disconnect switches and control components to the building structure.
2. Fasten by means of wood screws or screw-type nails on wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; by machine screws; welded threaded studs, or spring-tension clamps on steel work. Threaded studs driven in by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts or machine or wood screws in special circumstances. Do not weld conduits or pipe straps to steel structures.
3. Holes cut to a depth of more than 1-1/2-inches in reinforced concrete beams or to a depth of more than 3/4-inch in concrete joints shall not cut the main reinforcing bars. Fill holes that are not used.
4. Loads applied to any fastener shall not exceed one-fifth of the proof test load. Use vibration and shock-resistant fasteners.

L. Sleeve Seals:

1. Tighten sleeve seal nuts until sealing grommets have expanded to form watertight and smoketight seal.
2. Sleeves: Where installed in slabs or partitions completely fill the void between the sleeve and masonry with expanding cement grout.

End of Section

SECTION 16195

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

A. Scope: Extent of electrical identification work required by this Section is indicated in this section, on the drawings or where specified in other sections of Division 16.

B. Types: Types of electrical identification work specified in this section include the following:

1. Identification of electrical power, control and communication raceways, cables, and conductors.
2. Equipment labels and signs.

C. Related Sections: Refer to other sections for the following:

1. Electrical Basic Requirements.

1.02 QUALITY ASSURANCE

A. National Fire Protection Association (NFPA): Comply with NFPA 70, "National Electrical Code" requirements for identification and for provision of warning and caution signs for wiring and equipment.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical identification materials and products.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application.

B. Furnish and install engraved laminated phenolic nameplates for all safety switches, panelboards, starters, and other electrical equipment supplied for the project for identification of equipment, controlled, served, phase, voltage, etc. Nameplates shall be securely attached to equipment with self-tapping stainless

steel screws, riveted or bolted and shall identify equipment controlled, attached, etc. Letters shall be approximately 1/2-inch high minimum for identification and ¼-inch high minimum for other descriptions. Embossed, self-adhesive plastic tape is not acceptable for marking equipment. Nameplate material colors shall be:

1. Blue surface with white core for 120/208 volt equipment.

C. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate. Identification shall be by tags with wire attached to conduit or outlet.

D. Wire/Cable Designation Tape Markers: Provide vinyl or vinyl cloth, self-adhesive wrap-around cable/conductor markers with pre-printed numbers and letters for designation purposes.

E. Cable Ties: Provide fungus-inert, self-extinguishing, one piece, self locking nylon cable ties, 0.18-inch minimum width, 50 pounds minimum tensile strength and suitable for a temperature range from -50 degrees F. to +350 degrees F. Provide ties in specified colors when used for color coding.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements:

1. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations, specified or indicated on drawings. Provide numbers, lettering and wording as approved in submittals, as required by code, or as recommended by manufacturers.
2. Install products covered by this section where indicated on drawings or specified. Install products covered by this section where required by NFPA 70, whether or not otherwise indicated. Install products in accordance with manufacturer's written instructions and requirements of NFPA 70.
3. Where identification is to be applied to surfaces which require finish, install identification after completion of finish work.

B. Tagging or Labeling Conductors: Tag or label conductors as follows:

1. Match identification markings with designations used in panelboards, shop drawings, contract documents and similar previously established identification schemes for the facility electrical work.

End of Section

SECTION 16231

PACKAGED ENGINE GENERATOR SYSTEM

PART 1 GENERAL

1.01 REFERENCES

A. The engine generator set, and all accessories, shall meet the requirements of:

U.L.	- Underwriters' Laboratory
N.E.C.	- National Electrical Code
N.E.M.A.	- National Electrical Manufacturer's Association
N.F.P.A.	- National Fire Protection Association (Pamphlets 30, 31, 37, & 110)
MIL-STD	- 705 B

1.02 QUALITY CONTROL

A. All elements of the emergency power system shall be new and the most current and proven design.

B. The complete system shall be of a type which has been in satisfactory service for at least 5-years under automatic emergency system conditions.

C. The generator set system shall be tested and shipped by one supplier so that there is one source of supply and responsibility.

D. The Supplier shall be a factory trained and certified manufacturer's representative and shall maintain a complete service facility. The service facility shall be capable of making delivery to the generator set site all generator set parts within 48 hours of placing the order. The Supplier shall employ a manufacturer trained and certified technician on a full time basis at the service facility capable of making repairs and responding to service calls within 24 hours of notice. Certified proof of this requirement shall be available from the Supplier.

1.03 SUBMITTALS

The following shall be submitted in accordance with The General Provisions. All shop drawing submissions and resubmissions required under Division 16 shall be submitted in one complete package.

A Product Data

Submit manufacturer's catalog data, shop drawings, certifications and installation instructions for the following:

Generator and accessories
Automatic transfer switch

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.

Engine generator system plans, elevations, shop drawings, and dimensional drawings shall clearly indicate all aspects of the system including points for each of the inter-connections required including:

1. Engine generator/exciter control cubicle lay-out and component descriptions.

2. Exhaust muffler and vibration isolator descriptions.

3. Schematic ladder and control wiring diagrams for the generator system.

4. Printed literature and brochures describing the system including all sizing requirements and components specified.

5. The weight of the engine, generator and complete system.

6. Points of measurement and maximum vibration readings (measured as velocity) for the installed system recommended by the manufacturer.

7. Battery, battery rack and battery charger literature and description.

8. Fuel tank, piping schematic and fuel connection information for the generator.

9. The specified standby KW of the generator shall be for continuous electrical service during interruption of the normal utility power source and this shall be certified to this effect by the manufacturer for the actual unit supplied.

10. Automatic Transfer Switch.

11. Water Jacket Heater.

12. Complete parts manual for the generator, engine, transfer switch and all related components.

13. Sound attenuated, weatherproof enclosure.

C. Posting Instructions

Emergency generator operating instructions (start-up and shut-down) and emergency safety instructions.

D. Reports

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 systems. Each test report shall indicate the final position of all control functions.

E. Operation and Maintenance Manuals

Prior to the completion of the Work, submit operation and maintenance manuals for the emergency generator and automatic transfer switch in accordance with Section 01781.

F. Warranty

All equipment shall be guaranteed against defective materials, design and workmanship for a period of five years or 1500 running hours from date of initial start-up. Upon receipt of notice from the Owner of failure of any part during the guarantee period, the affected part or parts shall be replaced promptly with new parts by and at the expense of the manufacturer. The defective part or parts shall be returned to the manufacturer. Warranty shall include all materials and labor.

1.04 WORK INCLUDED

The work includes provision of a complete emergency power system for the pumping station consisting of a diesel fueled, engine driven generator set, an automatic load transfer switch, time switches, contactors, wiring, conduit, piping, and accessories as shown on the drawings. The performance of the electric plant shall be certified by an independent testing laboratory as to the plant's full power rating and voltage and frequency regulation. An authorized distributor of the manufacturer shall inspect the equipment installation after it is completed and perform initial start-up and testing of the system. All equipment shall be listed by UL and so labeled. Equipment shall be manufactured by Caterpillar, Onan, Detroit Diesel.

PART 2 PRODUCTS

2.01 ENGINE GENERATOR SET

A. Engine generator set shall be a diesel engine driven machine with continuous standby rating as shown on the drawings at 80% power factor, 60 Hertz, 120/208 volts, 3-phase, 4-wire, connected with solidly grounded neutral. The set shall be complete with welded steel mounting base, belly type fuel tank and piping, vibration isolators, nickel-cadmium battery and exhaust silencer. Engine-generator set shall have a motor starting capacity of 100 KVA based on an instantaneous voltage dip below rated not to exceed 35 percent.

B. The engine shall be diesel fueled, four cycle, naturally aspirated or turbocharged, water cooled with mounted radiator, outward-blow propeller type fan and water pump. Number of cylinders, cylinder arrangement, total piston displacement and engine horsepower shall be selected so that the engine is capable of driving the alternator and all accessories at 1800 rpm on a continuous standby basis for the duration of normal source interruptions in accordance with SAE J1349 conditions. Free turn, overhead valves shall be carbon-alloy-steel and exhaust valve shall be hard-chrome-cobalt alloy faced. Intake valve seats shall be replaceable. Exhaust valve seats shall be replaceable and shall have inserts of solid chrome-cobalt alloy. Provide complete fuel injection system with electric motor driven fuel element. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have replaceable, full-flow, oil filter, pressure relief valve, dipstick oil level indicator and oil drain valve with hose extension. Engine speed shall be governed by a pressure lubricated mechanical governor to maintain alternator frequency within 5 percent from no-load to full-load alternator output. Provide a complete fuel system. The engine shall have a 12 or 24 volt, DC, battery charging alternator with transistorized voltage regulator. Starting shall be by 12 or 24 volt electric starter with electric solenoid shift. Starter sized in accordance with the engine manufacturer's recommendation. Complete engine control shall be 2-wire type which operates to start engine on closing contact and to stop engine on opening contact. A cycle-type cranking limiter shall be provided to open the starting circuit in approximately 45 seconds if the plant is not started within that time. The electric plant controls shall also include a 3-position, engine-mode, selector switch with the following: RUN-STOP-REMOTE. High engine temperature, low oil pressure, and overspeed shutdown shall be provided.

C. Mount engine instrument panel on the set, wired, tested and provided with vibration isolators. The engine mode selector switch shall be mounted in this panel as shall a common signal light which shall be illuminated when the engine is shut-down by cranking limiter, high engine temperature, low oil pressure or overspeed. In addition, provide a separate labeled signal lamp for each of the engine shut-down malfunctions. Shut-down for any of these causes shall require

manual resetting before engine can be restarted. Provide a set of normally open contacts to which a remote alarm can be connected to warn of engine malfunction. In addition, the engine instrument panel shall contain an oil pressure gauge, water temperature gauge and battery charge rate ammeter.

D. The alternator (generator) shall be 4-pole, revolving field design with temperature-compensated, solid-state, voltage regulator and brushless rotating rectifier exciter system. No brushes shall be allowed. The stator shall be directly connected to the engine flywheel housing, and the rotor shall be driven through a semiflexible driving flange to insure permanent alignment. The insulation system shall be Class F as defined by NEMA MG1.1.65. Voltage regulation shall be within plus or minus 2 percent of rated voltage, from no load to full rated load. The instantaneous voltage dip shall be less than 15.0 percent of rated voltage when full load at rated power factor is applied to the alternator. Recovery to stable operation shall occur within 2.0 seconds. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus 1 percent of rated voltage. A rheostat on the alternator instrument panel shall provide a minimum of plus or minus 5 percent voltage adjustment from rated value. Temperature rise shall be within NEMA MG1.22.40 definition.

E. Provide an alternator instrument panel adjacent to the engine instrument panel. The alternator instrument panel shall be wired, tested and shock mounted on the generator set by the manufacturer of the alternator. It shall contain panel lighting; manual reset main line generator output circuit breaker; frequency meter; running time meter; voltage adjusting rheostat; AC voltmeter (dual range, indicates all voltages); AC ammeter (dual range, indicates current in each phase); and voltmeter and ammeter phase selector switches with OFF position.

F. The electric plant shall be rubber cushioned and mounted on a welded steel base with spring isolation dampeners. Mount base to foundation using ¼" thick neoprene rubber pads.

G. Engine generator set accessories shall be provided as follows: critical exhaust silencer to reduce exhaust noise level to standards for residential areas; flexible exhaust connection; two 12 volt, NICAD type starting batteries of adequate capacity for starting the engine and continued starting during the specified starting cycle, complete with battery cables (mount battery on non-metallic or insulated rack within base of unit); solenoid valve and shut-off valve for fuel lines; anti-freeze coolant in radiator and engine and detailed operating and maintenance manuals complete with illustrated parts lists. Provide engine coolant or engine crankcase heater, thermostatically controlled, to aid starting in cold weather. Supply power to heater from separate circuit as shown. Heater shall be sized with cubic inch of engine displacement.

H. Fuel piping shall be Type K soft copper tubing. Flexible connections in fuel piping at engine shall be corrugated seamless bronze or stainless steel tubing with

single wire braid. Valves shall be suitable for fuel oil service. Provide a shut off valve in the fuel supply line at the engine as well as a solenoid operated valve which shall close whenever the engine is stopped. Strainers shall have steel housings with fiber treated cloth cone tube capable of removing particles 10 microns and larger. Provide a strainer in the fuel supply line at the engine.

I. Exhaust piping shall be extra strong steel pipe with screwed or welded fittings. Pipe supports shall be provided for exhaust piping. Isolation supports shall be provided for all piping connections to the generator set. Provide calcium silicate insulation with a 0.016 inch thick aluminum jacket on exhaust silencer and on all interior engine exhaust piping for a total thickness of 6-inches. Provide condensate drain valve(s) at low point(s) in exhaust system. Support silencer and piping from building structure with adjustable hangers having vibration isolators and plates to protect the insulation.

J. Provide a sub-base fuel tank sized to run the generator set for a minimum of 24 hours at full rated load. Tank shall be double wall, UL listed, both inner and outer tanks shall have relief openings integral stub-up area, fuel gauge, primed and painted black. Tank shall be vented to atmosphere (outside the building) using approved piping materials.

K. Engine cooling air exhaust ductwork and accessories shall conform to applicable requirements of Division 15 and to details shown on drawings. Provide flexible duct connector at duct connection to the engine exhaust air outlet, engine radiator. Connectors shall be supported at each end by metal angle frame bands, securely bolted in place as to be air-tight.

L. Contractor to provide and install one battery charger, voltage as required by the plant manufacturer; charger by American Battery Charge model EZ-12-10, mounted within the enclosure same side of the generator as the battery pack.

M. The generator set shall be enclosed in a factory installed UL2200 listed 14 gauge steel weather protective enclosure with polyester powder finish. The enclosure shall have an internally mounted silencer and a minimum of four lockable, gasketed personnel doors for maintenance, along with fixed air intake and radiator discharge louvers. The enclosure shall have the manufacturer's sound attenuating insulation applied to the interior of the enclosure. The unit shall produce output no more than 75 dBA at 23 feet.

2.02 AUTOMATIC LOAD TRANSFER SWITCH

Automatic load transfer switch shall be rated as shown on the drawings at 208 volts, three phase, 4 wire, 60 Hertz. The manufacturer shall furnish schematic and wiring diagrams for the particular automatic transfer switch and typical interconnection wiring diagram for the entire standby system. The automatic transfer switch shall be rated for continuous operation in ambient temperatures of -25 degrees F. To +125 degrees F. The transfer

switch shall be rated for all classes of load, both inductive and noninductive, at 600-volt, and shall be designed, built, and tested to close on an inrush current up to and including 20 times the continuous rating of the switch without welding or excessive burning of the contacts. The transfer switch shall be capable of enduring 6000 cycles of operation, at rated current, at a rate of 6 cycles per minute, without failure. One cycle shall consist of complete opening and closing of both sets of contacts on an inrush current 10 times the continuous rating of switch. The automatic transfer switch, with terminal lugs for either copper or aluminum wire, shall have individual, heat resistant chambers enclosing solid silver cadmium oxide, double-break contacts. The transfer switch, with mechanical and electrical interlocks to prevent simultaneously energizing both normal and emergency service, shall be mechanically held both sides, with manual operator and auxiliary contacts rated 6-amp, 120-volt AC; 3-amp, 240 volt AC both sides. It shall be factory installed in a non-ventilated NEMA enclosure as shown on the drawings. Control accessories shall mount on a dead-front, swing-out control accessory panel to avoid shock hazard while adjusting control functions, but will swing out exposing the wiring to facilitate servicing. Indicating lamps and meter shall be set in a front mounted panel visible after opening rain tight front door of cabinet. Control accessories shall be solid state type and shall provide the following functions:

A. Monitor each ungrounded line with calibrated dial, adjustable voltage solid state UNDERVOLTAGE SENSORS to sense a decrease of voltage below a set point, or a loss of voltage on any phase of the normal power source. Voltage sensors shall be temperature compensated for 2 percent maximum deviation over the temperature range -25 degrees F. to +125 degrees F above.

B. Signal the engine-generator set to start in the event of a power interruption. A solid state TIME DELAY START (adjustable from 0 to 60 seconds) shall delay this signal to avoid nuisance startups on momentary voltage dips or power outages.

C. Retransfer the load to the line after normal power restoration. A TIME DELAY RETRANSFER (adjustable from 0 to 30 minutes) shall delay this transfer to avoid retransfer in case of short term normal power restoration.

D. Provide an automatic RETRANSFER TIME DELAY BYPASS to retransfer the load from generating set to normal source if generating set output interrupts after normal source restores voltage.

E. Provide a TIME DELAY NEUTRAL feature adjustable from no less than 0 – 10 seconds. This feature provides a neutral position when the load is transferred in either direction.

F. Signal the engine-generator to stop after load retransfer to normal source. A solid state TIME DELAY STOP (adjustable from 0.5 to 5 minutes) shall permit engine to run unloaded to cool down before shutdown.

G. Provide a TEST SWITCH to simulate an interruption of power from the normal source.

H. Provide an EXERCISER CLOCK to automatically start the generating set at a designated day and time and allow it to run for a preset time period, such as 30 minutes per week.

I. Provide with a WITH LOAD-WITHOUT LOAD SELECTOR SWITCH to select test or exercise as follows:

1. "Without load", the generating set runs unloaded.

2. "With Load", the automatic transfer switch transfer load to generating set, after time delay, the same as it would for a normal source interruption.

J. Provide a CONTROL DISCONNECT PLUG to electrically disconnect the control section from the transfer switch for maintenance service during normal operation.

K. Provide an auxiliary relay or auxiliary contact on the main power contactors so that a remote alarm or light can be connected to indicate that power is being supplied from the engine generator set. Generator run alarm shall be wired to the SCADA system junction box.

L. Provide 12volt Nickel-cadmium battery set in a fiberglass case; batteries are to be sized to the engine.

M. Provide a three phase power monitor to detect loss of phase. Phase reversal or low voltage condition. Power monitor shall be wired so as to de-energize the control circuit to the pumps and close a set of contacts wired to a delay on release relay (0-60 sec) wired to a terminal strip for the alarm transmitter. The phase monitor shall be provided with a minimum (1) normally open and (1) normally closed contact. Fuse blocks and fuses shall be provided for each phase of the power monitor. Power monitor shall be Time Mark Model B2644 or approved equal. Time delay on release relay shall be diversified model TDT-2120-AKA-060 or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

Engine generator set and automatic load transfer switch shall be installed in strict accordance with the recommendations of the manufacturer and with all applicable codes and regulations. Engine-generator set shall be mounted on a concrete foundation pad as shown on the drawings. All connections to it shall be made with flexible pipe, conduit, etc., to minimize transfer of vibration.

3.02 BATTERY CHARGING / JACKET HEATERS CIRCUITS

Provide battery charging and jacket heater circuits from panel board to battery charger and the jacket heater and make necessary connections per the equipment manufacturer(s).

3.03 STARTUP AND TRAINING

The Contractor shall provide the services of a factory trained representative of the power system supplier for a period of not less than eight (8) hours per pumping station to assist in startup of the system and to train the Owner's personnel in proper operation and maintenance.

3.04 INSTRUCTIONS, MANUALS AND SPARE PARTS

Complete instructions covering the operation of the engine-generator set and associated equipment shall be provided for the plant, together with a manual covering operation and maintenance. Operating instructions shall include any minor adjustments necessary to obtain operation of the set. Maintenance instruction shall include complete trouble shooting and diagnostic information, disassembly instructions, assembly instructions and preventative maintenance schedule. The preventative maintenance schedule shall be in outline form, include recommended lubricants and specify all necessary service checks. Spare parts books for the engine-generator, and associated equipment shall also be furnished. Three (3) hard copies and one (1) digital copy of all instructions shall be furnished. Shop test reports shall be incorporated in the manuals.

3.05 GENERATOR SYSTEM TESTS - FACTORY

A. The combined engine-generator set shall be tested at the plant of the manufacturer. Certified copies of the data obtained during these tests shall be submitted in triplicate. Test shall consist of standard factory load testing and shall include testing at rated load at 1.0 power factor, two hours in duration.

B. Test readings of amperage, voltage, frequency, water temperature, oil pressure, D.C. ammeter, hour meter, ambient temperature, air temperature in and out of radiator and air temperature in and out of the generator shall be manually recorded every 15 minutes.

C. Chart recorders shall record the amperage, frequency and phase to phase voltage continuously throughout the test. The recorders shall have been calibrated within six months of the test and the calibration traceable to the U.S. Bureau of Standards.

D. Demonstrate functioning of high-temperature coolant circuit by removing the fan belts. Record the temperature at which the switch operates. If switch adjustment is necessary, re-run test.

E. Shutdown engine and observe operation of low-oil pressure control. Record pressure at which trip operates. If switch adjustment is necessary, re-run the test.

F. A battery starting test shall be performed, with the charger disconnected, consisting of six (6) cranking cycles of fifteen (15) seconds "on" and fifteen (15) seconds "off". The engine governor shall be disabled to prevent starting. Record the time for on and off cranking cycles and total cranking time.

G. Increase engine speed by manually overriding the governor. Speed shall be measured by a tachometer. Record speed at which overspeed trip operates.

3.06 GENERATOR SYSTEM TESTS - FIELD

A. Field tests shall be conducted at the site, after installation has been completed, in the presence of the Owner. The Contractor shall have the generator set manufacturer furnish an engineer to operate the engine during the tests, to check all details of the installation and to instruct the operators. This engineer will be required for a period of not less than 1 day for instruction and tests and all costs in connection therewith shall be included in the Contractor's bid.

B. Check all engine and generator mounting bolts. Check alignment of engine-generator and realign if not within manufacturer's limits.

C. Perform and record engine manufacturer's recommended prestarting checks and inspections. Include a check of water, fuel, and lube-oil levels within the engine.

D. Start engine and make and record manufacturer's required engine adjustments after-starting during a reasonable run-in or warm up period.

E. Check proper operation of all gauges and instruments throughout operation.

F. Inspection upon completion of the on-site testing, a general inspection shall be made for:

1. Leaks in the engine, piping system, etc.
2. Excessive blowby.
3. Crankcase contamination (perform oil sample analysis).
4. Any other deficiency which may impair proper operation.
5. Measure sound level to assure that the sound spectrum does not exceed the criteria as specified herein.

G. Automatic transfer switch (ATS) shall be field tested for proper operation in accordance with manufacturer's requirements. Station power outages shall be simulated to test ATS operation. ATS operation shall also be tested once restoration of utility power has been achieved.

H. All field tests under load specified herein, shall be performed once, utilizing actual building load.

3.07 SUPERVISION

Installation shall be supervised, checked, and tested by a qualified representative of the engine-generator set's manufacturer.

3.08 ACCEPTANCES

Final acceptance shall be made when the generator set has successfully completed the on-site tests and after all defects in material or operation have been corrected. Should any defect be discovered during acceptance tests, the test will be stopped, the defect corrected and the test started from the beginning.

End of Section

SECTION 16425

PUMP CONTROL SYSTEM

PART 1 - GENERAL

1.01 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 NATIONAL STANDARDS INSTITUTE (ANSI)

1. ANSI C12.1 - (1995) Code for Electricity Metering
2. ANSI C12.4 - (1984; R 1996) Mechanical Demand Registers
3. ANSI C12.10 - (1987) Electromechanical Watthour Meters
4. ANSI C12.11 - (1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL Through 350 kV BIL (0.6 kV NSV Through 69 kV NSV)
5. ANSI C39.1 - (1981; R 1992) Requirements for Electrical Analog Indicating Instruments

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

1. ASTM B 8 - (1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
2. ASTM D 709 - (1992) Laminated Thermosetting Materials

C. AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

(1996) Boiler and Pressure Vessel Code Industrial, Scientific, and Medical Equipment

D. INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

1. IEEE ANSI/IEEE C57.13 - (1993) Instrument Transformers

E. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

1. NEMA 250 - (1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
2. NEMA AB 1 - (1993) Molded Case Circuit Breakers and Molded Case Switches
3. NEMA FU 1 - (1986) Low Voltage Cartridge Fuses
4. NEMA ICS 1 - (1993) Industrial Control and Systems

5. NEMA ICS 2 - (1993) Industrial Control and Systems Controllers, Contactors, Overload Relays Rated Not More Than 2,000 Volts AC or 750 DC
6. NEMA ICS 3 - (1993) Industrial Control and Systems Factory Built Assemblies

7. NEMA ICS 6 - (1993) Industrial Control and Systems Enclosures
8. NEMA MG 1 - (1993; Rev 1; Rev 2; Rev 3) Motors and Generators

F. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

1. NFPA 70 - (1999) National Electrical Code

G. UNDERWRITERS LABORATORIES (UL)

1. UL 50 - (1995; Rev Oct 1996) Enclosures for Electrical Equipment
2. UL 83 - 1996) Thermoplastic-Insulated Wires and Cables
3. UL 198B - (1995) Class H Fuses
4. UL 467 - (1993; Rev thru Aug 1996) Grounding and Bonding Equipment
5. UL 486A - (1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors
6. UL 486E - (1994; Rev thru Feb 1997) Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
7. UL 489 (1996; Rev May 1997) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
8. UL 508 - (1993) Industrial Control Equipment
9. UL 510 - (1994) Insulating Tape
10 UL 512 - (1993; R Dec 1995) Fuseholders
11. UL 845 - (1995; Rev Feb 1996) Motor Control Centers
12. UL 854 - (1996; Rev May 1996) Service-Entrance Cables
13. UL 1004 - (1994; Rev thru Feb 1997) Electric Motors

1.02 GENERAL CONDITIONS

A. Rules

The installation shall conform to the requirements of NFPA 70, unless more stringent requirements are indicated herein or shown.

B. Coordination

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 located and readily accessible. Equipment and materials shall be located to avoid

interference with mechanical or structural features. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change.

C. Standard Products

Material and equipment shall be new and of the minimum quality specified and shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 5 years prior to bid opening. Used, recycled, or rehabilitated material or equipment will not be acceptable.

D. Identification Nameplates

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Unless otherwise specified, identification nameplates shall be made of laminated phenolic in accordance with ASTM D 709 with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated phenolic. The following equipment, as a minimum, shall be provided with identification nameplates:

Minimum 1/4 inch High Letters	Minimum 1/8 inch High Letters
Starters	Control Power Transformers
Control Panels	Control Devices
Equipment Enclosures	

1.03 SUBMITTALS

The following shall be submitted in accordance with the General Provisions. All shop drawing submissions and resubmissions required under Division 11, 15, and 16 shall be submitted in one complete package.

A. Product Data

Submit manufacturer's catalog data, shop drawings, certifications and installation instructions for the following:

Motor Control Panel and its Associated Components
Circuit Breakers, Switches, Relays, Fuses, Instruments, Enclosures, Starters, Automatic Control Devices, Programmable Logic Controller, Meters, Transformers
Flow Metering Equipment and Data Logger
Variable Frequency Drives
Pressure Sensing Equipment
Wet Well Level Sensing System
Float Switches
Gauges
24V Backup Power Supplies

B. Drawings

Contractor to submit 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.

Submit 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:

1. Motor control panel.
2. Single line electrical diagrams including primary, metering, sensing and relaying, control wiring, and control logic.

Electrical drawings including single-line diagrams, and schematics or elementary diagrams of each electrical system; internal wiring and field connection diagrams

of each electrical device when published by the manufacturer; wiring diagrams of cabinets, panels, units, or separate mountings; interconnection diagrams that show the wiring between separate components of assemblies; field connection diagrams that show the termination of wiring routed between separate items of equipment; internal wiring diagrams of equipment showing wiring as actually provided for this project. Field wiring connections shall be clearly identified.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures, including changes in related portions of the project and the reasons why, shall be submitted with the detail drawings. Approved departures shall be made at no additional cost to the Owner.

C. As-Built Drawings.

The as-built drawings shall be a record of the construction 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 of the control panel submitted under the shop drawing phase; however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full-sized set of prints marked to reflect all deviations, changes, and modifications. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. 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. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Owner for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Owner for approval within ten calendar days from the time the drawings are returned to the Contractor. Submit the following items with the "As-Built":

1. Electronic copy of PLC program on diskette or compact disk.
2. Three hard copies of PLC program.

D. Factory Test Reports.

Contractor to provide six copies of the information described below in 81/2 x 11 inch binders having a minimum of 5 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.

1. A list of equipment used, with calibration certifications.

2. A copy of measurements taken.
3. The dates of testing.
4. The equipment and values to be verified.
5. The conditions specified for the test.
6. The test results, signed and dated.
7. A description of adjustments made.

E. Operational Test Plan

Detailed testing protocol at least 30 days prior to scheduled operational testing to demonstrate pumping system operational testing. The protocol shall describe all tests to be conducted and the inter-relationships thereof. The operational testing will not be scheduled or performed until the contractors test plan is approved.

F. Operational Test Report

A detailed field testing and equipment adjustment report within 30 days of completion of successful operational tests and prior to substantial completion 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.

Submit the information described below in 8 1/2 x 11-inch binders, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

1. Contractor's certification that the operational test was satisfactorily completed, all deficiencies were corrected and successfully retested, and that the pump station is ready for Substantial Completion Testing.
2. A list of equipment used, with calibration certifications.
3. A copy of measurements taken.
4. The dates of testing.
5. The equipment and values to be verified including acceptable reference values.
6. The conditions specified for the test.
7. The test results, signed and dated.
8. A description of adjustments made.
9. Final position of controls and device settings.
10. Submit in accordance with part I. below.

G. Substantial Completion Test Plan

Detailed testing protocol at least 14 days prior to scheduled substantial completion 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 substantial completion testing will not be scheduled or performed until the contractors test plan is approved.

H. Substantial Completion Testing Report

A detailed substantial completion testing and equipment adjustment report within 30 days of completion of successful substantial completion tests and prior to substantial completion. 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.

Submit the information described below in 8 1/2 x 11-inch binders, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

1. Contractor's certification that the Substantial Completion 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.
2. A list of equipment used, with calibration certifications.
3. A copy of measurements taken.
4. The dates of testing.
5. The equipment and values to be verified including acceptable reference values.
6. The conditions specified for the test.
7. The test results, signed and dated.
8. A description of adjustments made.
9. Final position of controls and device settings.
10. Submit in accordance with part I. below.

I. Operation and Maintenance Manuals

Submit operation and maintenance manuals for the motor control panel in accordance with Section 01781.

J. Warranty – Motor Control Panel

The controls manufacturer shall warrant the 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 O&M manuals.

All standard manufacturer warranties of control panel components shall be provided in writing with a summary of each component warranty information.

1.04 WORKMANSHIP

Materials and equipment shall be installed in accordance with NFPA 70, recommendations of the manufacturer, and as shown.

PART 2 - PRODUCTS

Products shall conform to the respective publications and other requirements specified herein. Materials and equipment not listed below shall be as specified elsewhere in this section. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.01 CABLES AND WIRES

Conductors for control, alarm, and signal circuits, shall be stranded. All conductors shall be copper.

A. Insulation
Unless indicated otherwise, or required by NFPA 70, power wires shall be 600-volt, Type THWN, THHN, or THW conforming to UL 83 control and signal circuits shall be Type TW, THW or TF, conforming to UL 83.

B. Bonding Conductors
ASTM B 8, Class B, stranded bare copper wire.

C. Power and control wiring shall be run in separate conduit.

2.02 MOLDED-CASE CIRCUIT BREAKERS

Molded-case circuit breakers shall conform to NEMA AB 1 and UL 489. Circuit breakers may be installed in control panel.

A. Construction

Circuit breakers shall be suitable for mounting and operating in any position. Lug shall be listed for copper conductors only in accordance with UL 486E. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle such that an overload or short circuit on any one pole will result in all poles opening simultaneously. All circuit breakers shall have a quick-make, quick-break overcenter toggle-type mechanism, and the handle mechanism shall be trip-free to prevent holding the contacts closed against a short-circuit or sustained overload. All circuit breaker handles shall assume a position between

"ON" and "OFF" when tripped automatically. All ratings shall be clearly visible. Circuit breakers shall be bolt-on type.

B. Ratings

Voltage ratings shall be not less than the applicable circuit voltage. The interrupting rating of the circuit breakers shall be at least equal to the available short-circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short-circuit current rating specified for the control panel. Molded-case circuit breakers shall have nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings in accordance with NEMA AB 1.

C. Thermal-Magnetic Trip Elements

Thermal magnetic circuit breakers shall be provided as shown. Automatic operation shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. The instantaneous magnetic trip shall be adjustable and accessible from the front of all circuit breakers, where applicable.

2.03 CONNECTORS, WIRE PRESSURE

UL 486A, for use with copper conductors.

2.04 ELECTRICAL GROUNDING AND BONDING EQUIPMENT

UL 467.

2.05 ENCLOSURES

NEMA ICS 6 or NEMA 250 unless otherwise specified. Cabinets and boxes with volume greater than 100 cubic inches shall be in accordance with UL 50, hot-dip, zinc-coated, if sheet steel.

2.06 LOW-VOLTAGE FUSES AND FUSEHOLDERS

A. Fuses, Low Voltage Cartridge Type

NEMA FU 1.

B. Fuses, Class H

UL 198B.

C. Fuseholders

UL 512.

2.07 INSTRUMENTS, ELECTRICAL INDICATING

ANSI C39.1.

2.08 FLOATS, LIQUID LEVEL CONTROL AND DISCHARGE MONITORING SYSTEMS

A. Level Sensing System, Solid State (4-20mA)

The liquid level sensing system shall consist of one (1) KPSI Series 750 (or approved equal) industrial submersible pressure transducer. Device shall utilize a 4-20mAdc process signal to communicate with the control panel's programmable logic controller (PLC). Device shall be approved and listed for use in Class 1, Division 1 hazardous locations. Device shall be capable of supporting a minimum of four (4) setpoint levels. Device shall be provided complete with shielded cabling from mounting location back to PLC location without splices and with vapor filtering system. Device shall be provided with one (1) conduit fitting adapter for installation in conduit within the wet well. Coordinate with specified unit. Transducers shall be installed in a PVC stilling well as shown on the Drawings. Provide a ¼" stainless steel stop bolt at 6-inches from the bottom of the well.

B. Limit Switches

Limit switches shall be provided on the check valves to shut down each pump in event of a failure to pump condition so as to prevent pump damage. Limit switches shall be as manufactured by Square D, Allen Bradley, or approved equal.

C. Float Switches

Float type liquid level sensors shall be provided in the wet wells and pump rooms as shown on the drawings. Float type sensors shall be the mercury switch, 3-wire cable type housed in a smooth, polypropylene, chemical resistant casing. Mercury switches shall be furnished in a normally open configuration for each sensor and shall be permanently molded to the signal cable.

Signal cable shall be #18 AWG.

Provide a strain relief connector for floats used in wet wells.

Sensors shall be of a specific gravity between 0.95 and 1.10 and shall remain operable between the temperature range of 0-degrees to 90-degrees Centigrade.

Acceptable manufacturers are ITT/Flygt Model ENM-10.
Float switches shall be wired directly to the RTU.

D. Discharge Flow Meter

Provide transient time type ultrasonic flow meter on discharge force main to continuously monitor discharge flow rate. Meter shall include non-wetted clamp-on type transducers and provide accuracy of +/- 2 percent when installed and calibrated on ductile iron pipe transporting domestic wastewater under pressurized flow conditions. Output shall include two 4 to 20 mA signal for instantaneous flow (gallons per minute) and a frequency output for totalized flow (millions of gallons). Meter shall operate on 120 volt single phase AC power source, be fully enclosed in NEMA 7/4x epoxy coated aluminum enclosure, 39-key tactile feedback membrane keypad, two 64x128 pixel LCD graphic displays, specified outputs, one digital communications port, one infrared link and one digital output card for connection of station flow to SCADA System. Card to be scaled to one pulse equal to 500 gallons. Meter shall be GE/Panimetrics Aquatrans Model AT868. Provide signal to the SCADA system for totalized flow. Provide signals to the Data Logger for instantaneous flow rate and totalized flow.

E. Discharge Pressure Sensor

Provide discharge pressure sensor, gauge and transducer mounted on the discharge force main to continuously monitor discharge pressure conditions. The pressure transducer shall feature 316 stainless steel housing, corrosion resistant diaphragm seal pressure gauge, ½-inch NPT connections with isolation ball valve, liquid filled gauge measuring in increments of 5 psi with a range of 0 to 100 psi and 4 to 20 mA output signal. Pressure sensing equipment shall be Red Valve Series 742 or approved equal.

F. Data Logger

Provide a paperless data logger to record flow rates and totalized flow from the station. The data logger shall include a color LCD touch screen, and shall be a Monarch Instrument Data Chart 6000. Data logger shall be furnished with a 1 gigabyte internal storage memory and Windows-compatible software. The system shall be wall mounted, and shall be configured to the County's requirements. Provide a minimum of 8 hours of onsite training in the set-up and operation of system by an authorized manufacturer's representative.

2.09 MOTOR CONTROLS AND CONTROL PANELS

A. General

NEMA ICS 1, NEMA ICS 2, NEMA ICS 3 and NEMA ICS 6, and UL 508 and UL 845.

B. Thermal-Overload Protection

Each motor of 1/8 hp or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating.

C. Low-Voltage Motor Overload Relays

1. General
Thermal and magnetic current overload relays shall conform to NEMA ICS 2 and UL 508. Overload protection shall be provided integral with the motor controller, and shall be rated in accordance with the requirements of NFPA 70. Quick trip units shall be used on hermetically sealed, submersible pumps.

2. Construction
Manual reset type thermal relay shall be melting alloy or bimetallic construction. Automatic reset type thermal relays shall be bimetallic construction. Magnetic current relays shall consist of a contact mechanism and a dash pot mounted on a common frame.

3. Ratings
Voltage ratings shall be not less than the applicable circuit voltage. Trip current ratings shall be established by selection of the replaceable overload device and shall not be adjustable. Manual reset overload relays shall be provided otherwise, and at all locations where automatic starting is provided. Where the motor is located in a constant ambient temperature, and the thermal device is located in an ambient temperature that regularly varies by more than minus 18 degrees F, an ambient temperature-compensated overload relay shall be provided.

D. Automatic Control Devices

1. Direct Control - Automatic control devices (such as float or pressure switches) which control the starting and stopping of motors directly shall be designed for that purpose.

2. Pilot-Relay Control- Where the automatic-control device (such as float or pressure switches) does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit.

3. Manual/Automatic Selection

   a. Where combination manual and automatic control is specified and the automatic-control device actuates the pilot control circuit of a magnetic starter, the magnetic starter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC.

   b. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low-or high-pressure cutouts, loss of prime, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Owner as shown on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

4. ITT/FLYGT Mini-CAS II (Control and Status) Module

   Each submersible motor's winding thermal switches and float leakage sensor shall be routed though a Flygt Mini-CAS II. Each motor shall be protected by an individual Flygt Mini-CAS module and each module shall report alarms as specified herein.

E. Control Panels

Control panels shall conform to the requirements of NEMA ICS 1, NEMA ICS 2, NEMA ICS 3 and NEMA ICS 6, and UL 508 and UL 845. Control panels shall be indoor type and shall contain equipment as indicated. Control panels shall be NEMA ICS 2, Class II, Type B. Each control panel shall be mounted on floor sills or mounting channels. Each circuit shall have a suitable metal or laminated plastic nameplate with white cut letters. Control panels shall be provided with a full-length ground bus bar.

F. Variable Frequency Drive System for Motors

Provide all labor, materials, equipment and incidentals required to furnish, install,

test, and place in operation the Variable Frequency Drives (VFDs) required for pump speed regulation and related equipment and accessories as shown and specified. VFDs shall be the H7 Series as manufactured by Toshiba. Provide each sewage pump motor with a VFD unit, installed in the control center and integrated into the motor and wet well level control system as specified. The VFDs shall start, stop, and vary the speed of the pumps in response to changes in wet well level as sensed by the wet well level sensing system and transmitted through a programmable logic controller. Operation of the VFDs shall be as outlined in Part 2.10A, Pump Operation and Sequencing. The VFDs 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 a potentiometer installed on the control panel door. The VFDs shall be capable of remote operation of all functions via terminal input points. All normal operating functions, e.g., starting, stopping, manual/automatic selection, speed control, and fault reset, shall be accessible from the control panel door mounted operator interface controls and/or the automatic pressure controls via the terminal input points and shall not require physical access to the VFD itself. The controller electronics shall contain light emitting diodes (LEDs) to monitor and indicate the following conditions on the face of the control panel:

1. Undervoltage
2. Overvoltage
3. Overtemperature
4. Instantaneous overcurrent
5. Ground fault
6. Shoot through
7. Motor overload threshold exceeded
8. Motor overload shutdown
9. Power up delay
10. Controller enabled
11. Current limiting operating (motor mode)
12. Gate driver cards operating
13. Bus power undervoltage
14. Memory failure
15. EEPROM error
16. Electronic thermal overload
17. Emergency stop

The controller shall include external fault reset capability. All logic necessary to accept an external fault reset contact shall be included.

Provide a full-voltage, non-reversing magnetic motor controller and a fully rated magnetic controller connected so that the variable speed controller can be isolated and bypassed and the motor operated at constant speed. This isolation, bypass and constant speed motor operation shall be controlled by a two-position selector

switch (VFD, bypass) installed on the face of the VFD cabinet.

Provide an analog speed meter and a running time meter in the door of the controller unit.

Provide relays with dry contacts to indicate that (1) incoming power to the controller is energized and the unit is ready for operation, (2) the motor is energized (at any speed) and (3) that the system has been shut-down because of motor overload, failure of a system component or any other shut-down function in the system. Provide pilot lights in door of controller unit to indicate these three conditions.

Provide ventilating fan or fans (with thermostatic control) in variable frequency controller enclosures to prevent overheating of system components.

Provide an input circuit breaker for the required short circuit protection. The breaker shall have an external operator in the door of the controller unit. Current limiting fuses shall be provided in the controller input.

A rectifier stage shall change fixed voltage, fixed frequency, ac line power to a fixed dc voltage. The rectifier shall consist of six power diodes in a three phase, full wave diode bridge configuration. The rectifier shall be insensitive to the phase rotation of the ac line and shall not cause displacement power factor to less than .95 lagging under any speed and load condition.

An inverter shall change the fixed dc voltage to variable frequency, variable voltage, ac for application to a standard NEMA design B squirrel cage motor. The inverter shall utilize gate turn off (GTO) devices switched in a manner to produce a sine-coded, pulse-width-modulated (PWM) output waveform.

The controller shall be rated to operate in an ambient temperature 0 degrees C to 40 degrees C continuously. Installation at altitudes less than 3,300 feet above sea level shall not require derating. The controller shall be capable of supplying 150% of rated full load current for one minute and 110% continuously at maximum ambient temperature. The controller shall be designed to operate from 208 volt +10%, -5% three phase, 60 Hertz supply and control a motor with a corresponding voltage rating.

A Hand-Off-Automatic selector switch and manual speed potentiometer shall be provided for operator control functions. The controller shall accept an input signal of 4-20ma dc as automatic speed reference signal when the controller is in the automatic mode of operation.

Acceleration and deceleration time shall be independently adjustable from 6 seconds to 60 seconds. Adjustable full-time current limiting shall limit the current

to a preset value which shall not exceed 120% of the controller rated current.

The controller shall be capable of producing an output frequency over the range of 3 to 60 Hertz (20 to 1 speed range), without low speed cogging. Over-frequency protection shall be included such that a failure in the controller electronic circuitry shall not cause frequency to exceed 110% of the maximum controller output frequency. Minimum and maximum output frequency shall be adjustable over the following ranges:

1. Minimum frequency 3 Hertz to 54 Hertz
2. Maximum frequency 40 Hertz to 60 Hertz

Protection of power semiconductor components shall be accomplished without the use of fast acting semiconductor output fuses. Subjecting the controller to any of the following conditions shall not result in component failure or the need for fuse replacement:

1. Short circuit at controller output
2. Ground fault at controller output
3. Open circuit at controller output
4. Input undervoltage
5. DC bus overvoltage
6. Loss of input phase
7. AC line switching transients
8. Instantaneous overloading
9. Sustained overload exceeding 100% of controller rated current
10. Overtemperature

Solid state motor overload protection shall be included such that current exceeding an adjustable threshold shall activate a 60 second timing circuit. Should current remain above the threshold continuously for the timing period, the controller will automatically shut down. The timing circuit shall include a memory such that current exceeding the threshold for less than 60 seconds and dropping back below the threshold momentarily shall not cause the timer to reset to zero but shall cause the timing circuit to pick up at a point dependent upon the length of the time the current was below the threshold.

The power system for the pump station is provided with a backup package generator set with an automatic load transfer switch and a solid-state electronic voltage regulating system. The variable speed controller shall be provided with an isolating transformer, filter coils, in-line reactor or other devices on its line side to protect the generator voltage regulating circuitry from the possible adverse effects of harmonic voltages generated in the variable speed controller.

In case of interruption of power (failure of normal utility supply system and

transfer to the engine generator set or restoration of normal power and retransfer from the generator set to it) the variable speed control equipment shall introduce a time delay adjustable from 0 to 30 seconds before any pump is started and shall include relays and other components to require that only one pump may be called for by the level sensing and control equipment.

2.10 PROGRAMMABLE LOGIC CONTROLLER

Provide programmable logic controller (PLC) to perform control and monitoring functions for the pump station. PLC shall be Allen Bradley Micrologic 1200 with input and output modules as required to perform all specified process control and monitoring functions with at least four of each type of I/O available as spares.

A. Pump Operation and Sequencing

The PLC shall receive a signal from the wet well level sensing system and shall transmit signals to the variable frequency drives to achieve the following control sequence:

At a preset point during a rise in wet well level, the first variable speed pump (the lead pump) shall be started at its preset speed shall attempt to maintain the wet well level within its control range. If the level continues to rise, the lead pump will ramp to 100% speed. If the wet well level should begin to drop when only the lead pump is on the line, at a preset level the pump shall be stopped and reset to the initial preset speed. If the level continues to rise with the lead pump at 100% speed, the second variable speed pump (the lag pump) shall be started at 100% speed, and the two pumps then on the line shall operate in parallel at the same speed operating to maintain the wet well level within the control range. If the wet well level should begin to drop when two pumps are on the line, at a preset point, the lag pump shall be stopped leaving only the lead variable speed pump running. On a further continuing drop in level, at a preset point the lead pump shall be stopped. After stop sequences, the pump speeds shall be reset to initial preset speeds. Selection of the lead-lag sequence (alternating of the two pumps) will by either manual or automatic operation. Provide a three-position pump alternating switch for this purpose (1, Alternate, 2). Automatic (alternating) lead-lag sequencing shall be performed by the PLC such that sequence selection is rotated every cycle. Automatic mode shall also skip sequence selections involving pumps that are manually or automatically locked-out.

Liquid level control of the station's pumps and pump motors shall be normally controlled via the station's solid-state, liquid level sensing transducer (4-20mA). Should this transducer fail and the liquid level rises to the high level float switch, a high water alarm shall be transmitted by the float switch to the RTU.

The PLC shall also receive, process and manage output signals to the RTU for the

wet well level, discharge pressure, flowrate and totalized flow signals from the specified equipment.

Programmable logic controller (PLC) shall be in accordance with NEMA ICS3. In the normal operating mode, the PLC shall perform all control functions as required. The controllers shall be microprocessor based and programmed via 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 controller. 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.

B. General Requirements

Environmental ratings for all components of the PLC shall operate satisfactorily under the following requirements/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

The entire PLC system shall immediately shut down and annunciate the occurrence of any of the following abnormal circumstances:

1. Memory parity error
2. Loss of signal communication between CPU and I/Os
3. Loss of logic power to any portion of the system
4. Halt or interruption of memory scan
5. Detection of any "incomplete" relay ladder rungs in memory.

Provide a power supply for the memory, I/O modules, and processor. Power supply shall operate on 120 VAC, 60 Hz. Provide circuitry that limits the output current and protects both the load and power supply. A single logic power supply shall suffice for an entire PC system, regardless of number of I/O's. The power supply shall be protected against short circuits and shall contain its own overcurrent and overvoltage protection. Provide replaceable battery which shall supply power necessary to maintain the memory for a minimum of 1 year when AC power is not available. The controller shall monitor the charge of the battery

and indicate that the battery has sufficient charge to maintain the memory. In the event of power loss, Register of Ladder information will be retentive. To allow monitoring of a malfunctioning machine or process, it shall be possible to connect or disconnect programming equipment at all times.

The Central Processor Unit (CPU) shall perform the logic control functions based upon the program stored in memory and the status of inputs and outputs. The minimum standard control functions of the CPU shall include: relay ladder logic; latch/unlatch relays; timers (.1 sec time base); counters (up/down); compares (=,≠,>,<); data transfers; shift registers Forward reverse); and transition detection.

A key operated selector switch shall be used for the selection of at least these minimum modes of operation:

HALT - Processor is not scanning program in memory and outputs are turned off.

RUN - Processor is executing program in memory and outputs are controlled according to the program.

The processor shall incorporate extensive self-diagnostic features which will halt the processor. In addition separate visual indicators will annunciate at least these following conditions:

RUN - Indicates that the processor is operating properly and executing the program in memory.

HALT - indicates that the processor is not executing the program in memory and all outputs are turned off, due to key position, fault in I/O or memory structure(s) or through programming.

MEMORY - Indicates that a parity error or malfunction has been detected in memory. Also, the HALT indicator will be on.

The memory shall be read/write semi-conductor random access memory (RAM) with battery back-up, or Electrically Erasable Programmable Read Only Memory (EEPROM). The memory shall be programmed by adding, deleting, or altering data without removing the memory from the PLC. A hardware key switch or password shall be provided to prevent unauthorized program changes. Memory shall be sized for all control and monitoring functions plus 50 percent spare capacity.

Whenever works (contacts, entire rungs, etc.) are intentionally deleted from an existing logic program, the remaining program words shall be automatically repositioned so as to fill this temporary void. The use of NOPs to replace any

deleted words is not acceptable. Whenever words (entire rungs, etc.) are intentionally inserted into an existing logic program, the original program shall be automatically repositioned so as to "open up" a gap of sufficient size to accommodate the additional words. This shall be possible insofar as there is adequate unused memory available to accommodate the enlarged program. In order to reduce the effective scan time for select I/Os to detect both high frequency and short pulse duration inputs, it shall be possible to program any logic equation as often in memory as desired, or utilize an immediate I/O update function.

The minimum word utilization for program storage shall be as follows:

1. No more than one word for each contact or coil, including address
2. No more than one word for a branch
3. No words for spaces or connects
4. No words to simply begin a new rung

Each word of memory shall incorporate a parity bit, with odd parity indicating proper memory operation and even parity resulting in the halting of the processor, accompanied by a visual annunciation of a memory error.

Programming the controller shall be accomplished using ladder relay logic. As a minimum, the following programming features shall be provided for programming the controller: 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.

It shall be possible to transfer data from one storage register to another using a single programming instruction. Programming techniques shall allow each register to be programmed as a counter, timer, shift register or data storage. Programming techniques shall allow cascading of storage registers to allow comparison operations with numbers having more than three digits. It shall be possible to monitor and alter any register via the programming equipment without halting the processor, provided those registers have not been intentionally fenced by the user. It shall be possible to monitor and alter the individual bits of a storage register using programming techniques or directly with the programming equipment. It shall be possible to reset the value of a storage register to zero with the use of a single programming instruction. It shall be possible to preset any value into a storage register with the use of a single programming instruction.

There shall be at least one time base of .1 second. It shall be possible to program a reset contact, such that timer operation can be halted, and timer value reset to zero. Programming techniques shall allow for programming of ON delay and OFF delay timers. It shall be possible to program up counters, down counters, and

up/down counters. It shall be possible to program a reset contact such that counter operation can be halted and countervalue reset. Programming techniques shall provide for as many timer and counter decode values as desired.

C. Inputs-Outputs

In order to provide flexibility of arrangement and to economize on hardware, all digital I/O cards shall be physically and electronically interchangeable within the I/O card frames. However, cards should be color coded to help identify specific types of input cards from output cards.

Upon final selection and arrangement for I/O cards, the user shall have the option to "key" the card receptacles in the I/O structure to prevent future incorrect placement of I/O cards.

Convenience marker strips shall be provided adjacent to the I/O field writing terminals for use labeling. It shall be possible to replace any I/O card without disturbing or removing user wiring.

Each I/O shall be equipped with an LED to provide a visual display for on/off status.

All I/Os shall provide optical (or read) isolation between the internal logic and external power circuits. Minimum isolation shall be 1500 volts RMS per NEMA standards.

2.11 TAPES

A. Plastic Tape

UL 510, Scotch brand or approved equal.

B. Rubber Tape

UL 510, Scotch brand or approved equal.

2.12 WATTHOUR METERS

Watthour meters shall conform to ANSI C12.1 and ANSI C12.10, except numbered terminal wiring sequence and case size may be the manufacturer's standard. Watthour meters shall be of the socket-mounted indoor type having a 15-minute, cumulative form, demand register meeting ANSI C12.4 and provided with not less than two and one-half stators.

2.13 CONTROL PANEL ARRANGEMENT

A. Enclosure

The enclosure shall be constructed as one piece, shall be NEMA 12 in design, free-standing style suitable for pad mounting with a housekeeping pad (6" clearance on front and sides of panel) or wall mounted. It shall be provided with an epoxy powder coat finish, grey on the outside, and white on the inside. Each enclosure door shall be provided with a 3 point latching mechanism operated by a single handle on the door.

B. Panel Components

Wires shall be identified at both ends by adhesive wire labels and all wire numbers shall appear on drawings. No two wires shall have the same number. All motor wiring and line wiring in the control panel shall be copper type THW or THWN. All controls and control voltage shall be 120 volts. All wiring shall be completely connected, requiring only connection for service.

All equipment in the control panel shall be identified by black laminated phenolic nameplates with engraved white lettering. The size of the plates shall be such that the lettering for major designations such as pump numbers, shall be a minimum height of 1/2 inch. Secondary descriptions shall have lettering, selector switches, etc., may be provided with standard nameplates.

Control relays shall be 10 ampere multi-pole "machine tool" type. Each contact shall be housed in a clear plastic enclosure to permit visual contact inspection. Contact shall be easily convertible from normally open to normally closed and vice versa. The relays shall hold up to eight convertible contacts and four fixed contacts for a total of 12 pole capability. Relay magnet shall have a double-wound molded epoxy magnet coil. Relays shall have a concealed but accessible operator for manual operation with provisions for holding the relay in the energized position for circuitry testing. Provide relays as required for system operation.

C. Panel Arrangement

The control panel may be provided in a single, sectioned enclosure. All components shall be wired and tubed to terminal strips for wiring and quick-disconnect bulkhead fittings for tubing.

One or more sections shall house the following:

1. A programmable logic controller (PLC) for receiving level signals from the wet well level sensing system and transmitting those signals in the proper sequence to the variable frequency drives for start, stop and speed

control of the sewage pumps; sequencing of the VFDs and pumps; generation of alarm signals; and, other system operation and data management functions.

2. A solid-state (4-20 mA) wet well sensing system to sense wet well liquid level and transmit it to the PLC.

3. A voltage monitor shall continuously monitor incoming voltage to the control center. The voltage monitor shall provide protection for 3 phase under voltage, voltage spike, power loss, voltage unbalance, and phase reversal. The monitor shall have separately adjustable pickup and dropout ranges and maximum 6 second time delay on drop out. Activation of the voltage monitor shall disconnect power to the pumps. The voltage monitor shall automatically reset upon restoration of voltage. The monitor shall have one set of normally open contacts with a minimum 3 ampere continuous current rating for remote alarm function. Plug-in style monitor will not be acceptable.

4. FLYGT Mini CAS II Module

   a. Provide a motor-winding-overheat system for each dry-pit submersible motor which shall consist of sensors imbedded in the motor windings and one (1) Flygt Mini-CAS II module in the control center. If sensors indicate a high winding temperature condition, relays in the center shall stop the respective motor and cause a pilot light on the face of the center to be illuminated. The sensors in the winding shall reset automatically when temperatures return to normal, but the motor shall remain shutdown and the pilot light illuminated should the system not automatically reset. The function of the systems shall be performed by the PLC.

   b. Provide a seal failure alarm system for each submersible pump. The system shall detect moisture in the pump motor stator chamber by a float leakage sensor connected to one (1) Flygt Mini-CAS II module in the control center. Operation of the system on a pump shall cause a seal failure signal to be sent to the alarm transmitter and shall cause a seal failure light on the face of the control center to be illuminated and remain illuminated until the system is reset manually. Operation of a seal failure system shall not lock out the respective pump. The function of this system shall be performed by the PLC.

5. Provide a failure-to-pump system for each pump which shall consist of a limit switch mounted on the discharge check valve at the pump and necessary relays, timers, pilot light and control switches in the control

center. When a pump is called upon to run, a 0-30 second adjustable time delay shall be energized to allow enough time for the pump to establish flow. If after this set time elapses, and the check valve limit switch has not detected flow, the pump shall stop, the respective failure-to-pump light on the face of the control center shall be illuminated, and a failure-to-pump signal shall be sent to the alarm transmitter. A failure-to-pump condition shall not lock out the pump. The system failure-to-pump light shall remain illuminated until the system is reset manually. The function of these systems shall be performed by the PLC.

6. Provide interposing relays, as required, between PLC outputs and other system components.

7. Provide alarm contacts and circuitry wired to a terminal strip for the following station output signals:

   High Wet Well Liquid Level (Float)
   High Wet Well Liquid Level (Transducer)
   Low water level
   Main Power Failure (Power Company) 0-60 second delay set to 30 seconds (from ATS)
   Pump No. 1 Failure to Pump
   Pump No. 2 Failure to Pump
   VFD No. 1 Fail
   VFD No. 2 Fail
   Valve Vault Flood
   Station Door Open
   RTU Door Open
   Standby Power Running (from contact in ATS)
   Generator Fail (from generator control panel)
   PLC Failure
   Generator Run (Event) plus alarm in parallel at RTU connection (from ATS)
   Pump No. 1 Run-Event, to RTU
   Pump No. 2 Run-Event, to RTU

The pump control panel shall contain the following (pilot lights, control switches, pushbuttons and meters shall be mounted in the door or doors of the panel):

1. Running time meter reading in hours and tenths, total of 6 digits, nonsetting type, one for each motor. Each motor's running time meter shall have a capability to generate an analog signal to the RTU for transmission.
2. Analog type percent speed meter to register pump motor speed in percent of nameplate speed. Display shall by 0 to 100% base

speed. The meter shall be driven by scaled 0-1 mADC output signal from the VFD and will be active only while the VFD is operating. The speed meters shall match the running time meters in size and appearance, and shall be General Electric Type 250 or approved equal.

3. Hand-Off-Auto switch. Handle shall be illuminated when switch is in the auto position by lone life LED white lamp, or separate pilot light may be provided to indicate this condition.
4. VFD-bypass switch, to be a.25 inch NEMA type 12. e that all pilot lights, push buttons, and selector switches shall be this size and type.
5. Manual speed setting potentiometers for VFD input reference, to be housed in a 1.25 inch NEMA 12 operator body.
6. Pilot to indicate VFD fault condition with long life LED lamp. Note that all pilot lights shall have this type lamp.
7. Green pilot light to indicate pump running condition.
8. Red pilot light to indicate a failure-to-pump condition.
9. Reset push button for failure-to-pump condition.
10. Red pilot light to indicate a motor overload trip condition.
11. Reset push button for electromagnetic reset of the thermal overload relay.
12. Amber pilot light to indicate seal failure condition.
13. Red pilot light to indicate motor winding overheat condition (automatic reset via Flight Mini CAS II).
14. 1-White "control on" pilot light.
15. 1-Wet well level indicator (4-20mA) input from PLC. (Red Lion)
16. 1-Discharge pressure indicator (4-20mA) input from PLC. (Red Lion)
17. Three position pump sequence selector (1, Alternate, 2).

PART 3 - EXECUTION

3.01 GROUNDING

Grounding shall be in conformance with NFPA 70 and the contract drawings.

3.02 CONDUCTOR IDENTIFICATION AND TAGGING

Control and signal circuit conductor identification shall be provided within each enclosure.

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.

3.03 CIRCUIT PROTECTIVE DEVICES

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 PAINTING AND FINISHING

Field-applied paint on exposed surfaces shall be provided as specified in Section 09900 PAINTING.

3.05 FIELD TESTING

Field testing shall be performed in the presence of the Owner in accordance with these specifications. The Contractor shall notify the Owner 5 days prior to conducting tests. 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 will be signed and dated by the Contractor.

A. Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged during testing or handling.

3.06 OPERATING TESTS

After the installation is completed, electrical testing is successfully completed in accordance with Section 16035 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. Operating test report shall be submitted in accordance with paragraph SUBMITTALS.

3.07 FIELD SERVICE

A. Onsite Training

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

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.

3.08 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 the Owner.

End of Section

SECTION 16450

SECONDARY GROUNDING

PART 1 - GENERAL

1.01 SUMMARY

A. Scope: Extent of the secondary grounding work required is indicated on drawings, by the requirements of this Section, and Section 16010, "Electrical Basic Requirements".

B. Provide grounding in accordance with NEC as a minimum. Additional grounding requirements shall be as specified or indicated on drawings.

C. Related Sections: Refer to other Division 16 Sections for grounding and testing.

1.02 QUALITY ASSURANCE

A. American National Standards Institute (ANSI): Comply with the requirements of:
1. C2 National Electric Safety Code.

B. American Society for Testing and Materials (ASTM): Comply with the requirements of:

1. B 1 Standard Specification for Hard-Drawn Copper Wire
2. B 2 Standard Specification for Medium-Hard-Drawn Copper Wire
3. B 3 Standard Specification for Soft or Annealed Copper Wire
4. B 8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
5. B 228 Standard Specification for Concentric-Lay-Stranded Copper-Clad Steel Conductors

C. Institute of Electrical and Electronics Engineers (IEEE): Comply with the following standards which apply to the grounding of electrical systems:

1. Recommended Practice for Grounding of Industrial and Commercial Power Systems
2. Recommended Practice for Electric Power Systems in Commercial Buildings

D. National Fire Protection Association (NFPA): Comply with the requirements of NFPA 70, "National Electrical Code" for the grounding of electrical systems.

E. Underwriters Laboratories, Inc. (UL): Provide material and installation conforming to the following standards:

1. Grounding and Bonding Equipment
2. Service Equipment

F. UL Labels: Provide grounding electrodes and connectors which are UL listed and labeled.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's data on conductors, grounding electrodes, ground clamps, and exothermic welding devices.

PART 2 - PRODUCTS

2.01 GROUND RODS

A. Ground rods shall be copper clad steel, 10 feet in length and ¾-inch in diameter.

2.02 GROUNDING ELECTRODE CONDUCTORS

A. Grounding electrode conductors shall be bare copper sized in accordance with NEC Table 250-66.

2.03 EQUIPMENT GROUNDING CONDUCTORS

A. Equipment grounding conductors in raceways shall be copper with green insulation, sized in accordance with NEC 250-122. Bare copper grounding conductors will be acceptable in underground outside raceways.

2.04 GROUND CONNECTIONS

A. Ground connections shall be exothermic type cadweld or thermoweld, when direct buried.

PART 3 - EXECUTION

3.01 INSPECTION

A, General: Examine all areas and conditions under which electrical grounding connections are to be made. Do not proceed with the grounding work until such unsatisfactory conditions have been corrected.

3.02 GROUNDING BUILDING SERVICE

A. General: Supplement the grounded neutral of the secondary distribution system with an equipment grounding system to properly safeguard equipment and

personnel. The system shall, as a minimum, comply with NFPA 70. Where the drawings or specifications exceed the requirements of NFPA 70 the drawings or specifications take precedence.

B. Building Steel: Ground the electrical service to the reinforcing bars of the building.

C. Common Ground Bus: Connect the system neutral ground and the equipment ground system to the common ground bus as indicated on the drawings. Where the connection is not shown, provide connection as required by NFPA 70.

3.03 GENERAL

A. Install equipment grounding conductors in all raceways containing conductors having 100 volts or more to ground.

B. Ground all metallic enclosures.

C. The ground ring shall be furnished with one inspection point unless otherwise indicated on the Drawings. The inspection point shall consist of a six inch diameter Sch 40 PVC conduit brought flush with finished grade and extending down to four inches below point on ground rod where ring conductor is attached. The PVC shall be notched as required to prevent stress on the ground ring conductor if the PVC is pushed downward from grade for any reason. Provide threaded end cap on top of PVC conduit. End cap shall be labeled "Ground Inspection Point".

D. The ground resistance of any "made" electrode shall be measured by an earth megger device and it shall be 25 ohms or less as per NEC 250-84.

E. A copy of the service ground resistance test shall be sent to the Owner and Owner representative.

End of Section

SECTION 16470

PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Scope: Extent of panelboard work is indicated on the drawings and schedules, by the requirements of this Section, and Section 16010, "Electrical Basic Requirements".

B. Types: Types of panelboards and enclosures covered under this Section include the following:

1. Panelboards with automatic circuit breakers.

1.02 QUALITY ASSURANCE

A. National Electrical Manufacturers Association (NEMA):

1.	AB 1	Molded Case Circuit Breakers and Molded Case Switches
2.	KS 1	Enclosed Switches
3.	PB 1	Panelboards

B. National Fire Protection Association (NFPA): Conform to the requirements of NFPA 70, "National Electrical Code".

C. Underwriters Laboratories, Inc. (UL): Construct panelboards in conformance with the following UL publications:

1.	UL 50	Cabinets and Boxes
2.	UL 67	Panelboards
3.	UL 310	Electrical Quick-Connect Terminals
4.	UL 486A	Wire Connectors and Soldering Lugs for Use with Copper Conductors
5.	UL 486B	Wire Connectors for Use with Aluminum Conductors
6.	UL 489	Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
7.	UL 512	Fuseholders
8.	UL 943	Ground-Fault Circuit Interrupters
9.	UL 1053	Ground-Fault Sensing and Relaying Equipment

1.03 SUBMITTALS

Submit the following:

A. Product Data: Submit manufacturer's data on panelboards including:

1. Manufacturer's materials specifications.
2. Certification for compliance with referenced standards.
3. Enclosed type.
4. Breaker types.
5. Bus ampacity.
6. Voltage rating.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Square D, General Electric, Cutler Hammer or approved equal.

2.02 PANELBOARDS

A. Buses: Provide panelboards with buses constructed of solid copper, minimum conductivity 98 percent and rectangular shape.

1. Mechanically mount and brace buses in conformance with UL 67.
2. Provide solderless lugs for copper or aluminum cable.
3. Provide ampacity as scheduled on the drawings.

B. Grounding Bus: Provide bare, uninsulated copper, factory installed grounding bus with ampacity equal to the main bus.

1. Provide copper pressure connected terminations.

C. Bus sequencing: Provide bus bar connections to branch circuits of the sequenced phased type.

1. Mount in accordance with UL 67.
2. Provide numbered terminals.
3. Provide pressure connectors, copper.

D. Service Equipment: Panelboards identified for use as service equipment shall be labeled.

E. Spaces: Where words similar to "space", "space only", "future space" or similar wording are used on the drawings and panel schedules, provide bus space for future overcurrent devices.

1. Extend buses full size.
2. Brace and insulate bus in accordance with UL 67.
3. Provide bolted connections for future overcurrent devices.

F. Enclosures: Construct in accordance with UL 50 except modify as hereinafter specified.

1. Construct of minimum 16-gauge galvanized steel.
2. Conform to UL 67 for additional enclosure requirements.

G. Knockouts: Provide multiple knockouts not fewer than 1.5 times the number of bus circuits.

H. Painting: In addition to galvanizing or priming coat, all inside and outside surfaces of trim and doors shall be given a factory finish coat of gray paint. Recessed boxes, and surface boxes in transformer vaults, switchgear rooms and electrical closets may be galvanized or painted as described above.

I. Directories: Provide waterproof, white cardboard stock, factory printed directories with a clear plastic directory cover and metal frame attached to the panel door. Directory information shall be typed.

J. Wiring Space: Conform to the requirements of UL 67. Feed-through gutters not permitted.

K. Conform to NFPA 70 for maximum gutter fill.

L. Conform to UL 67 for minimum width of gutter and wire bending space.

M. Manufacturer: Panelboard, back-box and front plate shall be the product of one manufacturer. Factory fit components before shipment.

N. Enclosure Type: Provide enclosure type in conformance with UL 50 and NEMA PB 1.

O. Front Plates: Provide removable front plates of the dead-front type with removable, adjustable cadmium plated trim clamps, and flush hinged enclosure door.

2.03 LOAD CENTERS ARE NOT ACCEPTABLE.

2.04 AUTOMATIC CIRCUIT BREAKERS

A. Circuit Protective Devices: Provide molded case circuit breakers conforming to UL 489 and NEMA AB 1; voltage and poles as scheduled:

1. Provide interrupting ratings as schedules.
2. Provide common trip mechanisms for multi-pole breakers.
3. Provide instantaneous automatic trips conforming to NEMA AB 1.
4. Provide breakers with adjustable trip settings as scheduled.
5. Breakers shall be bolt-on type, factory assembled.
6. Stab-in circuit breaker types are not acceptable.
7. Provide branch circuit arrangement as scheduled.
8. Provide quick-make and quick-break mechanism.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install panelboards in conformance with NEMA PB 1, and NFPA 70.

B. Lug Torquing: Torque lug screws in accordance with UL 486A for copper conductors. Install connectors, lugs, neutral bus and other field installed components in accordance with manufacturer's published literature.

C. Wiring: Refer to drawings for feeder and branch circuit wiring.
1. Verify gutter size conforms to wire bending space requirements of NFPA 70 and UL 67.
2. Wire wrap branch circuit in gutters after installation. Use approved wire ties.
3. Verify maximum gutter fill to conform with NFPA 70 and UL 67.
4. Verify bolted circuit breaker connection lugs conforming to shop drawings.
5. Verify breaker size, trip setting, and breaker type in conformance with schedules.

Complete typewritten panelboard circuit directory prior to project acceptance.

D. Only wires made of the conductor material for which the panelboard terminals have been marked shall be used.

3.02 GROUNDING

A. Provide equipment grounding connections for panelboards as indicated on drawings or schedules.

1. Conform to the requirements of NFPA 70.
2. Install lugs and ground connectors in conformance with UL 486A and UL 486B.

3.03 ADJUSTABLE TRIP SETTINGS

A. Verify factory settings for adjustable trip breakers.

B. Field adjust in conformance with manufacturer's recommendations, if necessary.

3.04 NAMEPLATES

A. Identification: Provide rigid engraved plastic nameplates conforming to the requirements of Section 16195, "Electrical Identification", for each panelboard.

3.05 INSPECTION AND TESTS

A. Check circuit breakers and switches for proper mounting, conductor size, and feeder designation.

B. Operate circuit breakers and switches to ensure smooth operation.

C. Inspect the cases of molded case circuit breakers for cracks or other defects.

D. Measure the insulation resistance of the panelboard bus system using a 500VDC megohm-meter.

E. Measure both phase-to-phase and phase-to-ground resistance. The minimum acceptable resistance shall be two megohms.

End of Section

SECTION 16482

MOTOR STARTERS

PART 1 - GENERAL

1.01 SUMMARY

A. Scope: Extent of motor starter work is indicated on the drawings and schedules, by the requirements of this Section, and Section 16010, "Electrical Basic Requirements".

B. Types: Types of motor starters specified in this Section include the following:

1. Manual.
2. Magnetic full voltage.

C. Other Divisions: Refer to Division 15 sections for the following work:

1. Starters furnished as an integral part of mechanical equipment.

D. Related Sections: Refer to the sections of Division 16 for the following:

1. Switches and Disconnects.

1.02 QUALITY ASSURANCE

A. National Electrical Manufacturers Association (NEMA): Provide starters and controllers conforming to the following NEMA standards:
1. ICS 2 Standards for Industrial Control Devices, Controllers and Assemblies.
2. Enclosures for Electrical Equipment (1,000 Volts Maximum).
3. Underwriters Laboratories, Inc. (UL): Provide fuses conforming to the following:
4. 198D Class K Fuses.
5. 198E Class R Fuses.
6. 198G Fuses for Supplementary Overcurrent Protection.
7. Provide starters conforming to UL 508 "Industrial Control Equipment".
8. Provide motor starters and components UL listed and labeled.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's data on all motor starters indicated or scheduled. For each starter show the following:

1. Type.
2. NEMA size.
3. Enclosure.
4. Pilot lights.
5. Selector switches.
6. Disconnect switches.
7. Circuit breakers.
8. Instruments.
9. Control transformer.

PART 2 - PRODUCTS

2.01 STARTERS: GENERAL

A. Starters: For each motor scheduled or indicated and not provided with integral starter, install a motor starter, unless otherwise indicated on Drawings.

B. Types: Provide types indicated and coordinate each starter in motor characteristics and control requirements.

C. Contacts: Equip each starter with contacts to break each ungrounded line to the motor.

D. Inept Trips: Provide thermal inept devices, in each phase, to open all contacts simultaneously. Equip starters with a manual inept trip reset button. Size inept trips to match motor nameplate amperes, in accordance with the requirements of National Fire Protection Association (NFPA) 70, "National Electrical Code".

E. Enclosures: Unless otherwise specified or indicated, provide each starter in a NEMA Type 1 general purpose enclosure. Examine the drawings and schedules for enclosure types.

F. Construction: Design and construct starters as follows:

1. For each starter provide doors arranged for padlocking and with a cardholder for starter identification. Provide an external reset mechanism, "start-stop" pushbuttons for manually controlled motors, and hand-off-automatic ("H-O-A") switch for automatically started motors. Provide green "stop", red "run" pilot lights of the heavy duty oil-tight diode or resistor type.
2. Make connections to the selector switch such that only the manual automatic regulatory control devices will be bypassed when the switch is in the "hand" position. Control safeties cannot be bypassed.

3. All safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protectors, shall be connected in the motor control circuit in both the "hand" and the "automatic" positions.
4. Control circuit connections to any "hand-off-automatic" selector switch or to more than one automatic regulatory control device shall be made in accordance with an indicated, or a manufacturer's approved, wiring diagram.
5. Provide the selector switch with means for locking in any position.
6. The controller disconnecting means shall be capable of being locked in the "open" position. For each motor not in sight of the controller, provide a manually operated, nonfused switch which will disconnect the motor from the source and which is placed within sight of the motor location.
7. Overload protective devices shall give adequate protection to the motor windings, be of the thermal inverse-time-limit type, and include a manual-reset type pushbutton on the outside of the motor controller case.
8. Provide each magnetic starter with a control transformer located within the starter enclosure and with wiring extended to associated accessories and to terminal boards for remotely located accessories.

2.02 MAGNETIC FULL VOLTAGE STARTERS

A. General: Conform to the requirements of paragraph, "Starters: General".

B. Type: Provide starters of the full voltage magnetic across-the-line type, with undervoltage release and auxiliary contacts indicated or specified, and of sizes indicated on the drawings.

C. Single Phase Protection: Provide single phase protection in each multi-phase magnetic starter.

2.03 MANUAL STARTERS

A. General: Conform to the requirements of "Starters: General", article, of this Section.

B. Maximum Size: Use manual starters for motors less than 1/2 horsepower unless otherwise indicated.

C. Type: Provide manual starters as follows:

1. Manually operated quick-make, quick-break toggle mechanism.
2. One piece melting alloy thermal switch.
3. Double break silver alloy contacts.
4. Red run pilot light.

5. Arrange for padlocking "Off".
6. Horsepower rate per NEMA standards.
7. NEMA Type 1 general purpose enclosure unless otherwise indicated or specified.

PART 3 - EXECUTION

3.01 INSTALLATION OF STARTERS

A. Standard: Install motor starter where indicated, in accordance with manufacturer's written instructions and in conformance with NFPA 70 and NEMA standards.

B. Coordination: Coordinate starter accessories such as pushbutton switches or H-O-A switches and auxiliary contacts with automatic control sequencing requirements.

C. Mounting: Bolt wall mounted panels to walls or mount on lightweight structural steel bolted to the wall. Mount floor supported starters on structural steel welded frames of 1-1/2-inch by 1-1/2-inch by 1/4-inch welded steel, two vertical posts with crossarm, and bolt to the floor. Construct feet of 6-inch by 6-inch by 3/8-inch thick steel plate bolted to the floor.

D. Location: Locate starters within sight of their associated motors. Where starter is not within sight of the motor, provide a heavy duty disconnect switch at the motor.

E. Fuses: Install fuses in fused disconnect switches. Size fuses in conformance with NFPA 70, and UL 198D, 198E and 198G listed.

End of Section

SECTION 16510

LIGHTING FIXTURES

PART 1 - GENERAL

1.01 SUMMARY

A. Scope: Extent of lighting fixture work is indicated on drawings and schedules, by requirements of this Section, and Section 16010, "Electrical Basic Requirements".

B. Types: Types of lighting fixtures in this Section include the following:

1. Fluorescent
2. High-Intensity Discharge

1.02 QUALITY ASSURANCE

A. Manufacturers: Provide products of firms regularly engaged in the manufacture of lighting fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than two (2) years.

B. The lighting fixtures, including information for lamp type and other accessories have been scheduled on the drawings by manufacturer and catalog number.

C. This information shall set the required fixture performance and level of quality. Fixture performance and quality specified elsewhere in this specification shall rule, if there is an implied conflict between the specification and the catalog number used. The intent is not to limit the fixture only to these manufacturers. Fixtures of equal performance and quality as judged by the Owner will be accepted.

D. Certified Ballast Manufacturers Association (CBM) Labels: Provide ballasts which comply with CBM standards and carry the CBM label.

E. National Fire Protection Association (NFPA): Comply with NFPA 70, "National Electrical Code", as applicable to construction and installation of interior building lighting fixtures and emergency lighting.

F. Underwriters Laboratories, inc. (UL): Provide interior lighting fixtures which have been UL listed and labeled.

1.03 SUBMITTALS

Submit the following:

A. Product Data: Submit manufacturer's data on lighting fixtures, lamps and ballasts.

B. Shop Drawings: Submit dimensioned drawings of lighting fixtures. Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in order of luminaire "Type" designation with proposed fixture and accessories clearly indicated on each sheet.

PART 2 - PRODUCTS

2.01 GENERAL

A. Lighting Fixture Requirements: Provide fixtures which meet the requirements of these specifications and the project drawings.

B. General Requirements: Provide lighting fixtures of sizes, types, and ratings indicated; complete with, but not necessarily limited to, housing, lamps, lamp holders, reflectors, ballasts, starters, and wiring.

2.02 FLUORESCENT LIGHTING FIXTURES

A. General: Conform to UL 1570, except for damp and wet locations conform to UL 57.

B. Fluorescent Lamps: Provide the number, type, and wattage indicated. Provide lamps conforming to American National Standards Institute (ANSI) C78.

C. Fluorescent Ballasts: The electronic ballast shall as a minimum meet the following characteristics:

1. Ballast shall comply with UL 935, ANSI C82.11, and NFPA 70 unless specified otherwise. Ballast shall be designed for operation of the lamps in the indicated application. Ballasts shall be designed to operate on the voltage system to which they are connected.
2. Power factor shall be .90 (minimum). Lamp current crest factor shall be 1.7 (maximum).
3. Ballast shall operate at a frequency of 20,000 Hertz (minimum).
4. Ballast shall have light regulation of plus or minus ten (10) percent lumen output with a plus or minus ten (10) percent input voltage regulation. Ballast shall have ten (10) percent flicker (maximum) using any compatible lamp.
5. Ballast shall be UL listed Class P with a sound rating of "A".

6. Ballast enclosure size shall conform to standards of electromagnetic ballasts. Ballast shall have circuit diagrams and lamp connections displayed on ballast packages. Ballast shall operate lamps in a parallel circuit configuration that permits the operation of remaining lamps if one or more lamps fail or are removed. Ballast lamp lead wire color code shall comply with ANSI C82.11 for parallel or independent lamp operation.
7. Ballast shall operate in a rapid start mode.
8. Ballast factor shall be 85 percent (minimum).
9. Input current third harmonics shall not exceed ANSI recommendations (32 percent total harmonic distortion, 27.5 percent of the third triplens).
10. Ballast design shall withstand line transients per IEEE 587, Category A.
11. Ballast case temperature shall not exceed 25 degrees C rise over 40 degrees C ambient.
12. Ballast shall meet FCC Rules and Regulations, Part 18.
13. Electronic ballast shall have a full replacement warranty of five years from date of manufacturer.

D. T-8 Lamp Ballast:
1. Ballast shall be capable of starting and maintaining operation at a minimum of 50° F for F32T8 lamps, unless otherwise indicated.
2. Total harmonic distortion (THD): Shall be less than 20 percent.
3. Input wattage:
. 62 watts (maximum) when operating two (2) F32T8 lamps.
4. Ballast shall be designed for the number of lamps and temperature specified.
5. Ballasts installed on building exterior shall be capable of starting and maintaining operation at a minimum of 0° F.

2.03 RECESSED AND FLUSH-MOUNTED FIXTURES

A. General: Provide type that can be relamped from the bottom, except as otherwise indicated. Trim for the exposed surface of flush-mounted fixtures shall be as indicated. Provide trims, mountings, supports and adapters for type of ceiling in which mounted. Verify before ordering. Exterior wall packs and wall mounted fixtures shall be installed in accordance with the Contract Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

Setting and Securing: Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved shop drawings. Conform to the requirements of NFPA 70.

A. Mounting: Mounting heights specified are indicated to the bottom of the fixture for suspended and ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting fixtures on the job before installation is commenced and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed.

B. Coordination: Coordinate with other trades as appropriate to properly interface installation of lighting fixtures with other work.

C. Grounding: Ground non-current-carrying parts of electrical equipment. Where the copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.02 ADJUST AND CLEAN

A. Clean: Clean lighting fixtures of dirt and debris upon completion of installation.

B. Protection: Protect installed fixtures from damage during remainder of construction period.

C. Adjust: Adjust light fixtures as directed by the Owner.

3.03 FIELD QUALITY CONTROL

A. Tests: Upon completion of installation of lighting fixtures, and after building circuits have been energized, apply electric energy to demonstrate capacity and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

B. Replacement Lamps: At the time of substantial completion and prior to field tests, replace lamps in interior lighting fixtures which are observed to be noticeably dimmed after Contractors' use and testing. Furnish stock or replacement lamps amounting to 15 percent (but not less than one lamp in each case) of each type and size lamp used in each type fixture. Deliver replacement stock as directed.

End of Section

SECTION 16900

REMOTE TERMINAL UNIT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Furnish and install a remote terminal unit (RTU) in the Pump Station to receive and report alarms, and to monitor data at the Station. The remote terminal unit shall become integrated with the County's existing SCADA System. The RTU installation shall be complete with power supply, radio transceiver, central processing unit (CPU) module, input/output (I/O) modules, antenna, antenna support, cables and all required auxiliary equipment and devices. Contractor shall coordinate additional points and descriptions with County central processing station.

1.02 QUALITY ASSURANCE

A. The existing monitoring system uses MOSCAD RTU's manufactured by Motorola. The RTU and antenna for the Station shall be a product of the manufacturer of the existing equipment.

1.03 SUBMITTALS

The following items shall be submitted in accordance with the General Provisions.

A. Product Data:

1. Submit manufacturer's catalog data, shop drawings, certifications and installation instructions for the Remote Terminal Unit (RTU). Submit manufacturer's latest publication for the remote terminal unit and antenna. Shop drawings shall indicate all dimensions, type of materials, modules, wiring and logic diagrams, and panel layout drawings for each station.

B. Drawings:

1. 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:

1. RTU system diagram and instructions.

D. Reports:

1. Detailed initial field and final acceptance testing protocols at least 30 and 14 days prior to scheduled initial field and final acceptance pumping system testing respectively. The protocol shall describe all tests to be conducted and the inter-relationships thereof.

2. Detailed initial field testing and final acceptance testing and equipment adjustment report within 30 days of completion of successful tests 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 systems. Each test report shall indicate the final position of all control functions.

3. Network Survey and Antenna Design Reports

   a. Submit a network survey and antenna design report as required under paragraph 2.01C.

4. Test Report

   a. Submit a field test report fully documenting all results of all tests, inspections and adjustments required by the equipment manufacturer and Owner to demonstrate proper operation of the RTU.

E. Operation and Maintenance Manuals:

1. Submit operation and maintenance manuals for the remote terminal unit in accordance with Section 01781.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Remote Terminal Unit (RTU):

1. MOSCAD-L w/ 4W UHF HT1000 Conventional Radio – F6854

    a. Includes NEMA housing, transformer, battery, CPU, power supply, HT1000 radio and DPSK modem.

2. Tamper Switch MOSCAD – V224

3. 16 Digital Input (DI) Module MOSCAD-L – V115 Mixed I/O 8DI, 2 Relay EE, 2AI 4-20mA Module MOSCAD-L - V436

    a. Provide the number and type of I/O Cards as may be required to provide the specified alarm and communications functions while providing at least four spare digital and two spare analog inputs.

4. 3AH Backup Battery MOSCAD-L – V328

5. The RTU supplier shall employ the services of a FCC licensed class II radio technician to optimize the radio equipment after it is installed but before it is put into use in compliance with FCC requirements.

B. RTU Termination Panel:

1. Provide an RTU termination panel with a NEMA 12 rating which provides connectivity between the RTU and sensors and I/O devices. The panel shall be manufactured by Hoffman, model A-48 with quick release hatches with dimensions of 10"H x 8"W x 6"D. The sensor configuration shall conform to York County's standard configuration for the type of station. Wiring between the Termination Panel and the RTU shall be in accordance with the County's standard RTU Wiring Color Code Chart.

C. Antenna:

1. The radio antenna shall be a directional Yagi antenna Model No. MYA4505 Series as manufactured by Maxrad or approved equivalent.

2. Prior to installation of the radio antenna, the supplier shall be responsible for conducting a survey of the radio network system to include:

    a. 30db fade margin for the radio cell site
    b. Point to Point Analysis for each radio cell site
    c. 30db fade margin performance test
    d. Written documentation for acceptance test

3. Upon completion of the above technical services, they are to be submitted and approved by the Owner.

4. The Contractor shall be responsible for determining the correct antenna design characteristics, mounting height, and position for the location based on the topography of the area, possible sources of interference, and the characteristics of the radio system being utilized. The radio antenna manufacturer shall prepare a written report containing this information which shall be submitted to the radio system manufacturer for approval. Coaxial antenna wiring shall be provided and installed by the supplier in conformance with the radio manufacturer's recommendations.

5. The radio antenna shall be properly grounded to the antenna support tower which shall in turn be grounded to a grounding rod installed in the earth in conformance with the National Electrical Code and County regulations.

D. Application Program:

1. The supplier shall obtain the RTU application program, configuration file and program file with license from the original supplier of the County's SCADA System, Gately Communication Co., or York County. The supplier shall coordinate all SCADA System Central Computer modifications for paging, reports, etc. with Gately Communications and the County Utilities Operations Supervisor.

2.02 ALARM AND REPORTING FUNCTIONS

A. The RTU shall receive and report the following alarm and monitoring data:

1. Digital Alarm Inputs to RTU:

a. Main Power Failure (Power Company)
b. Emergency Generator Running (Event)
c. Emergency Generator Alarm
d. Sewage Pump No. 1 Failure
e. Sewage Pump No. 2 Failure
f. Wet Well Low Level
g. Wet Well High Level
h. Station Door Open
i. RTU Door Open
j. PLC Failure
k. Control Panel 24vdc Power Supply Failure
l. Valve Vault Flooding

2. Digital Monitoring Inputs to RTU:

   a. Sewage Pump No. 1 Run Status (Event)
   b. Sewage Pump No. 1 Hour Meter (Part of Event)
   c. Sewage Pump No. 2 Run Status (Event)
   d. Sewage Pump No. 2 Hour Meter (Part of Event)

3. Analog Inputs to RTU (4-20mA):

   a. Sewage Pump No. 1 Speed
   b. Sewage Pump No. 2 Speed
   c. Wet Well Level
   d. Force Main Pressure
   e. Station Flow

2.03 SPARE PARTS

A. The necessary spare parts compatible with the RTU shall be furnished to allow continuous operation and functioning of the monitoring system. These are to include one (1) CPU, one (1) Mixed I/O Module, (1) power supply, and (1) 16 digital input module.

PART 3 - EXECUTION

3.01 MOUNTING AND WIRING

A. All enclosures, cables, wiring, connections, and other accessories shall be mounted, wired, and connected to insure installation of a complete and working system.

B. Antennas shall be properly mounted and supported per manufacturer's instructions. Antennas shall be tuned and directed for maximum efficiency of the system.

3.02 PROGRAMMING

A. Provide local and remote programming of RTU and County central processing facility incorporating specified alarm monitoring requirements, report functions, paging, etc.

3.03 FIELD SERVICES

A. Instruction of Owner's operating personnel dealing with the raw sewage pumps, controls, instrumentation, emergency generator system and remote terminal unit shall be done jointly with the start-up and performance testing.

B. Provide the services of a representative experienced in the installation and operation of the equipment supplied under this specification for not less than one 8-hour manday on site for installation, inspection, start-up and performance testing, and instructing Owner's personnel.

C. Provide for the above services to be performed during two separate visits to the project site. One visit to check the installation of the equipment in accordance with this specification, and one visit for start-up, performance testing and instruction of Owner's operating personnel in accordance with Section 01650.

End of Section

Appendix A

Geotechnical Engineering Study Report

Proposed Pump and Vacuum Stations with Pump Station Access Roadway
Queens Lake Sanitary Sewer Project
York County, Virginia

Prepared for

Mr. Christopher Garrett, PE
URS Corporation

Prepared by

FES

July 31, 2008

6.3 Subsurface Soil Conditions

The typical subsurface soils encountered at the boring locations within the proposed project site are shown in tabular format below. Complete boring profiles are presented in the Appendix of this report in the boring profile sheets.

BORING LOCATION	SOIL LAYER	SOIL DESCRIPTION	DEPTH RANGE (FEET)	SPT "N" VALUES (BPF)	USCS SYMBOL
FES-4 (Pump Station)	1	Brown, moist, clayey SAND with leaves and roots "Topsoil"	0 – 0.5	2	SC
	2	Light olive, moist, silty SAND	0.5 – 2	6	SM
	3	Light brown, moist, sandy CLAY	2 – 4	15	CL
	4	Yellowish brown, moist to saturated, silty SAND	4 – 8	1	SM
	5	Olive brown to greenish gray, moist to saturated, silty SAND with shells "Yorktown Formation"	8 – 55	6 - 51	SM
	6	Greenish to bluish gray, saturated, silty SAND with fragments of shells "Yorktown Formation"	55 – 75	11 - 33	SM
	7	Greenish gray, saturated, clayey SAND with traces of shells "Yorktown Formation"	75 – 90	12- 13	SC
	8	Greenish gray, saturated, sandy CLAY	90 – 100	8 - 9	CL
FES-1 (Roadway)	1	Light brown, moist, silty SAND with woods "FILL"	0 – 2	30	SM
	2	Yellowish brown, moist, sandy CLAY	2 – 6	21 - 27	CL
	3	Yellowish brown, moist, clayey SAND	6 – 10	22 - 28	SC
	4	Brownish yellow, moist, silty SAND	10 – 15	14	SM
	5	Yellowish to reddish brown, moist, sandy CLAY	15 – 20	15	CL
FOR VACUUM STATION EXISTING BORING LOG USED					
VS-1	1	Crushed Stone Aggregate "Pavement"	0 – 0.9	---	GW
	2	Reddish brown, moist to saturated, clayey SAND	0.9 – 6	5 – 17	SC
	3	Reddish brown to bluish gray, saturated, silty SAND with clay and shell fragments	6 – 8	7	SM
	4	Bluish gray, saturated, clayey to silty SAND with shell fragments	8 – 25	WOH – 17	SC-SM
	5	Light tan to bluish gray, saturated, silty SAND with shell fragments	25 – 40	18 – 27	SM
Ground Water Conditions: The ground water table was encountered at approximate depths ranging from six (6) to seven (7) feet below existing grade in boring FES-4, which was performed on July 17, 2008; however ground water tables were not encountered in borings performed along the access roadway on July 11, 2008.					

Based on our extensive experience with similar soil types, it is expected that the majority of the subsurface soils encountered within the borings performed at the **Pump Station** site, will be cohesive soils to an approximate depth of two (2) feet followed by cohesion less soils to boring termination depth at an approximate depth of one hundred (100) feet below existing grades.

Based on our extensive experience with similar soil types, it is expected that the majority of the subsurface soils encountered within boring performed at the **Vacuum Station** site, will be cohesion less soils from ground surface to boring termination depth at an approximate depth of forty (40) feet below existing grade.

8.0 SUBSURFACE DESIGN SOIL PARAMETERS

8.1 General

The recommended design soil parameters have been developed on the basis of the previously described project characteristics and subsurface conditions encountered. If there is any change in these project criteria, including project location on the site, a review must be made by **FES** to determine if any modifications in the recommendations will be required. The findings of such a review should be presented in a supplemental report.

8.2 Soil Parameters

Based on the soil conditions encountered in the borings performed for this project, there are four (4) to six (6) distinct soil layers. These soil layers and the design soil parameters computed are as tabulated below.

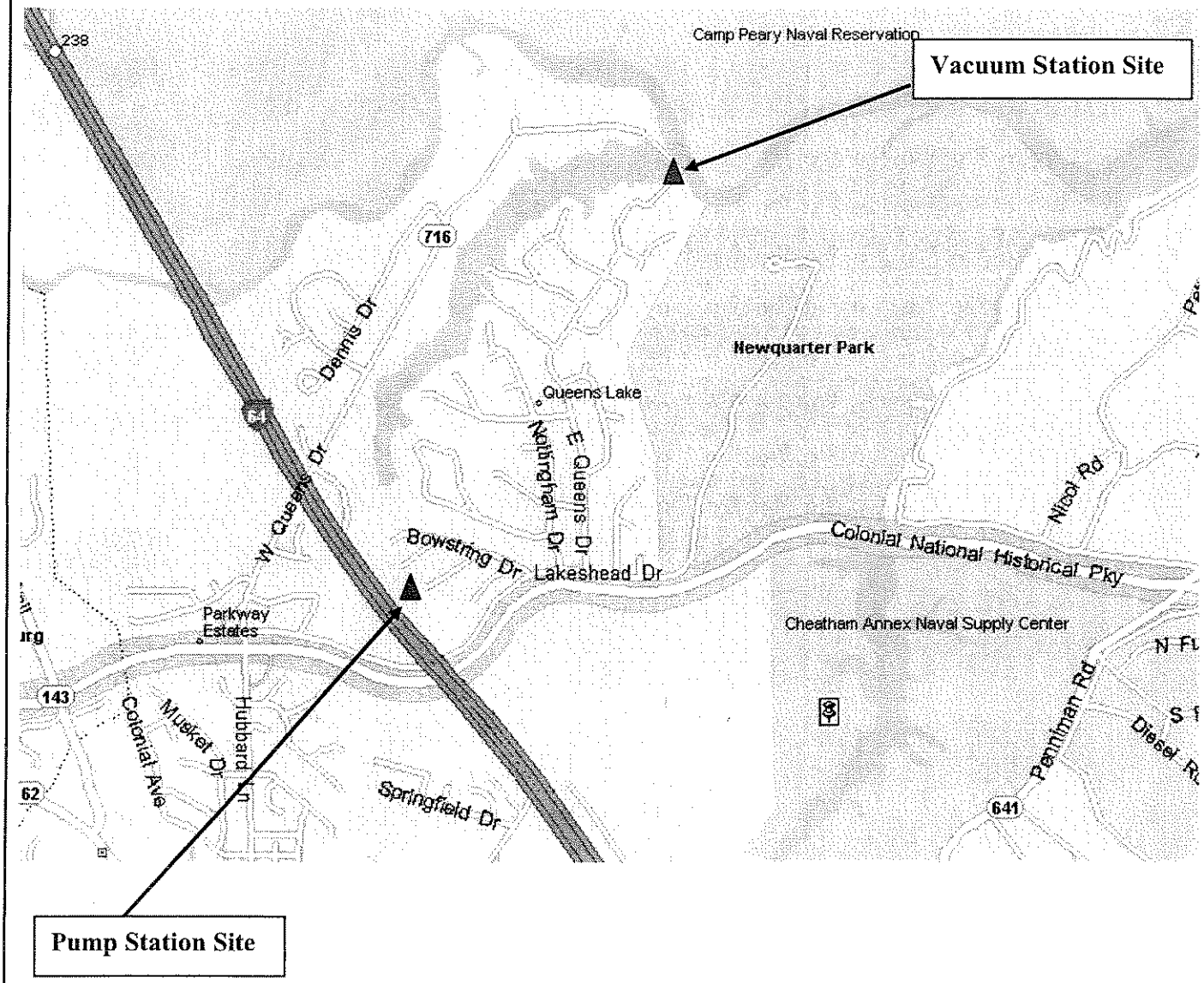
Summary of Typical Soil Parameters
Proposed Downtown Pump and Vacuum Stations
Queens Lake Sanitary Sewer System
York County, Virginia

Boring No.	Depth (feet)	USCS SYMBOL	Effective Overburden Pressure (tsf)	Corrected SPT N-value (bpf)	Estimated Soil Unit Weight (pcf)		Estimated Angle of Internal Friction (degrees)	Estimated Cohesion (psf)	Estimated Adhesion (psf)	Estimated* Earth Pressure Coefficients	
					Total	Submerged				Active	Passive
FES-4 (PS)	0 – 2	SM	0.120	16	120	57.6	32	---	---	0.3272	3.2546
	2 – 4	CL	0.149	24	120	57.6	0	3200	1150	1.0000	1.0000
	4 – 8	SM	0.293	2	120	57.6	27	---	---	0.3758	2.6665
	8 – 75	SM	1.257	20	120	57.6	33	---	---	0.3100	3.3959
	75 – 90	SC	2.438	8	120	57.6	29	---	---	0.3472	2.8849
	90 – 100	CL	2.798	5	120	57.6	0	3000	1050	1.0000	1.0000
FES-1	0 – 2	SM	0.120	48	120	57.6	28**	---	---	0.3610	2.7698
	2 – 6	CL	0.177	38	125	62.6	0	3500	1250	1.0000	1.0000
	6 – 10	SC	0.293	40	120	57.6	39	---	---	0.2286	4.4013
	10 – 15	SM	0.422	22	120	57.6	33	---	---	0.3100	3.3959
	15 – 20	CL	0.566	20	125	62.6	0	3500	1250	1.0000	1.0000
EXISTING DATA USED FOR VACUUM STATION											
VS-1	0 – 6	SC	0.1488	19	120	57.6	33	---	---	0.3100	3.3959
	6 – 8	SM	0.2640	11	120	57.6	30	---	---	0.3333	3.0000
	8 – 25	SC-SM	0.5376	7	120	57.6	29	---	---	0.3472	2.8849
	25 – 40	SM	0.9984	24	120	57.6	34	---	---	0.2827	3.5371

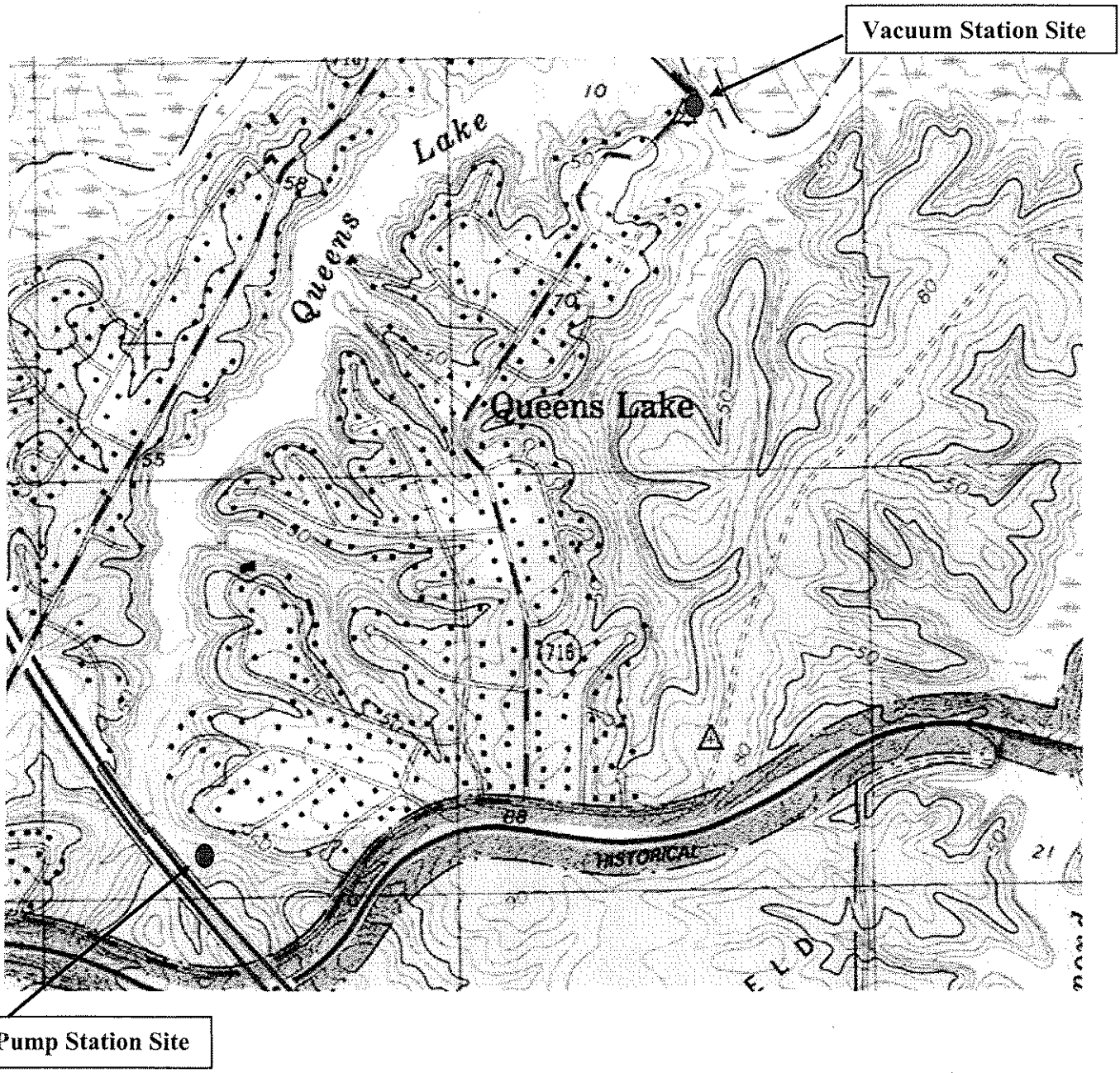
*Estimated earth pressure coefficients are based on a zero back slope. **Estimated lower internal friction angle due to "FILL" material.

FIGURES

Figure 1 – Site Vicinity Map
Figure 2 – USGS Quadrangle Map
Figure 3– Approximate Borings Locations Sketch
Figure 4– Drilling Photos



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DATE: **July 11, 2008**	SCALE: **N/A**	FES REPORT NO. **N741.005**
FIGURE – 1 SITE VICINITY MAP		



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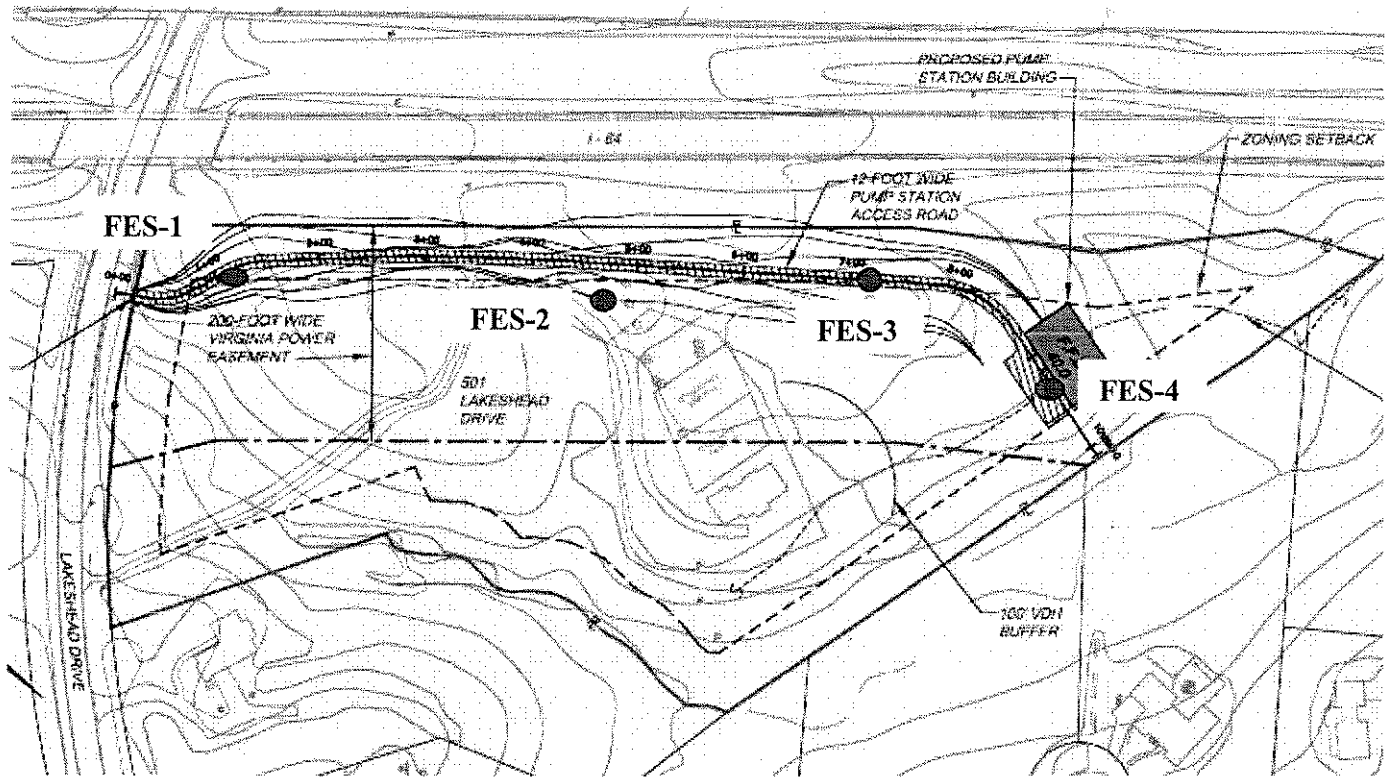
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GEOTECHNICAL ENGINEERING STUDY

QUEENS LAKE SANITARY SEWER SYSTEM
PUMP AND VACUUM STATIONS

YORK COUNTY, VIRGINIA

DATE:	SCALE:	FES REPORT NO.	**FIGURE – 2**
July 11, 2008	**N/A**	**N741.005**	USGS QUADRANGLE MAP



FES ENGINEERING & CONSTRUCTION 11843 CANON BOULEVARD, SUITE B NEWPORT NEWS, VIRGINIA 23606 PHONE: 757-873-4113 FAX: 757-873-4114 www.fescompany.com			GEOTECHNICAL ENGINEERING STUDY **QUEENS LAKE SANITARY SEWER SYSTEM PUMP AND VACUUM STATIONS** YORK COUNTY, VIRGINIA
DATE: **July 11, 2008**	SCALE: **N/A**	FES REPORT NO. **N741.005**	**FIGURE – 3** APPROXIMATE BORING LOCATIONS SKETCH PUMP STATION

BORINGS PROFILE SHEETS

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ENGINEERING AND CONSTRUCTION

11843 Canon Boulevard, Suite B
Newport News, Virginia 23606
Phone: (757) 873-4113 Fax: (757) 873-4114
www.fescompany.com

PROJECT NAME:	Queens Lake Sanitary Sewer System Development		
CLIENT:	URS Corporation	PROJECT NO.:	N741.005
PROJECT LOCATION:	York County, Virginia	DRILLING METHOD:	HSA
BORING LOCATION:	See Figure 3	OBSERVED G.W.T.:	

ELEVATION (Feet)	DEPTH (Feet)	SOIL LEGEND & SAMPLE TYPES	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %
	0		1	~~SM~~	Light gray, moist, silty SAND with gravel "FILL"	30
	1			SM	Light brown, moist, silty SAND with woods "FILL"	
	2		2	CL	Yellowish brown, moist, sandy CLAY	27
	3					
	4		3			21
	5					
	6		4	SC	Yellowish brown, moist, clayey SAND	28
	7					
	8		5			22
	9					
	10			SM	Brownish yellow, moist, silty SAND	
	11					
	12					
	13		6			14
	14					
	15			CL	Yellowish to reddish brown, moist, sandy CLAY	
	16					
	17					
	18		7			15
	19					
	20					

STANDARD PENETRATION TEST N-VALUE (Blows/Ft)

1 10 20 30 50 80

HOLE COMPLETION & REMARKS

COMPLETION DEPTH:	20.0 feet
DATE BORING STARTED:	7/11/08
DATE BORING COMPLETED:	7/11/08
ENGINEER/GEOLOGIST:	VJ
DRILLING CONTRACTOR:	FES

Sample Types:

- Auger Cutting
- Vane Shear
- SPT
- UD
- Penetrometer
- Rock Core

Remarks:

Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries. The transition may be gradual.

LOG OF BORING N741.005.GPJ FES.GDT 8/4/08

FES

ENGINEERING AND CONSTRUCTION

11843 Canon Boulevard, Suite B
Newport News, Virginia 23606
Phone: (757) 873-4113 Fax: (757) 873-4114
www.fescompany.com

PROJECT NAME:	Queens Lake Sanitary Sewer System Development		
CLIENT:	URS Corporation	PROJECT NO.:	N741.005
PROJECT LOCATION:	York County, Virginia	DRILLING METHOD:	HSA
BORING LOCATION:	See Figure 3	OBSERVED G.W.T.:	

ELEVATION (Feet)	DEPTH (Feet)	SOIL LEGEND & SAMPLE TYPES	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %	STANDARD PENETRATION TEST N-VALUE (Blows/Ft)	HOLE COMPLETION & REMARKS
	0		1	SC	Brownish yellow to reddish yellow, moist, clayey SAND	9		
	1							
	2		2			22		
	3							
	4		3			24		
	5							
	6		4			24		
	7							
	8		5	CL	Reddish yellow to yellowish brown, moist, sandy CLAY	14		
	9							
	10							
	11							
	12							
	13		6			11		
	14							
	15							
	16							
	17							
	18		7			13		
	19							
	20							

1 10 20 30 50 80

COMPLETION DEPTH:	20.0 feet
DATE BORING STARTED:	7/11/08
DATE BORING COMPLETED:	7/11/08
ENGINEER/GEOLOGIST:	VJ
DRILLING CONTRACTOR:	FES

Sample Types:

- Auger Cutting
- Vane Shear
- SPT
- UD
- Penetrometer
- Rock Core

Remarks:

Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries. The transition may be gradual.

LOG OF BORING N741.005.GPJ FES.GDT 8/4/08

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ENGINEERING AND CONSTRUCTION

11843 Canon Boulevard, Suite B
Newport News, Virginia 23606
Phone: (757) 873-4113 Fax: (757) 873-4114
www.fescompany.com

PROJECT NAME:	Queens Lake Sanitary Sewer System Development		
CLIENT:	URS Corporation	PROJECT NO.:	N741.005
PROJECT LOCATION:	York County, Virginia	DRILLING METHOD:	HSA
BORING LOCATION:	See Figure 3	OBSERVED G.W.T.:	

ELEVATION (Feet)	DEPTH (Feet)	SOIL LEGEND & SAMPLE TYPES	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %	STANDARD PENETRATION TEST N-VALUE (Blows/Ft)	HOLE COMPLETION & REMARKS
	0		1	CL	Brownish yellow, moist, sandy CLAY	10		
	2		2	SC	Brownish yellow, moist, clayey SAND	15		
	4		3			15		
	6		4	CL	Yellowish red, moist, sandy CLAY	16		
	8		5			11		
	13		6			11		
	15			SC	Strong brown, moist, clayey SAND			
	18		7			16		
	20							

1 10 20 30 50 80

COMPLETION DEPTH:	20.0 feet
DATE BORING STARTED:	7/11/08
DATE BORING COMPLETED:	7/11/08
ENGINEER/GEOLOGIST:	VJ
DRILLING CONTRACTOR:	FES

Sample Types:

- Auger Cutting
- Vane Shear
- SPT
- UD
- Penetrometer
- Rock Core

Remarks:

Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries. The transition may be gradual.

LOG OF BORING N741.005.GPJ FES.GDT 8/4/08

FES

ENGINEERING AND CONSTRUCTION

11843 Canon Boulevard, Suite B
Newport News, Virginia 23606
Phone: (757) 873-4113 Fax: (757) 873-4114
www.fescompany.com

PROJECT NAME:	Queens Lake Sanitary Sewer System Development		
CLIENT:	URS Corporation	PROJECT NO.:	N741.005
PROJECT LOCATION:	York County, Virginia	DRILLING METHOD:	Mud Drilling
BORING LOCATION:	See Figure 3	OBSERVED G.W.T.:	7.0 feet

ELEVATION (Feet)	DEPTH (Feet)	SOIL LEGEND & SAMPLE TYPES	SAMPLE NO.	SOIL CLASSIFICATION	MATERIAL DESCRIPTION	SPT, N VALUE OR RQD %	STANDARD PENETRATION TEST N-VALUE (Blows/Ft)	HOLE COMPLETION & REMARKS
	0–100		1	SC	Brown, moist, clayey SAND with leaves and roots	10		
			2	SM	"Topsoil"	15		
			3	CL	Light olive, moist, silty SAND	2		
			4	SM	Light brown, moist, sandy CLAY	WOH		
			5	SM	Yellowish brown, moist to saturated, clayey to silty SAND	7		
			6			6		
			7		Olive brown to greenish gray, moist to saturated, silty SAND with shells "Yorktown Formation"	12		
			8			13		
			9			9		
			10			6		
			11			22		
			12			31		
			13			28		
			14			34		
			15			33		
			16			19		
			17			21		
			18			19		
			19			21		
			20			25		
			21			29		
			22			28		
			23			51		
			24			33		
			25			22		
			26			23		
			27			11		
			28	SC	Greenish gray, saturated, clayey SAND with traces of Shells "Yorktown Formation"	12		
			29			13		
			30			12		
			31	CL	Greenish gray, saturated, sandy CLAY	9		
			32			8		

COMPLETION DEPTH:	100.0 feet
DATE BORING STARTED:	7/17/08
DATE BORING COMPLETED:	7/18/08
ENGINEER/GEOLOGIST:	VJ
DRILLING CONTRACTOR:	FES

Sample Types:

- Auger Cutting
- Vane Shear
- SPT
- UD
- Penetrometer
- Rock Core

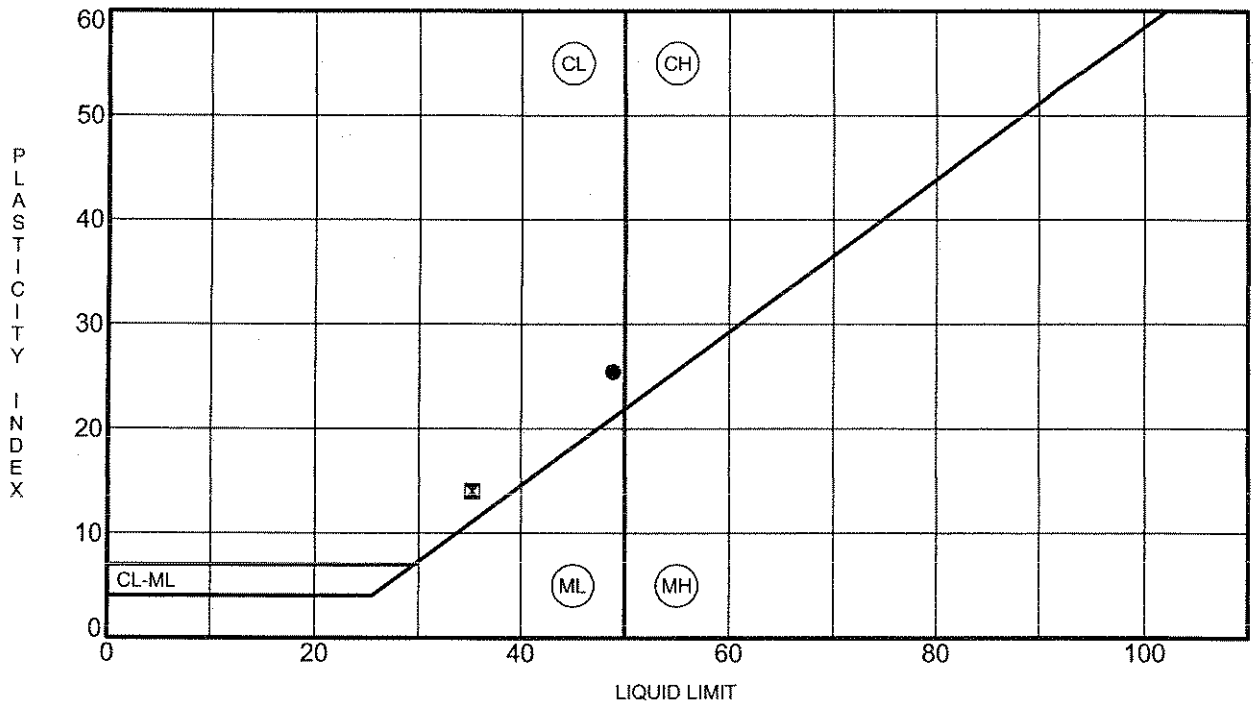
Remarks:

Unless otherwise noted, water encountered but not recorded.

The stratification lines represent approximate boundaries. The transition may be gradual.

LOG OF BORING N741.005.GPJ FES.GDT 8/4/08

LABORATORY TESTING RESULTS AND FIGURE



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**FES-1**	**5.0**	**49**	**23**	**26**	**59**	**(CL)**
⊠	**FES-4**	**3.0**	**35**	**21**	**14**	**51**	**(CL)**

US_ATTERBERG_LIMITS N741.005.GPJ US_LAB.GDT 8/4/08

FES

Foundation Engineering Science, Inc
11843-B Canon Boulevard
Newport News, Virginia
Telephone: (757) 873-4113
Fax: (757) 873-4113

ATTERBERG LIMITS RESULTS

Project: Queens Lake Sanitary Sewer System Development

Location: York County, Virginia

Number: N741.005

Appendix B

Storm Water Pollution Prevention Plan

Queens Lake Sanitary Sewer Project
Contract 3 – Transfer Station

DECEMBER 2009

York County
VIRGINIA
America's Future Since 1781

Prepared for:

County of York
Department of Environmental and Development Services
Yorktown, VA 23690

Prepared by:

URS
11832 Rock Landing Drive, Suite 306
Newport News, VA 23606

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B. DCR01 – VSMP GENERAL PERMIT

C. CERTIFICATION STATEMENT

D. SITE VICINITY MAP

E. EROSION AND SEDIMENT CONTROL NARRATIVE

F. EROSION AND SEDIMENT CONTROL PLAN

G. POLLUTANT DESCRIPTIONS AND POSSIBLE LOCATIONS

H. DCR01 COVERAGE TERMINATION

1. Introduction

a. Stormwater pollution prevention plan background

Construction activities are required by the Virginia Stormwater Management Act to prepare a Stormwater Pollution Prevention Plan (SWPPP). The purpose of the SWPPP is to identify potential sources of pollution, which may reasonably be expected to affect the quality of storm water discharges from the construction site. The SWPPP will also describe the practices used to reduce pollutants in storm water discharges from the construction site.

b. Project location

The project is located at 501 Lakeshead Drive, east of I-64 near Williamsburg in York County, VA. The project site will be located within a 200 foot easement acquired for York County on privately owned property. A wooded area will be cleared and an asphalt drive will be extended to the site. The project area drains to Queens Lake which has a spillway to Queens Creek, a tributary to the York River. A site vicinity map is provided in Appendix D.

2. Site and Activity Description

a. Project site description

This project is located east of I-64 in the Queens Lake subdivision. An asphalt drive will connect the site to Lakeshead Drive. The project site will be in a cleared wooded area. The average elevation for the site is about 50 feet above mean sea level (AMSL), and ranges from about 25 to 75 feet AMSL across the site. Current groundcover is comprised of gravel roads and wooded areas.

b. Nature of the construction activity

This is a public sewer pump station project that will convey sewage from the Queens Lake subdivision to other county owned facilities and then ultimately to the HRSD Sewage Treatment Plant. Proposed activity will include the complete construction of the pumping station, 170 LF of concrete retaining wall, 180 LF of gravity sanitary sewer, and installation of approximately 380 LF of sewer force main.

Approximately 1.0 acres of land will be disturbed during the completion of this project. Land disturbing activities include erosion and sediment (E&S) control installation, tree clearing, trench and wet well excavation, stockpiling of excavated material, construction of proposed pump station, and hauling and disposing of unsuitable material.

c. Intended timing and sequencing of land disturbing activities

The intended timing and sequencing of land disturbing activities associated with this project will be in a fashion such that any area disturbed will have either dedicated, or site-wide erosion and sediment control measures in place prior to the land disturbance. Additionally, any portion of the site which has reached a point where construction-related activities will cease on that portion of land for any period longer than 30 days will be stabilized.

Intended sequencing of all land disturbing activities shall be as follows:

1) Mobilization
2) Install construction entrance, silt fence, and tree protection
3) Unload equipment and materials at contractor staging area
4) Clearing, grubbing, and grading
5) Install pumps and filter bags for dewatering
6) Excavate trenches for gravity sanitary sewer and sewer force main installation
7) Installation of proposed gravity sanitary sewer and sewer force main
8) Install retaining wall
9) Fill inside retaining wall to proposed grade.
10) Install sheeting and excavate for wet well
11) Construct proposed pump station
12) Perform backfill and compaction activities
13) Stabilize and restore site.
14) Perform pump station startup activities

d. Estimate of total area of land disturbance

Approximately 1.0 acres of land will be disturbed.

e. Potential pollution sources

Stormwater runoff on the project site may come in contact with pollutants that result from the sewer force main pipe installation, clearing, and excavation. Potential pollution sources related to the construction activity include:

- Construction equipment fluids (motor oil, transmission fluids, fuel, engine coolant, lubricants, etc.)
- Fertilizers or other chemicals associated with permanent vegetation
- Trash
- Construction debris
- Sediment

A description of potential pollutants and their potential sources is included in Appendix G.

f. Identification of nearest receiving waters

The project area drains to Queens Lake which has a spillway to Queens Creek, a tributary to the York River. This project will result in minor changes to the topography of the project area.

g. Location and description of non construction-related industrial discharges

No non construction-related industrial discharges have been identified for this project.

h. Site Plan

Please see Appendix F.

3. Controls to Reduce Pollution

Stormwater pollution prevention will be accomplished through various erosion and sediment control measures including the installation of construction entrance, silt fence, and tree protection. Effluent from dewatering activities will be discharged through an approved sediment trapping device. Throughout construction, the project area will continue to drain to the York River, which is located northeast of the project area. The Erosion and Sediment Control plans for the project contain detailed information regarding the various types of controls. A brief explanation of controls and measures is included below.

a. Erosion and sediment controls

An Erosion and Sediment Control (ESC) Plan has been developed in accordance with regulations found in *4VAC30-50, Virginia Erosion and Sediment Control Regulations*. ESC measures aim to minimize erosion from land disturbing activities and also deter sediment from entering water bodies.

Temporary sediment and erosion controls will be installed and maintained during construction until the area being served by the control has been stabilized. Structural controls and their functions are as follows:

- Silt fencing – Silt fencing will be installed parallel to trenching to prevent sedimentation damage to areas outside the project area.

- Temporary construction entrances – Temporary stone construction entrances are provided to reduce the amount of mud transported onto surrounding paved roadways by construction vehicles. Each entrance is approximately 150-feet in length, 30-feet wide, and six inches deep. The section consists of 2-inch stone underlain with filter fabric.

- Tree protection – Tree protection will be installed around all trees to be retained on the site to prevent destruction or damage of trees and roots.

- Dewatering Effluent – Effluent from dewatering activities will be discharged through an approved sediment trapping device.

Vegetative controls are as follows:

- Topsoil stockpiling - Topsoil should be stripped from trenches in wooded areas and stockpiled for use in permanent stabilization. The stockpile must be stabilized with temporary vegetation to prevent soil loss and sediment transport from the stockpile itself until needed. The stockpile shall be no greater than 15-feet in height, have side slopes not steeper than 3:1, or have a base larger than 10,000 square feet. Prior to land-disturbing activities, the contractor shall submit a supplementary E&S plan to the owner covering any off-site stockpile area(s), which would have to be approved by the plan approving authority.

- Temporary seeding – to provide temporary stabilization for areas within the construction area until permanent seeding can be installed

- Permanent seeding – to promote stabilized surfaces which resist erosion

b. Stormwater management practices

Stormwater management for this project will entail attenuating the post-development run-off rate to the pre-development rate. Stormwater run off will be attenuated by infiltration trenches.

c. Other controls

Other controls have been incorporated into the stormwater pollution prevention plan. They include general construction practices and site coordination.

General construction practices include the following:

- Chemical storage areas shall be weather-proof, locked, and secured when not in use. An inventory log shall be maintained and periodically reviewed.

- Trash, construction debris, and contractor equipment and supplies exposed to stormwater shall be prevented from becoming a pollutant source in stormwater discharges.

- The contractor shall dispose of all construction material waste in an approved location.

- All vehicles on site will be monitored for leakage and receive regular preventative maintenance to reduce the chance of leakage.

- All personnel will be instructed regarding good housekeeping and spill control practices.

- A spill isolation and containment kit shall be maintained on site.

- Portable toilets shall be pumped as necessary, and under the direction of the construction supervisor.

- Dewatering operations will be performed, if needed, through the use of a pump filter bag, such as *Dirtbag* ®, or equivalent.

Coordination practices include:

- Temporary perimeter controls will be installed before any clearing or excavation begins.

- Clearing and excavation will not occur in an area until it is necessary for construction to proceed.

- The temporary perimeter controls will remain for the duration of land disturbing activities.

4. Inspections and Maintenance

Inspections by qualified personnel must be conducted in all the areas of the site disturbed by construction activity, and areas used for storage of materials that are exposed to stormwater. Inspections shall be conducted at least once every 14 calendar days and within 48 hours of the end of any runoff-producing storm event.

Inspections regarding erosion and sediment controls shall be conducted in accordance with the Erosion and Sediment Control Plan. Inspections regarding permanent stormwater management facilities shall be performed in accordance with all standards applicable to Stormwater Management Practices, Section 3b.

Major observations to note during the completion of site inspections shall include:

- The location(s) of discharges of sediment or other pollutants from the site

- Corrective action required including any changes to the SWPPP that are necessary and implementation dates

The inspection report will be made during each inspection. A copy of the report form to be completed by the SWPPP coordinator is provided in Appendix A of this SWPPP. Completed forms will be maintained on-site during the entire construction project. Following construction, the completed forms will be submitted in a report format to the ENRD Compliance Office. If there are construction activities that are not described in this document that could have stormwater pollution potential or if there are design modifications made to the construction plans that could have stormwater pollution potential, this SWPPP will be amended appropriately. The amended SWPPP will have a description of the new activities that contribute to the increased pollutant loading and the planned source control activities.

5. Non-Stormwater Discharge Management

The following non-stormwater discharges from the project site are authorized in accordance with DCR01, General Permit for Discharges of Stormwater from Construction Activities.

- Waters used to wash vehicles (without detergents)

- Waters used to control dust

- Water used for hydrostatic testing of new pipeline construction
- Potable water sources, including waterline flushing
- Pavement wash water where spills or leaks of toxic or hazardous materials have not occurred and where detergents are not used
- Uncontaminated groundwater
- Uncontaminated excavation dewatering
- Landscape irrigation

Pollution prevention measures for these non-stormwater discharges shall be met with best management practices delineated in this Stormwater Pollution Prevention Plan.

6. Certification

The SWPPP reflects Federal, State, and local requirements for storm water management and erosion and sediment control. To ensure compliance, this plan was prepared in accordance with the Virginia Storm Water Management Handbook, the Virginia Erosion and Sediment Control Handbook, and the York County Erosion and Sediment Control Ordinance.

- Federal – Section 402 of the Clean Water Act established the National Pollutant Discharge Elimination System (NPDES) to limit pollutant discharges into streams, rivers, and bays. As of January 29, 2005, oversight of the NPDES in the Commonwealth of Virginia was transferred to Virginia's Department of Conservation and Recreation (DCR). Land development projects that disturb more than one acre are subject to the regulations promulgated by the NPDES. The DCR manages aspects of the Virginia Pollutant Discharge Elimination System program through storm water permits issued to construction activities.

- State – The Virginia Storm Water Management Act enables local governments to establish management plans and adopt ordinances that require control and treatment of storm water runoff to prevent flooding and contamination of local waterways. Locally administered programs are voluntary but must meet or exceed the minimum standards contained in the Act regulations.

- Local – The Chesapeake Bay Preservation Act establishes requirements for storm water management within designated Chesapeake Bay Preservation Areas that are within the Tidewater region of Virginia. Each local government enforces its own program, which has been based on a model developed by the Chesapeake Bay Local Assistance Board and Chesapeake Bay Local Assistance Department.

A signed copy of the certification statement regarding liability for control measure operation and responsibility for implementing and maintaining controls is included in Appendix C.

Appendix A

Inspection Form

INSPECTION REPORT

(To be completed at a minimum of once every 14 days and within 48 hours of a rainfall event which produces runoff.)

Project Name: Queens Lake Sanitary Sewer Project Contract 3 – Pump Station

Days since last rainfall: _____

Project Location: York County, VA Amount of last rainfall: _____

Inspector Name: _____ Inspection Date: _____ Time: _____

STAGE OF CONSTRUCTION

Pre-Construction Conference	☐	Building Construction	☐	Construction of SWM Facilities	☐
Clearing and Grubbing	☐	Finish Grading	☐	Maintenance of SWM Facilities	☐
Rough Grading	☐	Final Stabilization	☐	Other: Excavation, Initial E&S Controls	☐

Item #	Reference	Inspection		Description and Location of Observations	Required/Recommended Corrective Actions, current Conditions, and Comments
		Initial	Repeat		

Notes:

(1) Reference applicable project or contract specifications, on-file SWPPP,E&S Plan, Virginia Erosion and Sediment Control Regulations (4VAC50-30) or Virginia Stormwater Management Regulations (4VAC3-20).

The required corrective action re-inspection/deadline date applied to all problem areas noted on this report. Required corrective actions are to be completed by the person responsible for ensuring compliance on the above project and acknowledging receipt of this report.

Inspector: _____ _____

Signature(s) Date

Verbal Written notification given to: _____

Appendix B

DCR01 – VSMP General Permit

General Permit No.: VAR10

Effective Date: July 1, 2009

Expiration Date: June 30, 2014

GENERAL PERMIT FOR DISCHARGES OF STORMWATER FROM CONSTRUCTION ACTIVITIES

AUTHORIZATION TO DISCHARGE UNDER THE VIRGINIA STORMWATER MANAGEMENT PROGRAM AND THE VIRGINIA STORMWATER MANAGEMENT ACT

In compliance with the provisions of the Clean Water Act, as amended, and pursuant to the Virginia Stormwater Management Act and attendant regulations, operators of construction activities covered by this permit with stormwater discharges are authorized to discharge to state waters, including discharges to a regulated MS4 system, within the boundaries of the Commonwealth of Virginia, except those specifically named in State Water Control Board and Virginia Soil and Water Conservation Board regulations that prohibit such discharges.

The authorized discharge shall be in accordance with this cover page, Section I—Discharge Authorization and Special Conditions, Section II—Stormwater Pollution Prevention Plan, and Section III—Conditions Applicable To All VSMP Permits as set forth herein.

SECTION I
DISCHARGE AUTHORIZATION AND SPECIAL CONDITIONS

A. Coverage under this permit.

1. During the period beginning with the date of coverage under this general permit and lasting until the permit's expiration date, the operator is authorized to discharge stormwater from construction activities.

2. This permit may also authorize stormwater discharges from support activities (e.g., concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas) located on-site or off-site provided that:

a. The support activity is directly related to the construction site that is required to have VSMP permit coverage for discharges of stormwater associated with construction activity;

b. The support activity is not a commercial operation serving multiple unrelated construction projects by different operators, and does not operate beyond the completion of the construction activity at the last construction project it supports; and

c. Appropriate control measures are identified in a stormwater pollution prevention plan and implemented to address the discharges from the support activity areas.

3. There shall be no discharge of floating solids or visible foam that contravenes established standards or interferes directly or indirectly with designated uses of surface waters.

B. Limitation on coverage.

1. Post-construction discharges. This permit does not authorize stormwater discharges that originate from the site after construction activities have been completed and the site, including any temporary support activity site, has undergone final stabilization. Post-construction industrial stormwater discharges may need to be covered by a separate VPDES permit.

2. Discharges mixed with nonstormwater. This permit does not authorize discharges that are mixed with sources of nonstormwater, other than those discharges that are identified in Section I D 2 (Exceptions to prohibition of nonstormwater discharges) and are in compliance with Section II D 5 (Nonstormwater discharge management).

3. Discharges covered by another permit. This permit does not authorize stormwater discharges associated with construction activity that have been covered under an individual permit or required to obtain coverage under an alternative general permit.

4. TMDL limitation. Discharges to waters for which a wasteload allocation (WLA) for a pollutant has been established in a "total maximum daily load" (TMDL) approved by the State Water Control Board that would apply to stormwater discharges from a construction activity are not eligible for coverage under this permit unless the stormwater pollution prevention plan (SWPPP) developed by the operator is consistent with the requirements related to TMDLs contained in Section II D 6.

5. Impaired waters limitation. Discharges to waters that have been identified as impaired in the 2008 § 305(b)/303(d) Water Quality Assessment Integrated Report are not eligible for coverage under this permit unless the operator implements strategies and control measures consistent with Sections I H and II D 7.

C. Commingled discharges. Any discharge authorized by a different VSMP or VPDES permit may be commingled with discharges authorized by this permit.

D. Prohibition of nonstormwater discharges.

1. Except as provided in Sections I A 2, I C and I D 2, all discharges covered by this permit shall be composed entirely of stormwater associated with construction activity.

2. The following nonstormwater discharges from active construction sites are authorized by this permit provided the nonstormwater component of the discharge is in compliance with Section II D 5 (Nonstormwater discharges):

a. Discharges from fire fighting activities;

b. Fire hydrant flushings;

c. Waters used to wash vehicles where detergents are not used;

d. Water used to control dust;

e. Potable water sources, including uncontaminated waterline flushings;

f. Routine external building wash down which does not use detergents;

g. Pavement washwaters where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents are not used;

h. Uncontaminated air conditioning or compressor condensate;

i. Uncontaminated ground water or spring water;

j. Foundation or footing drains where flows are not contaminated with process materials such as solvents;

k. Uncontaminated excavation dewatering, and

l. Landscape irrigation.

E. Releases of hazardous substances or oil in excess of reportable quantities. The discharge of hazardous substances or oil in the stormwater discharges from the construction site shall be prevented or minimized in accordance with the stormwater pollution prevention plan for the site. This permit does not relieve the permittee of the reporting requirements of 40 CFR Part 110 (2002), 40 CFR Part 117 (2002) and 40 CFR Part 302 (2002) or § 62.1-44.34:19 of the Code of Virginia.

Where a release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110 (2002), 40 CFR Part 117 (2002), 40 CFR Part 302 (2002), or § 62.1-44.34.19 of the Code of Virginia occurs during a 24-hour period:

1. The operator is required to notify the Department of Environmental Quality and the permit-issuing authority in accordance with the requirements of Section III G as soon as he has knowledge of the discharge;

2. Where a release enters a municipal separate storm sewer system (MS4), the operator shall also notify the operator of the MS4; and

3. The stormwater pollution prevention plan required under Section II D of this permit must be reviewed by the operator to identify measures to prevent the reoccurrence of such releases and to respond to such releases, and the plan must be modified where appropriate within seven calendar days of knowledge of a release.

F. Spills. This permit does not authorize the discharge of hazardous substances or oil resulting from an on-site spill.

G. Termination of permit coverage. Coverage under this permit may be terminated in accordance with 4VAC50-60-1160.

H. Water quality protection.

1. The operator must select, install, implement and maintain control measures at the construction site that minimize pollutants in the discharge as necessary to ensure that the operator's discharge does not cause or contribute to an excursion above any] applicable water quality standards.

2. If it is determined by the permit-issuing authority in consultation with the State Water Control Board at any time that the operator's stormwater discharges have reasonable potential to cause or contribute to an excursion above any applicable water quality standard, the permit-issuing authority shall require the operator to:

a. Modify control measures in accordance with Section II C to adequately address the identified water quality concerns;

b. Submit valid and verifiable data and information that are representative of ambient conditions and indicate that the receiving water is attaining water quality standards; or

c. Cease discharges of pollutants from construction activity and submit an individual permit application according to 4VAC50-60-410 B 3.

All written responses required under this part must include a signed certification consistent with Section III K.

SECTION II
STORMWATER POLLUTION PREVENTION PLAN

A. Stormwater Pollution Prevention Plan Framework.

1. A stormwater pollution prevention plan (SWPPP) shall be developed prior to submission of a registration statement and implemented for the construction activity covered by this permit. SWPPPs shall be prepared in accordance with good engineering practices.

2. The SWPPP shall:

a. Identify potential sources of pollutants that may reasonably be expected to affect the quality of stormwater discharges from the construction site;

b. Describe control measures that will be used to minimize pollutants in stormwater discharges from the construction site; and

c. Comply with the terms and conditions of this permit.

3. The SWPPP requirements of this general permit may be fulfilled by incorporating by reference other state or local plans such as (i) an erosion and sediment control (ESC) plan, (ii) an agreement in lieu of a plan as defined in 4VAC50-30-10, (iii) a stormwater management plan, (iv) a spill prevention control and countermeasure (SPCC) plan developed for the site under § 311 of the federal Clean Water Act or (v) best management practices (BMP) programs otherwise required for the facility provided that the incorporated plan meets or exceeds the SWPPP requirements of Section II D. If an erosion and sediment control plan for the land-disturbing activity is being incorporated by reference, the referenced plan must be approved by the locality in which the construction activity is to occur or by another appropriate plan approving authority authorized under the Virginia Erosion and Sediment Control Regulations (4VAC50-30) prior to the commencement of land disturbance.

4. All plans incorporated by reference into the SWPPP become enforceable under this permit. If a plan incorporated by reference does not contain all of the required elements of the SWPPP of Section II D, the operator must develop the missing elements and include them in the required SWPPP.

5. Once a definable area has been finally stabilized, the operator may mark this on the SWPPP and no further SWPPP or inspection requirements apply to that portion of the site (e.g., earth-disturbing activities around one of three buildings in

a complex are done and the area is finally stabilized; one mile of a roadway or pipeline project is done and finally stabilized, etc.).

6. The SWPPP shall identify all properties that are no longer under the control of the operator and the dates on which the operator no longer had control over each property.

7. The operator must implement the SWPPP as written and updated in accordance with Section II C from commencement of construction activity until final stabilization is complete.

B. Signature, SWPPP review and making SWPPPs available.

1. The SWPPP shall be signed in accordance with Section III K.

2. The SWPPP shall be retained, along with a copy of this permit, registration statement, and acknowledgement letter from the permit-issuing authority, at the construction site or other location easily accessible during normal business hours from the date of commencement of construction activity to the date of final stabilization. Operators with day-to-day operational control over SWPPP implementation shall have a copy of the SWPPP available at a central location on-site for the use of all operators and those identified as having responsibilities under the SWPPP whenever they are on the construction site. The SWPPP must be made available, in its entirety, to the department, the permit-issuing authority, and the operator of a municipal separate storm sewer system receiving discharges from the site for review at the time of an on-site inspection. If an on-site location is unavailable to store the SWPPP when no personnel are present, notice of the SWPPP's location must be posted near the main entrance at the construction site.

3. The operator shall make SWPPPs and all updates available upon request to the department; the permit-issuing authority; EPA; a state or local agency approving erosion and sediment control plans, grading plans, or stormwater management plans; local government officials; or the operator of a municipal separate storm sewer system receiving discharges from the site.

4. A sign or other notice must be posted conspicuously near the main entrance of the construction site. The sign or other notice must contain the following information:

a. A copy of the permit coverage letter than includes the registration number for the construction activity; and

b. The internet address at which a copy of the SWPPP may be found or the location of a hard copy of the SWPPP and name and telephone number of a contact person for scheduling viewing times.

For linear projects, the sign or other notice must be posted at a publicly accessible location near an active part of the construction project (e.g., where a pipeline project crosses a public road).

5. For discharges that commence on or after July 1, 2009 that have not previously held coverage under a VSMP or VPDES permit, the operator shall make the SWPPP available to the public for review. A copy of the SWPPP for each site shall be made available on the internet or in hard copy. The website address or contact person for access to the SWPPP shall be posted on the sign required by

subdivision B 4 of this section. If not provided electronically, access to the SWPPP may be arranged upon request at a time and at a publicly accessible location convenient to the operator or his designee but shall be no less than once per month and shall be during normal business hours. If a reproduced copy of the SWPPP is provided to the requestor, the requestor shall be responsible for the costs of reproduction. Information excluded from disclosure under applicable law shall not be required to be released Information not required to be contained within the SWPPP by this permit is not required to be released.]

C. Maintaining an updated SWPPP.

1. The operator shall amend the SWPPP whenever there is a change in design, construction, operation, or maintenance that has a significant effect on the discharge of pollutants to state waters and that has not been previously addressed in the SWPPP.

2. The SWPPP must be amended if during inspections or investigations by the operator's qualified personnel, or by local, state or federal officials, it is determined that the existing control measures are ineffective in minimizing pollutants in stormwater discharges from the construction site. Revisions to the SWPPP shall include additional or modified control measures designed to correct problems identified. If approval by a plan-approving authority is necessary for the control measure, revisions to the SWPPP shall be completed within seven calendar days of approval. Implementation of these additional or modified control measures must be accomplished as described in Section II D 3 b.

3. Revisions to the SWPPP must be dated and signed in accordance with Section III K 2, but are not required to be certified in accordance with Section III K 4.

4. The SWPPP must clearly identify the contractor(s) or subcontractor(s) that will implement and maintain each measure identified in the SWPPP. The SWPPP shall be revised to identify any new contractor that will implement a measure.

D. Stormwater pollution prevention plan contents. The SWPPP shall include the registration statement, this permit, and the following items:

1. Site and activity description. Each SWPPP shall provide the following information:

a. A narrative description of the nature of the construction activity, including the function of the project (e.g., low density residential, shopping mall, highway, etc.);

b. The intended sequence and timing of activities that disturb soils at the site (e.g., grubbing, excavation, grading, utilities and infrastructure installation);

c. A record of the dates when major grading activities occur, when construction activities temporarily or permanently cease on a portion of the site, and when stabilization measures are initiated;

d. Estimates of the total area expected to be disturbed by excavation, grading, or other construction activities including off-site borrow and fill areas;

e. A description of any other potential pollutant sources, such as vehicle fueling, storage of fertilizers or chemicals, sanitary waste facilities, etc.;

f. Identification of the nearest receiving waters at or near the construction site that will receive discharges from disturbed areas of the project;

g. The location and description of any discharge associated with industrial activity other than construction at the site. This includes stormwater discharges from dedicated asphalt plants and dedicated concrete plants that are covered by this permit;

h. A legible general location map (e.g., USGS quadrangle map, a portion of a city or county map, or other map) with sufficient detail to identify the location of the construction activity and surface waters within one mile of the construction activity; and

i. A legible site map identifying:

(1) Directions of stormwater flow and approximate slopes anticipated after major grading activities;

(2) Areas of soil disturbance and areas of the site which will not be disturbed;

(3) Locations of major structural and nonstructural control measures identified in the SWPPP, including those that will be permanent after construction activities have been completed;

(4) Locations where stabilization practices are expected to occur;

(5) Locations of surface waters;

(6) Locations where concentrated stormwater discharges;

(7) Locations of off-site material, waste, borrow or equipment storage areas covered by the SWPPP;

(8) Locations of other potential pollutant sources, such as vehicle fueling, storage of chemicals, concrete wash-out areas, sanitary waste facilities, including those temporarily placed on the construction site, etc.; and

(9) Areas where final stabilization has been accomplished.

2. Controls to minimize pollutants. The SWPPP shall include a description of all control measures that will be implemented as part of the construction activity to minimize pollutants in stormwater discharges. For each major activity identified in the project description, the SWPPP shall clearly describe appropriate control measures, the general sequencing during the construction process in which the control measures will be implemented, and which operator is responsible for the control measure's implementation.

a. Erosion and sediment controls.

(1) An erosion and sediment control plan or an agreement in lieu of a plan shall be approved by the appropriate plan-approving authority for the land-disturbing activity in accordance with the Virginia Erosion and Sediment Control Law (§ 10.1-560 et seq.) and regulations (4VAC50-30). Where applicable, a plan shall be developed in accordance with board-approved annual general erosion and sediment control specifications.

(2) All control measures required by the plan shall be designed, installed, and maintained in accordance with good engineering practices and the minimum

standards of the Virginia Erosion and Sediment Control Law (§ 10.1-560 et seq. of the Code of Virginia) and regulations (4VAC50-30).

b. Management practices.

(1) Plans should ensure that existing vegetation is preserved where possible and that disturbed portions of the site are stabilized.

(2) All control measures must be properly selected, installed, and maintained in accordance with good engineering practices and, where applicable, manufacturer specifications. If periodic inspections or other information indicates a control has been used inappropriately or incorrectly, the operator must replace or modify the control for site situations as soon as practicable and update the SWPPP in accordance with Section II C.

(3) If sediment escapes the construction site, off-site accumulations of sediment must be removed as soon as practicable to minimize off-site impacts. If approval by a plan-approving authority is necessary, control measures shall be implemented to minimize pollutants in stormwater discharges until such approvals can be obtained.

(4) Construction debris and construction chemicals exposed to stormwater shall be prevented from becoming a pollutant source in stormwater discharges.

(5) Litter exposed to stormwater shall be prevented from becoming a pollutant source in stormwater discharges and the construction site shall be policed daily to control litter.

c. Stormwater management.

(1) The operator shall ensure compliance with the requirements of 4VAC50-60-1180 through 4VAC50-60-1190 of the Virginia Stormwater Management Regulations, including but not limited to water quality and quantity requirements. The SWPPP shall include a description of, and all necessary calculations supporting, all post-construction stormwater management measures that will be installed prior to the completion of the construction process to control pollutants in stormwater discharges after construction operations have been completed. Structural measures should be placed on upland soils to the degree possible. Such measures must be designed and installed in accordance with applicable local, state, and federal requirements, and any necessary permits must be obtained.

(2) Control measures contained in Part II of the Virginia Stormwater Management Regulations, 4VAC50-60-1184, or on the Virginia BMP Clearinghouse may be utilized. Innovative or alternate control measures may be allowed by the department provided such measures effectively address water quality and quantity in accordance with the requirements of 4VAC50-60-1180 through 4VAC50-60-1190 and are not restricted by the locality.

(3) Where applicable, the SWPPP shall contain additional information related to participation in a regional stormwater management plan, including:

a. Type of regional facility or facilities to which the site contributes;

b. Geographic location of any regional facility to which the site contributes (county or city and Hydrologic Unit Code);

c. Geographic location of the site (county or city and Hydrologic Unit Code). Latitude and longitude may additionally be included if available; and

d. Number of acres treated by a regional facility.

(4) Where applicable, the SWPPP shall contain additional information related to nutrient offsets to be acquired in accordance with § 10.1-603.8:1 of the Code of Virginia, including:

a. Name of the broker from which offsets will be acquired;

b. Geographic location (county or city and Hydrologic Unit Code) of the broker's offset generating facility;

c. Number of nutrient offsets to be acquired (lbs. per acre per year); and

d. Nutrient reductions to be achieved on site (lbs. per acre per year).

(5) Outflows from a stormwater management facility or stormwater conveyance system shall be discharged to an adequate channel as defined in the Virginia Erosion and Sediment Control Regulations (4VAC50-30). In addition, all control measures shall be employed in a manner that minimizes impacts on the physical, chemical and biological integrity of rivers, streams, and other state waters, is protective of water quality standards, and is consistent with Section II D 6 and D 7 and other applicable provisions of this permit.

d. Other controls.

(1) The SWPPP shall describe measures to prevent the discharge of solid materials, including building materials, garbage, and debris to state waters, except as authorized by a Clean Water Act § 404 permit.

(2) The SWPPP shall describe control measures used to comply with applicable state or local waste disposal, sanitary sewer or septic system regulations.

(3) The SWPPP shall include a description of construction and waste materials expected to be stored on-site with updates as appropriate. The SWPPP shall also include a description of controls including storage practices, to minimize exposure of the materials to stormwater, and for spill prevention and response.

(4) The SWPPP shall include a description of pollutant sources from off-site areas (including stormwater discharges from dedicated asphalt plants and dedicated concrete plants), and a description of control measures that will be implemented at those sites to minimize pollutant discharges.

e. Applicable state or local programs. The control measures implemented at the site shall be consistent with all applicable federal, state, or local requirements for erosion and sediment control and stormwater management. The SWPPP shall be updated as necessary to reflect any revisions to applicable federal, state or local requirements that affect the control measures implemented at the site.

3. Maintenance of controls.

a. All control measures must be properly maintained in effective operating condition in accordance with good engineering practices and, where applicable, manufacturer specifications. If site inspections required by Section II D 4 identify control measures that are not operating effectively, maintenance shall be performed as soon as practicable to maintain the continued effectiveness of stormwater controls.

b. If site inspections required by Section II D 4 identify existing control measures that need to be modified or if additional control measures are necessary for any reason, implementation shall be completed before the next anticipated storm event. If implementation before the next anticipated storm event is impracticable, the situation shall be documented in the SWPPP and alternative control measures shall be implemented as soon as practicable.

4. Inspections. The name and phone number of qualified personnel conducting inspections shall be included in the SWPPP.

a. Inspections shall be conducted (i) at least every seven calendar days; or (ii) at least once every 14 calendar days and within 48 hours following any runoff producing storm event. Where areas have been temporarily stabilized or runoff is unlikely due to winter conditions (e.g., the site is covered with snow or ice, or frozen ground exists) such inspections shall be conducted at least once every month.

b. Inspections must include all areas of the site disturbed by construction activity, off-site areas covered by the permit, and areas used for storage of materials that are exposed to precipitation, but does not need to include areas identified pursuant to Section II A 5. Inspectors must look for evidence of, or the potential for, pollutants entering a stormwater conveyance system. Control measures identified in the SWPPP shall be inspected for proper installation, maintenance, and operation. Discharge locations, where accessible, shall be inspected to ascertain whether control measures are effective in minimizing impacts to receiving waters. Where discharge locations are inaccessible, nearby downstream locations shall be inspected to the extent that such inspections are practicable. Locations where vehicles enter or exit the site shall be inspected for evidence of off-site sediment tracking.

c. Utility line installation, pipeline construction, and other examples of long, narrow, linear construction activities may limit the access of inspection personnel to the areas described in Section II D 4 b. Inspection of these areas could require that vehicles compromise temporarily or even permanently stabilized areas, cause additional disturbance of soils, and increase the potential for erosion. In these circumstances, controls must be inspected on the same frequencies as other construction projects, but representative inspections may be performed. For representative inspections, personnel must inspect controls along the construction site for 0.25 miles above and below each access point where a roadway, undisturbed right-of-way, or other similar feature intersects the construction site and allows access to the areas described above. The conditions of the controls along each inspected 0.25-mile segment

may be considered as representative of the condition of controls along that reach extending from the end of the 0.25-mile segment to either the end of the next 0.25-mile segment, or to the end of the project, whichever occurs first. Inspection locations must be listed in the report required by Section II D 4 d.

d. A report summarizing the scope of the inspection, names and qualifications of personnel making the inspection, the dates of the inspection, major observations relating to the implementation of the SWPPP, and actions taken in accordance with Section II D 4 d of the permit shall be made and retained as part of the SWPPP in accordance with Section III B of this permit. Major observations should include:

(1) The location(s) of discharges of sediment or other pollutants from the site;

(2) Location(s) of control measures that need to be maintained;

(3) Location(s) of control measures that failed to operate as designed or proved inadequate for a particular location;

(4) Location(s) where additional control measures are needed that did not exist at the time of inspection;

(5) Corrective action required including any changes to the SWPPP that are necessary and implementation dates;

(6) An estimate of the amount of rainfall at the construction site (in inches) from the runoff producing storm event requiring the inspection, or if inspecting on a seven-day schedule, the amount of rainfall (in inches) since the previous inspection; and

(7) Weather information and a description of any discharges occurring at the time of inspection.

A record of each inspection and of any actions taken in accordance with Section II must be retained by the operator as part of the SWPPP for at least three years from the date that permit coverage expires or is terminated. The inspection reports shall identify any incidents of noncompliance. Where a report does not identify any incidents of noncompliance, the report shall contain a certification that the facility is in compliance with the SWPPP and this permit. The report shall be signed in accordance with Section III K of this permit.

5. Nonstormwater discharge management. The SWPPP shall identify all allowable sources of nonstormwater discharges listed in Section I D 2 of this permit that are combined with stormwater discharges from the construction activity at the site, except for flows from fire fighting activities. The SWPPP shall identify and require the implementation of appropriate control measures for the nonstormwater components of the discharge.

6. Total maximum daily loads. A total maximum daily load (TMDL) approved by the State Water Control Board may include a wasteload allocation to the regulated construction activity that identifies the pollutant for which stormwater control measures are necessary for the surface waters to meet water quality standards. The pollutant identified in a wasteload allocation as of the effective date of this permit must be specified in the SWPPP. The SWPPP shall include strategies and control measures to ensure consistency with the assumptions and requirements of

the TMDL WLA that apply to the operator's discharge. In a situation where a TMDL has specified a general wasteload allocation applicable to construction stormwater discharges, but no specific requirements for construction sites have been identified in the TMDL, the operator shall consult with the state or federal TMDL authority to confirm that meeting permit requirements will be consistent with the approved TMDL. If the TMDL specifically precludes such discharges, the operator is not eligible for coverage under the general permit.

7. Impaired waters. In accordance with Section I H, control measures shall be protective of water quality standards for impaired waters identified as having impairments for pollutants that may be discharged from the construction activity in the 2008 § 305(b)/303(d) Water Quality Assessment Integrated Report .

SECTION III
CONDITIONS APPLICABLE TO ALL VSMP PERMITS

NOTE: Discharge monitoring is not required for this permit. If the operator chooses to monitor stormwater discharges or control measures, the operator must comply with the requirements of subsections A, B, and C, as appropriate.

A. Monitoring.

1. Samples and measurements taken for the purpose of monitoring shall be representative of the monitoring activity.

2. Monitoring shall be conducted according to procedures approved under 40 CFR Part 136 (2001) or alternative methods approved by the U.S. Environmental Protection Agency, unless other procedures have been specified in this permit.

3. The operator shall periodically calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals that will ensure accuracy of measurements.

B. Records.

1. Monitoring records and reports shall include:

a. The date, exact place, and time of sampling or measurements;

b. The individual(s) who performed the sampling or measurements;

c. The date(s) and time(s) analyses were performed;

d. The individual(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of such analyses.

2. The operator shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the registration statement for this permit, for a period of at least three years from the date of the sample, measurement, report or request for coverage. This period of retention shall be extended automatically during the course of any unresolved litigation regarding

the regulated activity or regarding control standards applicable to the operator, or as requested by the board.

C. Reporting monitoring results.

1. The operator shall update the SWPPP to include the results of the monitoring as may be performed in accordance with this permit, unless another reporting schedule is specified elsewhere in this permit.

2. Monitoring results shall be reported on a discharge monitoring report (DMR); on forms provided, approved or specified by the department; or in any format provided that the date, location, parameter, method, and result of the monitoring activity are included.

3. If the operator monitors any pollutant specifically addressed by this permit more frequently than required by this permit using test procedures approved under 40 CFR Part 136 (2001) or using other test procedures approved by the U.S. Environmental Protection Agency or using procedures specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR or reporting form specified by the department.

4. Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in this permit.

D. Duty to provide information. The operator shall furnish, within a reasonable time, any information which the board, department, or other permit-issuing authority may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The board, department, or other permit-issuing authority may require the operator to furnish, upon request, such plans, specifications, and other pertinent information as may be necessary to determine the effect of the wastes from his discharge on the quality of state waters, or such other information as may be necessary to accomplish the purposes of the CWA and the Virginia Stormwater Management Act. The operator shall also furnish to the board, department, or other permit-issuing authority, upon request, copies of records required to be kept by this permit.

E. Compliance schedule reports. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

F. Unauthorized stormwater discharges. Pursuant to § 10.1-603.2:2 A of the Code of Virginia, except in compliance with a permit issued by the permit-issuing authority, it shall be unlawful to cause a stormwater discharge from a construction activity.

G. Reports of unauthorized discharges. Any operator who discharges or causes or allows a discharge of sewage, industrial waste, other wastes or any noxious or deleterious substance or a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110 (2002), 40 CFR Part 117 (2002), or 40 CFR Part 302 (2002) that occurs during a 24-hour period into or upon state waters or who discharges or causes or allows a discharge that may reasonably be expected to enter state waters, shall notify the Department of Environmental Quality of the discharge immediately upon discovery of the discharge, but in no case later than within 24 hours after said discovery. A written report of the unauthorized discharge shall

be submitted to the department, the Department of Environmental Quality, and the permit-issuing authority within five days of discovery of the discharge. The written report shall contain:

1. A description of the nature and location of the discharge;

2. The cause of the discharge;

3. The date on which the discharge occurred;

4. The length of time that the discharge continued;

5. The volume of the discharge;

6. If the discharge is continuing, how long it is expected to continue;

7. If the discharge is continuing, what the expected total volume of the discharge will be; and

8. Any steps planned or taken to reduce, eliminate and prevent a recurrence of the present discharge or any future discharges not authorized by this permit.

Discharges reportable to the department, the Department of Environmental Quality, and the permit-issuing authority under the immediate reporting requirements of other regulations are exempted from this requirement.

H. Reports of unusual or extraordinary discharges. If any unusual or extraordinary discharge including a "bypass" or "upset", as defined herein, should occur from a facility and the discharge enters or could be expected to enter state waters, the operator shall promptly notify, in no case later than within 24 hours, the department, the Department of Environmental Quality, and the permit-issuing authority by telephone after the discovery of the discharge. This notification shall provide all available details of the incident, including any adverse effects on aquatic life and the known number of fish killed. The operator shall reduce the report to writing and shall submit it to the department, the Department of Environmental Quality, and the permit-issuing authority within five days of discovery of the discharge in accordance with Section III I 2. Unusual and extraordinary discharges include but are not limited to any discharge resulting from:

1. Unusual spillage of materials resulting directly or indirectly from processing operations;

2. Breakdown of processing or accessory equipment;

3. Failure or taking out of service of some or all of the facilities; and

4. Flooding or other acts of nature.

I. Reports of noncompliance. The operator shall report any noncompliance which may adversely affect state waters or may endanger public health.

1. An oral report to the department, the Department of Environmental Quality, and the permit-issuing authority shall be provided within 24 hours from the time the operator becomes aware of the circumstances. The following shall be included as information that shall be reported within 24 hours under this subdivision:

a. Any unanticipated bypass; and

b. Any upset that causes a discharge to state waters.

2. A written report shall be submitted within five days and shall contain:

a. A description of the noncompliance and its cause;

b. The period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and

c. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

The permit-issuing authority may waive the written report on a case-by-case basis for reports of noncompliance under Section III I if the oral report has been received within 24 hours and no adverse impact on state waters has been reported.

3. The operator shall report all instances of noncompliance not reported under Section III I 1 or 2 in writing as part of the SWPPP. The reports shall contain the information listed in Section III I 2.

NOTE: The reports required in Section III G, H and I shall be made to the department's Stormwater Program Section of the Division of Soil and Water Conservation, appropriate Department of Environmental Quality's Regional Office Pollution Response Program, and the permit-issuing authority. Reports may be made by telephone or by fax. For reports outside normal working hours, leaving a recorded message shall fulfill the immediate reporting requirement. For emergencies, the Virginia Department of Emergency Management maintains a 24-hour telephone service at 1-800-468-8892.

4. Where the operator becomes aware of a failure to submit any relevant facts, or submittal of incorrect information in any report, including a registration statement, to the department or the permit-issuing authority, the operator shall promptly submit such facts or correct information.

J. Notice of planned changes.

1. The operator shall give notice to the permit-issuing authority as soon as possible of any planned physical alterations or additions to the permitted facility or activity. Notice is required only when:

a. The operator plans an alteration or addition to any building, structure, facility, or installation that may meet one of the criteria for determining whether a facility is a new source in 4VAC50-60-420;

b. The operator plans an alteration or addition that would significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants that are not subject to effluent limitations in this permit; or

2. The operator shall give advance notice to the permit-issuing authority of any planned changes in the permitted facility or activity, which may result in noncompliance with permit requirements.

K. Signatory requirements.

1. Registration statement. All registration statements shall be signed as follows:

a. For a corporation: by a responsible corporate officer. For the purpose of this part, a responsible corporate officer means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy-making or decision-making

functions for the corporation; or (ii) the manager of one or more manufacturing, production, or operating facilities, provided the manager is authorized to make management decisions that govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

c. For a municipality, state, federal, or other public agency: by either a principal executive officer or ranking elected official. For purposes of this part, a principal executive officer of a public agency includes: (i) the chief executive officer of the agency or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

2. Reports, etc. All reports required by permits, including SWPPPs, and other information requested by the board, the department, or the permit-issuing authority shall be signed by a person described in Section III K 1 or by a duly authorized representative of that person. A person is a duly authorized representative only if:

a. The authorization is made in writing by a person described in Section III K 1;

b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the operator. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and

c. The signed and dated written authorization is included in the SWPPP. A copy must be provided to the permit-issuing authority, if requested.

3. Changes to authorization. If an authorization under Section III K 2 is no longer accurate because a different individual or position has responsibility for the overall operation of the construction activity, a new authorization satisfying the requirements of Section III K 2 shall be submitted to the permit-issuing authority prior to or together with any reports or information to be signed by an authorized representative.

4. Certification. Any person signing a document under Section III K 1 or 2 shall make the following certification:

"I certify under penalty of law that I have read and understand this document and that this document and all attachments were prepared in accordance with a system

designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

L. Duty to comply. The operator shall comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Virginia Stormwater Management Act and the Clean Water Act, except that noncompliance with certain provisions of this permit may constitute a violation of the Virginia Stormwater Management Act but not the Clean Water Act. Permit noncompliance is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

The operator shall comply with effluent standards or prohibitions established under § 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions or standards for sewage sludge use or disposal, even if this permit has not yet been modified to incorporate the requirement.

M. Duty to reapply. If the operator wishes to continue an activity regulated by this permit after the expiration date of this permit, the operator shall submit a new registration statement at least 90 days before the expiration date of the existing permit, unless permission for a later date has been granted by the board. The board shall not grant permission for registration statements to be submitted later than the expiration date of the existing permit.

N. Effect of a permit. This permit does not convey any property rights in either real or personal property or any exclusive privileges, nor does it authorize any injury to private property or invasion of personal rights, or any infringement of federal, state or local law or regulations.

O. State law. Nothing in this permit shall be construed to preclude the institution of any legal action under, or relieve the operator from any responsibilities, liabilities, or penalties established pursuant to any other state law or regulation or under authority preserved by § 510 of the Clean Water Act. Except as provided in permit conditions on "bypassing" (Section III U) and "upset" (Section III V), nothing in this permit shall be construed to relieve the operator from civil and criminal penalties for noncompliance.

P. Oil and hazardous substance liability. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the operator from any responsibilities, liabilities, or penalties to which the operator is or may be subject under §§ 62.1-44.34:14 through 62.1-44.34:23 of the State Water Control Law or § 311 of the Clean Water Act.

Q. Proper operation and maintenance. The operator shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances), which are installed or used by the operator to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes effective plant performance, adequate funding, adequate staffing, and adequate laboratory and

process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems, which are installed by the operator only when the operation is necessary to achieve compliance with the conditions of this permit.

R. Disposal of solids or sludges. Solids, sludges or other pollutants removed in the course of treatment or management of pollutants shall be disposed of in a manner so as to prevent any pollutant from such materials from entering state waters and in compliance with all applicable state and federal laws and regulations.

S. Duty to mitigate. The operator shall take all reasonable steps to minimize or prevent any discharge in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

T. Need to halt or reduce activity not a defense. It shall not be a defense for an operator in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

U. Bypass.

1. "Bypass", as defined in 4VAC50-60-10, means the intentional diversion of waste streams from any portion of a treatment facility. The operator may allow any bypass to occur that does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to ensure efficient operation. These bypasses are not subject to the provisions of Section III U 2 and 3 herein.

2. Notice.

a. Anticipated bypass. If the operator knows in advance of the need for a bypass, the operator shall submit prior notice to the department, if possible at least 10 days before the date of the bypass.

b. Unanticipated bypass. The operator shall submit notice of an unanticipated bypass as required in Section III I herein.

3. Prohibition of bypass.

a. Except as provided in Section III U 1, bypass is prohibited, and the permit-issuing authority may take enforcement action against an operator for bypass unless:

(1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage. Severe property damage means substantial physical damage to property, damage to the treatment facilities that causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production;

(2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventive maintenance; and

(3) The operator submitted notices as required under Section III U 2.

b. The permit-issuing authority may approve an anticipated bypass, after considering its adverse effects, if the permit-issuing authority determines that it will meet the three conditions listed in Section III U 3 a.

V. Upset.

1. An upset, as defined in 4VAC50-60-10, means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the operator. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

2. An upset constitutes an affirmative defense to an action brought for noncompliance with technology-based permit effluent limitations if the requirements of Section III V 2 herein are met. A determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is not a final administrative action subject to judicial review.

3. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

4. An operator who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that:

a. An upset occurred and that the operator can identify the cause(s) of the upset;

b. The permitted facility was at the time being properly operated;

c. The operator submitted notice of the upset as required in Section III I herein; and

d. The operator complied with any remedial measures required under Section III S herein.

5. In any enforcement proceeding, the operator seeking to establish the occurrence of an upset has the burden of proof.

W. Inspection and entry. The operator shall allow the department as the board's designee, the permit-issuing authority, EPA, or an authorized representative of either entity (including an authorized contractor), upon presentation of credentials and other documents as may be required by law to:

1. Enter upon the operator's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect and photograph at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

4. Sample or monitor at reasonable times, for the purposes of ensuring permit compliance or as otherwise authorized by the Clean Water Act or the Virginia Stormwater Management Act, any substances or parameters at any location.

For purposes of this section, the time for inspection shall be deemed reasonable during regular business hours, and whenever the facility is discharging. Nothing contained herein shall make an inspection unreasonable during an emergency.

X. Permit actions. Permits may be modified, revoked and reissued, or terminated for cause. The filing of a request by the operator for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

Y. Transfer of permits.

1. Permits are not transferable to any person except after notice to the permit-issuing authority. Except as provided in Section III Y 2, a permit may be transferred by the operator to a new operator only if the permit has been modified or revoked and reissued, or a minor modification made, to identify the new operator and incorporate such other requirements as may be necessary under the Virginia Stormwater Management Act and the Clean Water Act.

2. As an alternative to transfers under Section III Y 1, this permit may be automatically transferred to a new operator if:

a. The current operator notifies the permit-issuing authority at least 30 days in advance of the proposed transfer of the title to the facility or property;

b. The notice includes a written agreement between the existing and new operators containing a specific date for transfer of permit responsibility, coverage, and liability between them; and

c. The permit-issuing authority does not notify the existing operator and the proposed new operator of its intent to modify or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in Section III Y 2 b.

3. For ongoing construction activity involving a change of operator, the new operator shall accept and maintain the existing SWPPP, or prepare and implement a new SWPPP prior to taking over operations at the site.

Z. Severability. The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

4VAC50-60-1180. Applicability.

Operators receiving coverage under this general permit shall remain subject to the water quality and quantity criteria set forth in 4VAC50-60-1182 through 4VAC50-60-1190, which specify technical criteria for every land-disturbing activity regulated by this general permit.

4VAC50-60-1182. General.

A. Determination of flooding and channel erosion impacts to receiving streams due to land-disturbing activities shall be measured at each point of discharge from the land disturbance and such determination shall include any runoff from the balance of the watershed that also contributes to that point of discharge.

B. The specified design storms shall be defined as either a 24-hour storm using the rainfall distribution recommended by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) when using NRCS methods or as the storm of critical duration that produces the greatest required storage volume at the site when using a design method such as the Modified Rational Method.

C. For purposes of computing runoff, all pervious lands in the site shall be assumed prior to development to be in good condition (if the lands are pastures, lawns, or parks), with good cover (if the lands are woods), or with conservation treatment (if the lands are cultivated); regardless of conditions existing at the time of computation.

D. Construction of stormwater management facilities or modifications to channels shall comply with all applicable laws and regulations. Evidence of approval of all necessary permits shall be presented.

E. Impounding structures that are not covered by the Impounding Structure Regulations (4VAC50-20) shall be engineered for structural integrity during the 100-year storm event.

F. Predevelopment and postdevelopment runoff rates shall be verified by calculations that are consistent with good engineering practices.

G. Outflows from a stormwater management facility or stormwater conveyance system, shall be discharged to an adequate channel.

H. Proposed residential, commercial, or industrial subdivisions shall apply these stormwater management criteria to the land disturbance as a whole. Individual lots in new subdivisions shall not be considered separate land-disturbing activities, but rather the entire subdivision shall be considered a single land development project. Hydrologic parameters shall reflect the ultimate land disturbance and shall be used in all engineering calculations.

I. All stormwater management facilities shall have an inspection and maintenance plan that identifies the owner and the responsible party for carrying out the inspection and maintenance plan.

J. Construction of stormwater management impoundment structures within a Federal Emergency Management Agency (FEMA) designated 100-year floodplain shall be avoided to the extent possible. When this is unavoidable, all stormwater management facility construction shall be in compliance with all applicable regulations under the National Flood Insurance Program, 44 CFR Part 59.

K. Natural channel characteristics shall be preserved to the maximum extent practicable.

L. Land-disturbing activities shall comply with the Virginia Erosion and Sediment Control Law (§ 10.1-560 et seq. of the Code of Virginia) and attendant regulations.

M. Flood control and stormwater management facilities that drain or treat water from multiple development projects or from a significant portion of a watershed may be allowed in Resource Protection Areas defined in the Chesapeake Bay Preservation Act, provided that (i) the local government has conclusively established that the location of the facility within the Resource Protection Area is the optimum location; (ii) the size of the facility is the minimum necessary to provide necessary flood control, stormwater treatment, or both; and (iii) the facility must be consistent with a stormwater management program that has been approved by the board, the Chesapeake Bay Local Assistance Board, or the Board of Conservation and Recreation.

4VAC50-60-1184. Water quality.

A. Compliance with the water quality criteria may be achieved by applying the performance-based criteria or the technology-based criteria to either the site or a planning area.

B. Performance-based criteria. For land-disturbing activities, the calculated postdevelopment nonpoint source pollutant runoff load shall be compared to the calculated predevelopment load based upon the average land cover condition or the existing site condition. A BMP shall be located, designed, and maintained to achieve the target pollutant removal efficiencies specified in Table 1 of this section to effectively reduce the pollutant load to the required level based upon the following four applicable land development situations for which the performance criteria apply:

1. Situation 1 consists of land-disturbing activities where the existing percent impervious cover is less than or equal to the average land cover condition and the proposed improvements will create a total percent impervious cover that is less than the average land cover condition.

Requirement: No reduction in the after disturbance pollutant discharge is required.

2. Situation 2 consists of land-disturbing activities where the existing percent impervious cover is less than or equal to the average land cover condition and the proposed improvements will create a total percent impervious cover that is greater than the average land cover condition.

Requirement: The pollutant discharge after disturbance shall not exceed the existing pollutant discharge based on the average land cover condition.

3. Situation 3 consists of land-disturbing activities where the existing percent impervious cover is greater than the average land cover condition.

Requirement: The pollutant discharge after disturbance shall not exceed (i) the pollutant discharge based on existing conditions less 10% or (ii) the pollutant discharge based on the average land cover condition, whichever is greater.

4. Situation 4 consists of land-disturbing activities where the existing percent impervious cover is served by an existing stormwater management BMP that addresses water quality.

Requirement: The pollutant discharge after disturbance shall not exceed the existing pollutant discharge based on the existing percent impervious cover while

served by the existing BMP. The existing BMP shall be shown to have been designed and constructed in accordance with proper design standards and specifications, and to be in proper functioning condition.

C. Technology-based criteria. For land-disturbing activities, the postdeveloped stormwater runoff from the impervious cover shall be treated by an appropriate BMP as required by the postdeveloped condition percent impervious cover as specified in Table 1 of this section. The selected BMP shall be located, designed, and maintained to perform at the target pollutant removal efficiency specified in Table 1. Design standards and specifications for the BMPs in Table 1 that meet the required target pollutant removal efficiency will be available at the department.

Table 1*

Water Quality BMP*	Target Phosphorus Removal Efficiency	Percent Impervious Cover
Vegetated filter strip	10%	16-21%
Grassed Swale	15%	
Constructed wetlands	20%	22-37%
Extended detention (2 x WQ Vol)	35%	
Retention basin I (3 x WQ Vol)	40%	
Bioretention basin	50%	38-66%
Bioretention filter	50%	
Extended detention-enhanced	50%	
Retention basin II (4 x WQ Vol)	50%	
Infiltration (1 x WQ Vol)	50%	
Sand filter	65%	67-100%
Infiltration (2 x WQ Vol)	65%	
Retention basin III (4 x WQ Vol with aquatic bench)	65%	

*Innovative or alternate BMPs not included in this table may be allowed at the discretion of the local program administrator or the department. Innovative or alternate BMPs not included in this table that target appropriate nonpoint source pollution other than phosphorous may be allowed at the discretion of the local program administrator or the department.

4VAC50-60-1186. Stream channel erosion.

A. Properties and receiving waterways downstream of any land-disturbing activity shall be protected from erosion and damage due to changes in runoff rate of flow and hydrologic characteristics, including but not limited to, changes in volume, velocity, frequency, duration, and peak flow rate of stormwater runoff in accordance with the minimum design standards set out in this section.

B. The permit-issuing authority shall require compliance with subdivision 19 of 4VAC50-30-40 of the Erosion and Sediment Control Regulations, promulgated pursuant to Article 4 (§ 10.1-560 et seq.) of Chapter 5 of Title 10.1 of the Code of Virginia.

C. The permit-issuing authority may determine that some watersheds or receiving stream systems require enhanced criteria in order to address the increased frequency of bankfull flow conditions (top of bank) brought on by land-disturbing activities. Therefore, in lieu of the reduction of the two-year post-developed peak rate of runoff as required in subsection B of this section, the land development project being considered shall provide 24-hour extended detention of the runoff generated by the one-year, 24-hour duration storm.

D. In addition to subsections B and C of this section, permit-issuing authorities, by local ordinance may, or the board by state regulation may, adopt more stringent channel analysis criteria or design standards to ensure that the natural level of channel erosion, to the maximum extent practicable, will not increase due to the land-disturbing activities. These criteria may include, but are not limited to, the following:

1. Criteria and procedures for channel analysis and classification.

2. Procedures for channel data collection.

3. Criteria and procedures for the determination of the magnitude and frequency of natural sediment transport loads.

4. Criteria for the selection of proposed natural or manmade channel linings.

4VAC50-60-1188. Flooding.

A. Downstream properties and waterways shall be protected from damages from localized flooding due to changes in runoff rate of flow and hydrologic characteristics, including but not limited to, changes in volume, velocity, frequency, duration, and peak flow rate of stormwater runoff in accordance with the minimum design standards set out in this section.

B. The 10-year postdeveloped peak rate of runoff from the development site shall not exceed the 10-year predeveloped peak rate of runoff.

C. In lieu of subsection B of this section, localities may, by ordinance, adopt alternate design criteria based upon geographic, land use, topographic, geologic factors or other downstream conveyance factors as appropriate.

D. Linear development projects shall not be required to control post-developed stormwater runoff for flooding, except in accordance with a watershed or regional stormwater management plan.

4VAC50-60-1190. Regional (watershed-wide) stormwater management plans.

This section enables localities to develop regional stormwater management plans. State agencies intending to develop large tracts of land such as campuses or prison compounds are encouraged to develop regional plans where practical.

The objective of a regional stormwater management plan is to address the stormwater management concerns in a given watershed with greater economy and efficiency by installing regional stormwater management facilities versus individual, site-specific facilities. The result will be fewer stormwater management facilities to design, build and maintain in the affected watershed. It is also anticipated that regional stormwater management facilities will not only help mitigate the impacts of new development, but may also provide for the remediation of erosion, flooding or water quality problems caused by existing development within the given watershed.

If developed, a regional plan shall, at a minimum, address the following:

1. The specific stormwater management issues within the targeted watersheds.

2. The technical criteria in 4VAC50-60-1180 through 4VAC50-60-1188 as needed based on subdivision 1 of this section.

3. The implications of any local comprehensive plans, zoning requirements, local ordinances pursuant to the Chesapeake Bay Preservation Area Designation and Management Regulations adopted pursuant to the Chesapeake Bay Preservation Act, and other planning documents.

4. Opportunities for financing a watershed plan through cost sharing with neighboring agencies or localities, implementation of regional stormwater utility fees, etc.

5. Maintenance of the selected stormwater management facilities.

6. Future expansion of the selected stormwater management facilities in the event that development exceeds the anticipated level.

Appendix C

Certification Statement

CERTIFICATION STATEMENT

Construction Site Operator or duly authorized representative

I certify under penalty that this document and all the attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage(s) the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Brian Woodward

Name

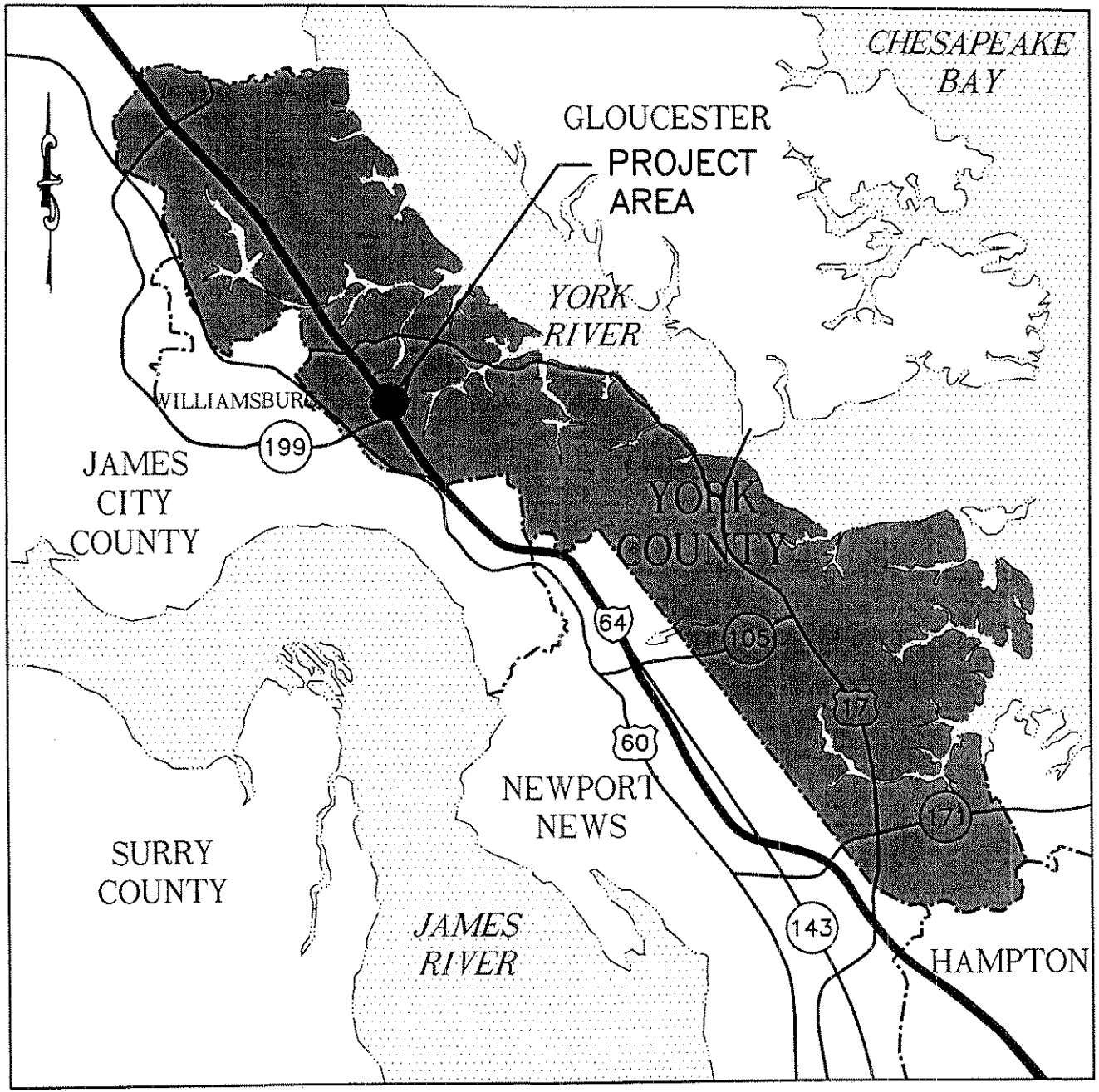
Chief of Utilities

Title

Date

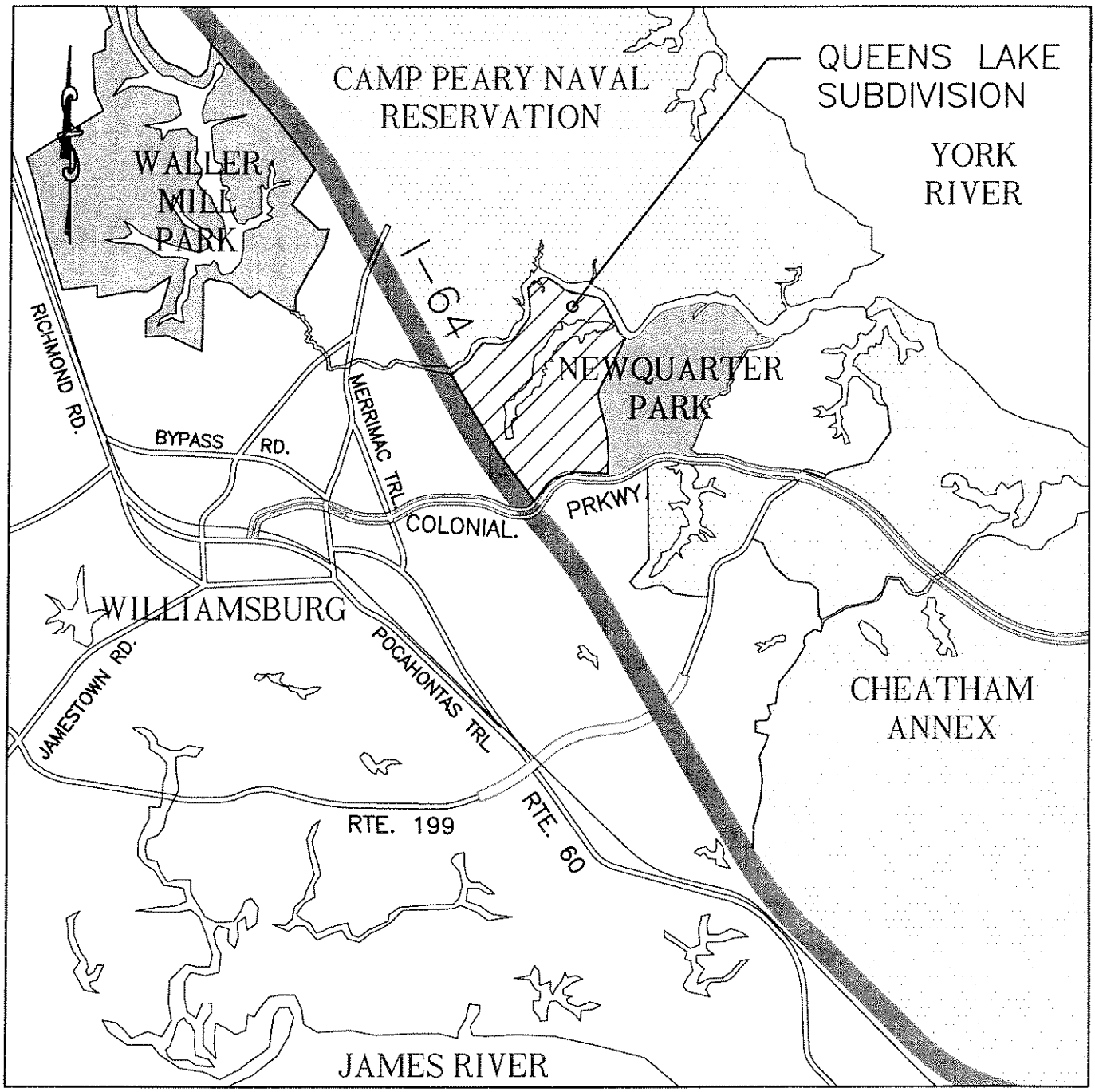
Appendix D

Site Vicinity Map



VICINITY MAP

SCALE: 1" = 18,000'



VICINITY MAP

SCALE: 1" = 6,000'

Appendix E

Erosion and Sediment Control Narrative

Erosion and Sediment Control Narrative

Management Strategies and Sequence of Erosion Control Measures

Unless otherwise indicated, all erosion and sediment control practices shall be constructed and maintained in accordance with the latest edition of the Virginia Erosion & Sediment Control (VE&SCR) Regulations, VE&SC Handbook and York County Erosion and Sedimentation Control Ordinance.

The following sequence of events and erosion control measures shall be incorporated into the construction schedule for this project and shall apply to all construction activities within project limits:

1a. Temporary construction entrance(s) shall be provided as necessary. This entrance(s) shall be constructed in accordance with the Virginia Erosion and Sediment Control Handbook (Std. & Spec. 3.02). Wash racks are to be provided where water is available.

1b. Where construction vehicle access routes intersect paved public roads, provisions shall be made to minimize the transport of sediment onto the paved surface. Where sediment is transported onto a public road surface, the road shall be cleaned thoroughly at the end of each day. Sediment shall be removed from the roads by shoveling or sweeping and transported to a sediment control disposal area (street washing shall be allowed only after sediment is removed in this manner).

1c. Construction traffic shall be limited to access roads. All traffic is prohibited from crossing drainage swales and streams except where absolutely necessary (Std. & Spec. 3.24 VE&SC Handbook).

2. Temporary sediment traps, sediment barriers, construction entrance, and erosion control stone are to be placed prior to clearing and grubbing.

3. All permanent storm water management facilities including erosion control are to be installed and made operational at the start of clearing operations, including approved sediment basins.

4. The contractor shall complete drainage facilities within thirty (30) days following completion of rough grading at any point within the project.

5. Construction will be sequenced so that grading operations can begin and end as quickly as possible.

6. Areas which are not to be disturbed shall be clearly marked by fencing, flags, signs, etc.

7a. Permanent or temporary soil stabilization shall be applied to denuded areas within seven (7) days after final grade is reached of any portion of the site. Temporary soil stabilization shall be applied within seven (7) days to denuded areas that may not be at final grade but will remain dormant (undisturbed) for longer than thirty (30) days. Permanent stabilization shall be applied to areas that are to be left dormant for more than one (1) year.

7b. During construction of the project, soil stockpiles shall be stabilized or protected with sediment trapping measures. The contractor is responsible for the temporary protection and permanent stabilization of all soil stockpiles on site as well as soil intentionally transported from the project site.

7c. A permanent vegetative cover shall be established on denuded areas not otherwise permanently stabilized. Permanent vegetation shall not be considered established until a ground cover is achieved that, in the opinion of the county, is uniform, mature enough to survive and will inhibit erosion. Vegetal cover shall be established as specified in the Hampton Roads Regional Construction Standards.

(Hydroseeding may be used in place of mulching on areas other than ditch banks). Stabilization measures shall be applied to earthen structures such as dams, diversions, and ditch or watercourse beds and banks immediately after installation (Std. & Spec. 3.36 VE&SC Handbook).

8a. All storm sewer inlets that are made operable during construction shall be protected so that sediment-laden water cannot enter the conveyance system without first being filtered or otherwise treated to remove sediment.

8b. Before newly constructed conveyance channels are made operational, adequate outlet protection and any required temporary or permanent channel lining shall be installed in both the conveyance channel and receiving channel.

9a. Cut and fill slopes shall be designed and constructed in a manner that will minimize erosion. Slopes that are found to be eroding excessively within one (1) year of permanent stabilization shall be reestablished to plan grade and provided with additional slope stabilizing measures until the problem is corrected.

9b. Concentrated runoff shall not flow down cut or fill slopes unless contained within an adequate temporary or permanent channel, flume, or slope drain structure.

10. Periodic inspections and required maintenance must be provided, especially after each significant storm. The project superintendent shall be responsible for the installation and maintenance of all erosion and sediment control practices.

11. All temporary erosion and sediment control measures shall be removed within thirty (30) days after final site stabilization or after the temporary measures are no longer needed, unless otherwise authorized by the county. Trapped sediment and the disturbed soils areas resulting from the disposition of temporary measures shall be permanently stabilized to prevent further erosion and sedimentation.

Maintenance

In general, all erosion and sedimentation control measures shall be checked after each rainfall or weekly, whichever is most frequent, and should be cleaned and repaired according to the following schedule:

1. All sediment traps, silt fence check dams and culvert/drop inlet protection measures will be checked regularly for sediment cleanout.

2. All sediment basins will be cleaned out when the level of sediment buildup reaches the cleanout point indicated on the riser pipe.

3. Erosion and sediment control will be checked regularly for undermining or deterioration and buildup or clogging with sediment. Corrective action will be taken immediately.

4. All seeded areas will be checked regularly to see that a good stand is maintained. Areas should be watered, fertilized, reseeded, and mown as needed.

5. All temporary erosion and sediment measures shall be disposed of within thirty (30) days after final site stabilization is achieved and vegetation is established.

Erosion Control and Construction Sequencing

1. Acquire all necessary permits.

2. Install silt fencing around project sites and around existing drainage structures and maintain throughout construction.

3. Install temporary construction entrance and establish perimeter protection and maintain throughout construction.

4. Install tree protection.

5. Where required clear and grub site and stock pile stripped material and install additional erosion control measures as needed.

6. Install underground utilities, structures and storm drainage and provide sediment traps or other approved protection at new drainage structures.

7. Grade all disturbed areas.

8. Dress and overseed all disturbed areas, maintain vegetative cover throughout the duration of project.

9. Maintain protection at drainage structures.

10. Repair any inadvertent erosion and remove accumulated sedimentation.

11. Fine grade & topsoil disturbed areas, establish permanent vegetation.

12. Remove remaining temporary sediment and erosion control measures within thirty days after final site is stabilized with vegetative crops.

Appendix F

Please see drawings G-4, C-1 and C-2 for the Erosion & Sediment Control Plan.

Appendix G

Pollutant Descriptions and Possible Locations

Table 1

Potential Construction Site Storm Water Pollutants

Trade Name of Material	Chemical/Physical Description	Storm Water Pollutants
Antifreeze & Coolant	Green liquid with mild odor; very soluble in water.	Diethylene Glycol
Diesel Fuel	Clear to amber, blue, or red liquid; mild petroleum odor. Insoluble in water.	Petroleum distillate, oil & grease, naphthalene, xylenes, and hydrocarbons.
Hydraulic Fluid	Brown oily petroleum; hydrocarbons.	Refined heavy paraffinic distillates.
Lubricant Grease	Dark, amber, smooth solid; slight odor.	Mineral oil, petroleum distillates, hydro treated (mild), heavy parafinic.
Motor Oil	Amber and bright; insoluble in water.	Base lubricant oil mixture, hydrocarbons.
Unleaded Gasoline	Colorless, pale brown or pink; petroleum hydrocarbons.	Ethyl benzene, toluene, xylene, MTBE.
Erosion/fugitive sediment	Solid particles.	Soil, sediment.
Fertilizer	White granules of powder.	Nitrogen and phosphorus.

Appendix H

DCR01 Coverage Termination

DCR
Department of Conservation & Recreation

VSMP General Permit Notice Of Termination - Construction Activity Stormwater Discharges (DCR01)

(Please Type or Print All Information)

1. **Construction Activity Operator**

   Name:_____

   Mailing Address:_____

   City:_____ State:_____ Zip:_____ Phone:_____

2. **Location of Construction Activity**

   Name:_____

   Address:_____

   City:_____ State:_____ Zip:_____

   If street address unavailable: Latitude _____ Longitude _____

3. **VSMP Stormwater General Permit Number:** _____

4. **The Reason for Terminating Coverage Under the General Permit** (Note: The construction activity operator may only submit a Notice of Termination after one or more of the conditions below have been met):

   ❑ **Final stabilization has been achieved on all portions of the site for which the operator is responsible;**

   ❑ **Another operator has assumed control over all areas of the site that have not been finally stabilized;**

   ❑ **Coverage under an alternative VPDES or VSMP permit has been obtained; or**

   ❑ **For residential construction only, temporary stabilization has been completed and the residence has been transferred to the homeowner.**

NOTE: The Notice of Termination must be submitted within 30 days of one of the above conditions being met. Authorization to discharge terminates seven (7) days after the Notice of Termination is submitted. For the purposes of this permit, a Notice of Termination that is mailed is considered to be submitted once it is postmarked.

5. **Certification:**
   "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations."

   Print Name: _____ Title: _____

   Signature:_____ Date:_____

(Please sign in INK. The person signing this form must be associated with the operator identified in Item #1 above.)

For Department of Conservation and Recreation Use Only

Accepted/Not Accepted by: _____ Date:_____

DCR
Department of Conservation & Recreation
CONSERVING NATURAL & CULTURAL RESOURCES

INSTRUCTIONS for FORM DCR 199-147

VSMP General Permit Notice Of Termination - Construction Activity Stormwater Discharges

General
A VSMP General Permit Notice of Termination must be submitted when an operator no longer wishes to be covered under a VSMP General Permit for Stormwater Discharges From Construction Activities. Mail the completed form to: The Department of Conservation and Recreation, Stormwater Permitting, 203 Governor Street, Suite 206, Richmond, Virginia 23219.

Section 1 Activity Operator Information
Give the legal name of the person, firm, public organization, or any other entity that was issued the general permit for the site described in this Notice of Termination. Do not use a colloquial name. Enter the complete address and phone number of the operator.

Section 2 Activity Location Information
Enter the activity's official name and complete street address, including city, state and ZIP code. If the activity or site lacks a street address, indicate the latitude and longitude to the nearest 15 seconds of the approximate center of the site.

Section 3 Permit Information
Enter the existing VSMP Stormwater General Permit number assigned to the activity or site identified in Section 1.

Section 4 Reason for Termination
Check the appropriate statement indicating the reason for submitting this Notice of Termination. The Notice of Termination may only be submitted after one or more of the following conditions have been met:

1. Final stabilization has been achieved on all portions of the site for which the operator is responsible;

2. Another operator has assumed control over all areas of the site that have not been finally stabilized;

3. Coverage under an alternative VPDES or VSMP permit has been obtained; or

4. For residential construction only, temporary stabilization has been completed and the residence has been transferred to the homeowner.

The Notice of Termination must be submitted within 30 days of one of the above conditions being met. Authorization to discharge terminates seven (7) days after the Notice of Termination is submitted. For the purposes of this permit, a Notice of Termination that is mailed is considered to be submitted once it is postmarked.

Section 5 Certification
State statutes provide for severe penalties for submitting false information on this Notice of Termination.

State regulations require this Notice of Termination to be signed as follows:

For a corporation: by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means: (1) A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (2) the manager of one or more manufacturing, production, or operating facilities provided the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures; ***[Note: if the title of the individual signing this form is "Plant Manager", submit a written verification that the authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures]***;

For a partnership or sole proprietorship: by a general partner or the proprietor; or

For a municipality, state, Federal, or other public facility: by either a principal executive officer or ranking elected official.

The Department of Conservation and Recreation reserves the right to request additional information not directly addressed by the registration statement if, in its discretion, a facility or operation poses a potential impact on water quality.