

PROFESSIONAL ENGINEERING SERVICES

WWA PROJECT No. 216038.02 (IFB No. PW-24-2001)



PROJECT MANUAL

CHERRY HILL WATER SYSTEM
PHASE I AND PHASE II
WATER LINE IMPROVEMENTS

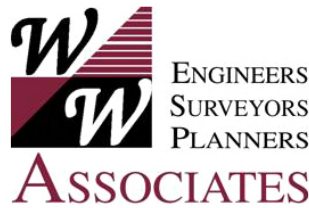
FOR

CULPEPER COUNTY, VIRGINIA

BID SET

July 9, 2020

Revised January 30, 2023



www.wwassociates.net

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Section 01000
Table of Contents

	<u>Section</u>
Division 1 – General Requirements	
Instructions to Bidders	01200
Bid Form	01300
Certification of Non-Discrimination and Anti-Collusion	01301
Contractor Qualifications	01303
Proof of Authority to Transact Business in Virginia	01304
General Requirements	01400
Supplementary Conditions	01500
Standard Contract Forms	01600
Division 2 – Site Work	
Demolition	02050
Traffic Regulation	02055
Earthwork	02200
Boring/Tunneling	02300
Trenchless Pipe Installation	02350
Paving and Surfacing	02500
Finished Water Distribution System	02660
Raw Water Piping System	02665
Seeding	02936
Divisions 3-16 – Not Used	
Appendices	
Geotechnical Engineering Report, by Underhill Engineering, LLC, Charlottesville, Virginia, dated December 12, 2019	A
Geotechnical Engineering Report, by Underhill Engineering, LLC,	

Charlottesville, Virginia, dated February 4, 2022.....B

End of Table of Contents

Section 01200
Instructions to Bidders

- 1 General: To be valid for consideration, bids must be completed and submitted in accordance with these instructions to bidders.
- 2 Qualification of Bidders
 - 2.1 The Contractor shall complete Section 01303 – Contractor Qualifications and submit with the bid to be considered a qualified bidder.
 - 2.2 In addition to the experience qualifications listed above, each bidder must be prepared to submit within 5 calendar days of the Owner’s request written evidence of his qualifications for the project, including financial data, previous experience, and evidence of authority to conduct business in the jurisdiction where the project is located.
- 3 Changes/Modifications to Solicitations
 - 3.1 Bid documents, and any and all changes, addendums, amendments, and/or supplements to any Invitation to Bid (IFB), shall be posted on the Culpeper County website on the Purchasing Office’s webpage under the tab titled “Current Active Solicitation” found at the following address:

<https://web.culpepercounty.gov/rfps>
 - 3.2 Any and all changes, addendums, amendments, and/or supplements to the IFB shall be posted no later than the latest time on the last day by which submissions have to be received by the Purchasing Office. Offerors/Bidders are responsible for monitoring the Purchasing Office’s webpage for the posting of any changes, addendums, amendments, and/or supplements.
- 4 Examination of Bid Documents and Site
 - 4.1 Before submitting bids, each bidder must examine bid documents thoroughly; familiarize himself with federal, state and local laws, ordinances, rules, and regulations affecting the work; and correlate his observations with the requirements of the bid documents.
 - 4.2 Bidders are requested and expected to visit the site of the project to alert themselves to local and special conditions, which may be encountered during construction of the project. Failure to make such investigations shall not relieve the successful bidder from performing and completing the work in accordance with the contract documents.
- 5 Interpretations
 - 5.1 **All questions concerning this project shall be directed in writing to WW Associates, Inc. Jason A. Clark, P.E. is the point of contact. E-Mail: jclark@wwassociates.net.** No oral interpretations of the bid documents will be

made to any bidder. To be given consideration, requests for interpretations must be received in time to allow preparation of written response at least 7 days prior for receipt of bids. Interpretations will be written in the form of written addenda to the bid documents and e-mailed to all parties recorded by WW Associates, Inc. as having received bid documents, prior to scheduled receipt of bids. Only interpretations by formal written addenda will be binding.

6 Bid Submission

6.1 Submit one copy of the bids using forms furnished by WW Associates, Inc. and fill in all blank spaces on the form. Repeat notation "Contractor's Current Virginia License No. _____" on outside of inner envelope containing bid and bid security, and place this envelope within another envelope addressed to:

6.1.1 Culpeper County Board of Supervisors
155 West Davis Street, Suite 100
Culpeper, VA 22701
Attn: Alan H. Culpeper, CPPO, VCO
IFB# PW-24-2001
Title: Cherry Hill Water System
Phase I and Phase II Water Line Improvements - Rebid

6.2 The inner envelope shall have noted thereon:

6.2.1 "IFB# PW-24-2001. Title: Cherry Hill Water System Phase I and Phase II Water Line Improvements - Rebid. Contractor's Name and Complete Mailing Address (Return Address).

6.3 Bid security, bidding documents, receipt deadline for bids, and pre-bid conferences shall be as specified herein.

6.3.1 No bidder shall withdraw, modify, or cancel any part of his bid for 90 days following bid opening.

6.3.2 Due to the restricted access, County personnel will provide only one inspection of the project site directly after the completion of the pre-bid conference.

6.4 Late Bids/Proposals and Modifications and Withdrawal of Bids/Proposals

6.4.1 Any bid/modification received at the office designated in the solicitation after the exact time specified for receipt of the bid/proposal/modification is considered a late bid/proposal/modification. The County is not responsible for delays in the delivery of the mail by the U.S. Postal Service, private carriers, or the inter-office mail system.

6.4.2 Late bids/proposals/modifications will be returned to the Bidder unopened, if solicitation number, acceptance date and Bidder return address are shown on the container.

6.4.3 If the County closes its offices due to inclement weather, scheduled bid openings or receipt will be extended to the next business day, same time.

6.4.4 Bids may be modified or withdrawn by appropriate document duly executed (in the manner that a bid must be executed) and delivered to the place where the bids are to be submitted at any time prior to the receipt of bids.

6.5 Errors in Bids/Proposals

6.5.1 When an error is made in extending total prices, the unit bid price will govern. Erasures in bids/proposals must be initialed by the Bidder. Carelessness in quoting prices, or in preparation of bid otherwise, will not relieve the Bidder. Bidders are cautioned to recheck their bids for possible error.

6.5.2 Withdrawal of bids after date for submission: In accordance with Procedure (ii) of Section 11-54(A) of the Code of Virginia, the bidder will have 2 business days after the opening of bids within which to claim in writing any mistake as defined in said section and withdraw his bid, provided such mistake be proved from the Contractor's work papers. Failure to submit Contractor's work papers will be considered as a waiver of any right of withdrawal of bids after the date for submission.

6.6 Bid Security: Bids shall be accompanied by a certified check or an acceptable bid bond in the amount of 5 percent of the base bid.

6.7 All Bid Items must be completed in their entirety; failure by the Contractor to fully complete the bid form will be considered a non-responsive bid.

6.8 Anti-Collusion Statement: Bidders shall complete Section 01301 – Certification of Non-Discrimination and Anti-Collusion and submit with the bid. Failure to sign, notarize, and submit this statement may result in rejection of the bid.

6.9 Proof of Authority to Transact Business in Virginia: Bidders shall complete Section 01304 – Proof of Authority to Transact Business in Virginia and submit with the bid. Failure to sign and submit this statement may result in rejection of the bid.

6.10 Acceptance of Bids/Proposals

6.10.1 Unless otherwise specified, all formal bids/proposals submitted shall be valid for a minimum period of ninety (90) calendar days following the date established for acceptance. At the end of the ninety (90) calendar days, the bid/proposal may be withdrawn at the written request of the Bidder. If the proposal is not withdrawn at that time, it shall remain in effect until an award is made, or the solicitation is canceled.

7 Agreement, insurance certificate, and bonds shall be drawn on forms identical to those bound within this project manual.

7.1 Bonds shall be with a surety company acceptable to the Owner.

- 7.2 A Performance Bond and a Labor and Material Payment Bond will be required in the amount of 100 percent of the bid.
- 8 Award of Contract
- 8.1 The award of the contract will be as specified in Section 01300 – Bid Form.
- 8.2 Should the responsive bid from the lowest responsible bidder exceed available funds, the Owner may negotiate with the lowest responsible bidder in accordance with Section 2.2-4318 of the Virginia Public Procurement Act to obtain a contract price within available funds.
- 8.3 The Owner reserves the right to reject any and all bids and waive any and all informalities and the right to disregard all nonconforming or conditional bids or counterproposals.
- 8.4 Submission of post-bid information shall be in accordance with the contract documents.
- 9 Bidders must comply with President’s Execution Order No. 11246, prohibiting discrimination in employment regarding race, color, creed, sex, or national origin, and Executive Order Nos. 12138 and 11625 regarding utilization of MBE/WBE firms; Certification that they do not or will not maintain or provide for their employees any facilities that are segregated on the basis of race, color, creed, or national origin; and Statement that bidders must comply with the Civil Rights Act of 1964.

End of Section

Contractor _____ Date _____

VA License No. _____

Section 01300
Bid Form

Gentlemen:

The undersigned, having visited and examined the site and having carefully studied the drawings and project manual for the Cherry Hill Water System Phase I and Phase II Water Line Improvements – REBID for Culpeper County, Virginia, hereby proposes to furnish all plant, labor, equipment, materials, and services and to perform all operations necessary to execute and complete the work required for the project, in strict accordance with the drawings and technical specifications prepared by WW Associates, Inc. Engineers • Surveyors • Planners, dated July 9, 2020, revised January 30, 2023, together with addenda numbered _____, issued during bidding period and hereby acknowledged, subject to the terms and conditions of the agreement as follows:

Base Bid Item No. 1 is defined as all work associated with the Phase I Cherry Hill water line improvements, including project mobilization, except for Base Bid Item No. 3 listed below, complete and in accordance with the drawings and technical specifications, for the sum of: _____ dollars
(\$ _____).

Base Bid Item No. 2 is defined as all work associated with the Phase II Cherry Hill water line improvements, including project mobilization, except for Base Bid Item No. 4 listed below, complete and in accordance with the drawings and technical specifications, for the sum of: _____ dollars
(\$ _____).

Base Bid Item No. 3 is the total of the unit prices for furnishing and installing the following quantities for the Phase I water line improvements:

- Water service lateral piping and appurtenances between the water line and the water meter assembly: \$ _____/LF x 400 LF of water service lateral piping = \$ _____,
- Water meter assembly, installation of water meter, and appurtenances: \$ _____/EA x 20 water meter assemblies, installation of water meter, and appurtenances = \$ _____,

Total of the unit prices times the quantities for the two (2) items listed above: _____ dollars
(\$ _____).

Base Bid Item No. 4 is the total of the unit prices for furnishing and installing the following quantities for the Phase II water line improvements:

Contractor _____ Date _____

VA License No. _____

-
- Water service lateral piping and appurtenances between the water line and the water meter assembly: \$ _____ /LF x 2,100 LF of water service lateral piping = \$ _____,
 - Water meter assembly, installation of water meter, and appurtenances: \$ _____ /EA x 20 water meter assemblies, installation of water meter, and appurtenances = \$ _____,

Total of the unit prices times the quantities for the two (2) items listed above: _____ dollars

(\$ _____).

Total Base Bid is defined as the sum of Base Bid Item Nos. 1-4:

_____ dollars (\$ _____).

Notes:

- a) The basis of award for determining the low bidder shall be the Total Base Bid.
- b) The method of installation of raw and finished water main piping shall be at the discretion of the Contractor, except where indicated on the drawings.
- c) The Base Bid items are founded upon furnishing equipment and materials of specified manufacturers, or approved equals.
- d) The Contractor shall include the costs in Base Bid Item No. 1 to furnish and install five (5) sampling stations at locations designated by the Owner on the Phase I water line.
- e) The Contractor shall include the costs in Base Bid Item No. 2 to furnish and install five (5) sampling stations at locations designated by the Owner on the Phase II water line.
- f) The Contractor is advised to refer to the Lines and Grades paragraph in Section 01400 – General Requirements for bidding instructions on construction stakeout services.
- g) Base Bid Item Nos. 3 and 4 shall include the designated quantities indicated above. The bidder declares that he understands that these designated quantities are subject to either increase or decrease based on the work shown on the drawings and for changes in the work as directed by the Owner. Should the quantities of any of the items of work be increased, the undersigned proposes to do the additional work at the unit price set out herein. Should the quantities be decreased, the undersigned also understands that payment will be made on the actual quantities installed at the unit prices, and will make no claim for the anticipated profits for any decrease in the quantities. Actual quantities will be determined upon completion of the work.

It is understood and agreed that the Owner, in protecting his best interest, reserves the right to:

Contractor _____ Date _____

VA License No. _____

Reject any or all bids,

Accept any bid at the base bid price, or any combination of the bid items, whereupon the Contractor shall furnish equipment and materials as specified,

We are properly equipped to execute work as defined in the contract documents and so covered by this bid and will enter into agreement for the execution and completion of the work in accordance with the drawings, project manual, and this bid. We further agree that if awarded the contract, we will commence the work on the date stated in the "Notice to Contractor to Proceed," and will prosecute the work and shall be substantially complete as defined in the General Conditions within 330 calendar days, and complete all obligations within 360 calendar days.

The Owner and Contractor recognize that time is of the essence with this agreement and that the Owner will suffer financial loss if the work is not completed within 330 calendar days. They also recognize the delays, expense, and difficulties involved in proving the actual loss suffered by the Owner if the work is not completed on time. Accordingly, instead of requiring any such proof, the Owner and Contractor therefore agree that, as liquidated damages for delay (but not as a penalty), the Contractor shall pay the Owner one thousand five hundred dollars (\$1,500.00) for each day that expires after the time specified for substantial completion of this project.

Enclosed herewith is the following security, offered as evidence that the undersigned will enter into agreement for the execution and completion of the work in accordance with the drawings and project manual:

Certified check for the sum of _____

Name of bank _____

Bidder's bond in amount of _____

Bond issued by _____

The undersigned further agrees that in case of failure on his part to execute the said agreement within 10 consecutive calendar days after written notice being given on the award of the contract, the monies payable by the securities accompanying this bid shall be paid to Culpeper County as liquidated damages for such failure; otherwise, the securities accompanying this bid shall be returned to the undersigned.

This bid is subject to acceptance within a period of 90 days from bid submission date.

Contractor _____ Date _____

VA License No. _____

Respectfully Submitted,

Contractor

By _____

Address

Telephone

Date _____

Contractor's Current Virginia
License Number _____ Code _____

Section 01301
Certification of Non-Discrimination and Anti-Collusion

By submitting their bids, all bidders certify to Culpeper County, Virginia, that they will conform to the provisions of the Federal Civil Rights Act of 1964, as amended, as well as the Virginia Fair Employment Contracting Act of 1975, as amended, where applicable, the Virginians with Disabilities Act, the Americans with Disabilities Act, and Section 2.2-4311 of the Virginia Public Procurement Act:

In every contract over \$10,000, the provisions below apply:

1. During the performance of this contract, the Contractor agrees as follows:
 - a. The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment, except where there is bona fide occupational qualification reasonably necessary to the normal operation of the Contractor. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.
 - b. The Contractor, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, will state that such contractor is an equal opportunity employer.
 - c. Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.
2. The Contractor will include the provisions of the foregoing Paragraphs a, b, and c in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.

I hereby certify that this bid is not the result of, or affected by, any act of collusion with another person engaged in the same line of business, or any act of fraud punishable under the Virginia Governmental Frauds Act.

Certified by: _____ (Corporate Seal)
Signature

Date: _____

Acknowledges before me this _____ day of _____, 2024.

Notary Public

My Commission Expires: _____

Section 01303
Contractor Qualifications

“The bidder shall state here what previous municipal type work he has performed similar to that contemplated in this contract, and give references that will afford Culpeper County an opportunity to judge experience and skill of proposed contractor and all subcontractor(s). The Contractor shall list five (5) projects of similar size and dollar value completed within the last five (5) years. If proposing to use subcontractors or joint partners to complete more than 20% of the work by partnership, joint venture, or subcontract means, then provide project experience information as outlined above for all contractors, partners, or subcontractors.”

Submittal of this information on other standard forms containing all the information noted below is acceptable.

Failure to provide satisfactory evidence of experience may cause the bid to be rejected.

Location	Dollar Value	Year Completed	Owner/Engineer	Phone Number	Contact Person	Type of Work Done

Section 01304
Proof of Authority to Transact Business in Virginia



Culpeper County, Virginia

Procurement Department
155 West Davis Street, Suite 100
Culpeper, Virginia 22701

**PROOF OF AUTHORITY TO TRANSACT BUSINESS IN VIRGINIA
THIS FORM MUST BE SUBMITTED WITH BID/PROPOSAL. FAILURE TO INCLUDE THIS FORM
SHALL RESULT IN REJECTION OF BID/PROPOSAL.**

Pursuant to Virginia Code § 2.2-4311.2, a bidder/offeror organized or authorized to transact business in the Commonwealth pursuant to Title 13.1 or Title 50 of the Code of Virginia shall include in its bid/proposal the identification number issued to it by the State Corporation Commission (SCC). Any bidder/offeror that is not required to be authorized to transact business in the Commonwealth as a foreign business entity under Title 13.1 or Title 50 of the Code of Virginia or as otherwise required by law shall include in its bid or proposal a statement describing why the offeror is not required to be so authorized. Any bidder/offeror described herein that fails to provide the required information shall not receive an award unless a waiver of this requirement and the administrative policies and procedures established to implement this section is granted by County Administrator.

If this bid/proposal for goods or services is accepted by the County of Culpeper, Virginia, the undersigned agrees that the requirement of the Code of Virginia § 2.2-4311.2 have been met.

Complete the following by checking the appropriate line that applies and providing the requested information.

A. ___ Bidder/offeror is a Virginia business entity organized and authorized to transact business in Virginia by the SCC and such bidder's/offeror's Identification Number issued to it by the SCC is

_____.

B. ___ Bidder/offeror is an out-of-state (foreign) business entity that is authorized to transact business in Virginia by the SCC and such bidder's/offeror's Identification Number issued to it by the SCC is

_____.

C. ___ Bidder/offeror does not have an Identification Number issued to it by the SCC and such bidder/offeror is not required to be authorized to transact business in Virginia by the SCC for the following reason(s):

Please attach additional sheets of paper if you need to explain why such bidder/offeror is not required to be authorized to transact business in Virginia.

Legal Name of Bidder/Offeror

Legal Name of Company

Authorized Signature

Date: _____

Print or Type Name and Title

(Return this Page)

Section 01400
General Requirements

1 General

1.1 Summary of Work

1.1.1 The work covered under this contract comprises the furnishing of all labor, materials, equipment, tools and services and the installation and construction of all items, and the performance of all work necessary to complete the work shown or called for on the drawings and/or this project manual.

1.1.2 All units under this Contract shall be operable, shall be installed as designed, and shall conform to the manufacturer's specifications for the particular application.

1.2 Contractor Use of Premises

1.2.1 The Contractor shall assume full responsibility for protection and safekeeping of products stored on or off premises.

1.2.2 The Contractor shall coordinate use of premises with the Owner and Engineer, and remove stored products that interfere with the operations of the Owner or other contractors.

1.2.3 The Contractor shall obtain and pay for all additional storage or work areas needed for operations under this Contract. These areas shall be subject to the same conditions as described for the Owner's property.

1.3 Construction and Scheduling Sequence

1.3.1 Phases of the construction which involve the temporary interruption of essential services and demolition of existing items shall be scheduled in consultation with the Owner or their representatives, shall not be of longer duration than essential to accomplish the purpose for such interruptions. Requests for outages must be submitted in writing to the Owner for approval. Liaison with the Owner in these matters is a salient feature of this contract.

1.3.2 Provide a written construction schedule and plan which describes in detail each major task and operation which will interfere with any existing system, equipment, or operation. The plan shall describe the sequence and proposed method of accomplishing each task and the proposed schedule for interruptions.

1.3.3 All construction activities shall be performed inside acquired easements and right of ways designated for this project. Laydown areas for this project

shall be the Contractor's responsibility. Coordination and scheduling of construction activities with the Owner is a salient feature of this contract.

- 1.3.4 The Contractor shall make provisions for protecting all asphalt and concrete surfaces. Rubber tired vehicles will be required. Any damage to asphalt or concrete surfaces shall be repaired/replaced in kind by the Contractor.
- 1.3.5 The Contractor shall create a pre-construction video of the entire project area to demonstrate pre-construction conditions. The Contractor shall provide the Owner with a DVD of the pre-construction video as a submittal.
- 1.3.6 A project entitled "Cherry Hill Water Treatment Facility – Culpeper County, Virginia" is an ongoing construction project to construct a new groundwater treatment facility. Coordination with this referenced project is a salient feature of this Contract. The Contractor shall coordinate final connections, and pressure, leakage, and disinfection testing with the Water Treatment Facility Contractor to provide a complete and useable water system. Connection points to the Water Treatment Facility project are shown on the Contract Drawings. Each Contractor will be responsible for disinfection, pressure, and leakage testing of the water lines indicated in their respective Contracts.
- 1.3.7 Culpeper County is currently in the process of acquiring easements for the water line improvements. All easements may not be obtained by the beginning of the contract. The Contractor shall construct in areas where easements have been obtained as directed by the County. All construction activities shall be performed inside acquired easements. Coordination and scheduling of construction activities with the County is a salient feature of this contract.

1.4 Work Restrictions

- 1.4.1 Occupancy: If the Owner elects to operate any of the wastewater treatment plant improvements under partial utilization, prior to the project's final acceptance, neither WW Associates, Inc. nor the Contractor shall be held responsible for the safety or well being of those occupants beyond the normal care and practice of the construction industry.
- 1.4.2 Normal working hours for the Contractor shall be 8:00 A.M. to 5:00 P.M., Monday through Friday, excluding state and federal holidays, unless otherwise approved by the Owner and WW Associates, Inc.

1.5 Contract Modification Procedures

- 1.5.1 Change Orders: No amount, in part or in whole, of a change order shall be included in a requisition for payment by the Contractor until the change order has been executed and copies of the change order have been distributed to the Owner and Contractor.

- 1.5.2 Work Orders: A work order is a device which enables the Owner to promptly order changes in the work which may involve changes in cost or contract time, or both pending preparation and execution of a formal change order.
- 1.5.3 Request for Change Order Proposal: The Owner may request the Contractor to submit a change order proposal for changes in contract work. The Contractor shall submit the proposal in accordance with contract requirements within 3 days of a request by the Engineer or Owner. The Owner may issue to the Contractor a work order authorizing the required changes for an additional amount not to exceed, or a deduction of not less than the amount shown in the work order. If the Contractor is not in agreement with the amount stipulated in the work order, he shall, within a reasonable time after the issue date of the order, submit to WW Associates, Inc. an equitable proposal and develop with the Owner a mutually acceptable price for the required change in work.
- 1.5.4 The Contractor may initiate changes by submitting a written notice to the Engineer containing:
 - 1.5.4.1 Description of the proposed changes.
 - 1.5.4.2 Statement of the reason for making the changes.
 - 1.5.4.3 Statement of the effect on the Contract Sum and the Contract Time.
 - 1.5.4.4 Statement of the effect on the Work of separate Contractors.
 - 1.5.4.5 Documentation supporting any change in Contract Sum or Contract Time, as appropriate.

1.6 Payment Procedures

- 1.6.1 Applications and Certificates for Payment: The form of each application for payment shall be EJCDC Document C-620 entitled, "Application and Certificate for Payment" accompanied by "Continuation Sheet," and "Stored Material Summary." Each application for payment by the Contractor, excluding the first, shall be accompanied by a "Contractor's Affidavit of Payment of Debts and Claims," AIA Document G706, and "Contractor's Affidavit of Release of Liens," AIA Document G706A. Each application shall be submitted on these forms as referenced in Section 01600 – Standard Contract Forms. Payment for stored material delivered but not incorporated in the work will be the invoiced amount only. Submit invoices with application for payment.
- 1.6.2 Upon recommendation by WW Associates, Inc. of the Contractor's request for partial payment, the Owner shall pay to the Contractor 95 percent of the

total amount due and the Owner shall retain 5 percent of the amount due until final completion and acceptance of all work covered by the contract.

- 1.6.3 Schedule of Values: Submit complete schedule of values at least 10 days prior to first application for payment.

1.7 Project Meetings

- 1.7.1 Preconstruction conferences with the Contractor will be held after the effective date of the agreement.

- 1.7.2 Progress Meetings: Each month, the Contractor, Engineer, and the Owner shall hold a progress meeting to review progress to date and to resolve all questions for the upcoming month.

- 1.8 Progress Schedules: Submit a detailed construction schedule prior to the preconstruction conference. Revise the schedule prior to each progress meeting. Construction schedule shall be in a form that will clearly show the proposed degree of completeness of each aspect of the construction throughout the life of the contract. Bar graphs and/or PERT diagrams are acceptable forms.

1.9 Submittal Procedures

- 1.9.1 Shop Drawings, Product Data, and Samples: Prior to the preconstruction conference, prepare a submittal schedule satisfactory to WW Associates, Inc. fixing the dates for submission of shop drawings, product data, samples, and the like and update this schedule at each progress meeting to reflect the status of each submittal item.

- 1.9.1.1 Submit one electronic copy of all shop drawings in Adobe Acrobat PDF format.

- 1.9.1.2 An Adobe Acrobat PDF electronic file of each reviewed shop drawing submittal will be returned to the Contractor.

- 1.9.1.3 Submit shop drawings, product data, samples, and the like as required by applicable specification sections.

- 1.9.1.4 Identify each item submitted using applicable specification section number and paragraph reference or drawing reference.

- 1.9.1.5 Shop drawings shall be approved by the Contractor and those subcontractors whose work is associated with the subject equipment as being in accordance with the contract documents prior to submission.

- 1.9.1.6 Failure to comply with these requirements will result in the submittal being returned unprocessed.

- 1.9.2 The Engineer's approval of Contractor's shop drawings will be general and shall not relieve the Contractor from the responsibility for adherence to the Contract, nor shall it relieve him of the responsibility for any errors that may exist. Where such errors or omissions are discovered later, they shall be made good by the Contractor, irrespective of any approval by the Engineer.
- 1.9.3 Equipment/Material Shop Drawings for any piece of equipment or item will be reviewed a maximum of one time by the Engineer. Subsequent reviews will be paid for by the General Contractor to the Engineer at the rate of \$160.00 per hour and paid to the Engineer by an Owner deduct from the Contractor's monthly pay request. Contractors are cautioned to select equipment that meets the requirements specified in the contract documents and to require their suppliers to provide detailed and accurate information in their submittal packages which can readily be approved.

1.10 Quality Control

- 1.10.1 Testing Laboratory Services: The Contractor will employ and pay for the services of an independent testing laboratory to perform testing specified to be done by an independent testing laboratory, unless specifically stated otherwise in other sections of the specifications. Employment of the laboratory shall in no way relieve the Contractor's obligations to perform the work of the contract.

1.11 Temporary Utilities

- 1.11.1 Temporary Electricity: The Contractor shall make all necessary arrangements for obtaining temporary electric power for construction purposes. No separate payment for electric power for construction purposes or testing other than the payment included in the contract lump sum or unit prices will be allowed.
- 1.11.2 Temporary Water: The Contractor may use the Owner's potable water during construction free of charge. The Contractor must provide an appropriate air gap to prevent cross contamination in the Owner's water system. Coordinate and schedule potable water usage with the Owner's personnel prior to construction activities.
- 1.11.3 Temporary Sanitary Facilities: Contractor shall provide and maintain in a neat and sanitary condition such accommodations for the use of his employees as will comply with laws and regulations.

1.12 Temporary Controls

- 1.12.1 Construction Cleaning: The Contractor shall clean daily all areas under construction to ensure minimum interference with roads, streets, sidewalks, and access of adjacent property owners.

1.12.2 Erosion and Sediment Control: These controls shall be in coordination with the appropriate drawings and any requirements of the local authority.

1.12.3 Dust Control: Contractor shall ensure that dust is held to a minimum throughout the length of the project through the application of moisture where applicable.

1.13 Vehicular Access and Parking

1.13.1 Parking and Laydown Areas: The location of Contractor parking and laydown areas shall be as agreed upon by the Owner and the Engineer. Provide gravel in the laydown area and comply with the latest edition of the Virginia Erosion and Sediment Control Handbook. Parking and laydown areas shall be restored to original condition at the end of construction.

1.13.2 Maintenance and Access Roads

1.13.2.1 All maintenance and access roads used by the Contractor shall be surfaced with 6 inches of VDOT No. 21A coarse aggregate. This work shall be progressively performed prior to use of any unsurfaced areas by the Contractor where construction will cause muddy and erodible conditions.

1.13.2.2 The Contractor shall maintain and supplement coarse aggregate and perform routine maintenance as required for all maintenance and access roads during construction. The Contractor shall develop suitable subgrade and provide 6 inches of VDOT No. 21A coarse aggregate as finished road course at the end of construction at no additional cost to the Owner.

1.14 E-Mail Address: The Contractor shall provide an e-mail address to allow the Owner and the Engineer to correspond with the Contractor's project manager during the construction period.

1.15 Product Requirements

1.15.1 Quality of Material and Equipment Incorporated into the Work:

1.15.1.1 Design, fabricate and assemble in accordance with the best engineering and shop practices.

1.15.1.2 Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.

1.15.1.3 Two or more items of the same kind shall be identical, by the same manufacturer.

1.15.1.4 Products shall be suitable for services conditions.

- 1.15.1.5 Equipment capacities, sizes, and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
- 1.15.2 Except as specifically indicated or specified, materials and equipment removed from the existing structure shall not be used in the completed work.
- 1.15.3 For material and equipment specifically indicated or specified to be reused in the work:
 - 1.15.3.1 Use special care in removal, handling, storage, and reinstallation to assure proper function in the completed work.
 - 1.15.3.2 Arrange for transportation, storage, and handling of products, which require off-site storage, restoration, or renovation. Pay all costs for such work.
- 1.15.4 Manufacturer's Instructions
 - 1.15.4.1 When contract documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to WW Associates.
 - 1.15.4.2 Maintain one set of complete instructions at the job site during installation and until completion.
 - 1.15.4.3 Handle, install, connect, clean, condition, and adjust products in accordance with such instructions and in conformity with specified requirements.
- 1.15.5 Transportation and Handling of Materials
 - 1.15.5.1 Arrange deliveries of products in accordance with construction schedules. Coordinate to avoid conflict with work and conditions at the site.
 - 1.15.5.2 Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
 - 1.15.5.3 Immediately on delivery, inspect shipments to assure compliance with requirements of contract documents and approved submittals, and that products are properly protected and undamaged.
- 1.15.6 Storage and Protection

1.15.6.1 Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.

1.15.6.2 Store products subject to damage by the elements in weathertight enclosures.

1.15.6.3 Maintain temperature and humidity within the ranges required by manufacturer's instructions.

1.15.6.4 Exterior Storage

1.15.6.4.1 Store fabricated products above the ground, on blocking or skids; prevent soiling or staining; cover products, which are subject to deterioration with impervious sheet coverings; and provide adequate ventilation to avoid condensation.

1.15.6.4.2 Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.

1.15.6.4.3 Protection after Installation: Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

1.16 Lines and Grades

1.16.1 The Contractor shall use a land surveyor currently licensed in the Commonwealth of Virginia to establish all controls and perform all construction stakeout necessary to determine the location, elevation, and construct all structures, pavements, roads, piping, buildings, and other improvements associated with this project. This stakeout will be in accordance with the dimensions and elevations shown on the contract drawings.

1.17 Starting of Systems

1.17.1 The Contractor shall initially start up and place all piping systems installed by the Contractor into successful operation as specified herein.

1.17.2 Provide all materials, labor, tools, equipment and expendables required.

1.17.3 Coordinate schedule for start-up of various piping systems. Notify the Engineer at least seven days prior to start-up of each system. The Owner's operator and the Engineer will be present during start-up.

1.17.4 Submit a written report that piping systems have been properly installed and is functioning correctly.

1.17.5 General activities include the following:

1.17.5.1 Cleaning.

1.17.5.2 Removing temporary protective coverings.

1.17.5.3 Test all piping systems at normal operating conditions and through the normal operating range.

1.17.5.4 Make all adjustments and balances required.

1.17.6 Minimum Start-Up Procedures

1.17.6.1 Valves: Inspect all valves, clean bonnets and stems. Inspect packing glands to assure no leakage, and tighten or replace as necessary. Verify that control valve seats are free from foreign material and are properly positioned for service.

1.17.6.2 Pipe Joints: Inspect all joints for leakage, and tighten, remake, or replace as necessary.

1.18 Demonstration and Instructions

1.18.1 Prior to final inspection, demonstrate operation of each piping system to the Engineer and the Owner.

1.18.2 Instruct the Owner's personnel in operation, adjustment, and maintenance of piping systems.

1.19 Acceptance for Operation

1.19.1 The Contractor shall maintain full responsibility for the maintenance of all units and systems placed on-line until they have been determined substantially complete. No warranties shall begin prior to the date of substantial completion.

1.19.2 Acceptance Requirements: All equipment shall pass the specified performance testing prior to substantial completion certifications. Partial acceptance of equipment will not be allowed.

1.20 Cleaning

1.20.1 Periodically clean premises of accumulated construction debris.

1.20.2 Prior to final completion, thoroughly remove from premises any debris remaining from construction activities, and properly dispose. Leave premises in a clean, neat, orderly and safe condition.

1.21 Contract Closeout Procedures

- 1.21.1 Punch List: Correct All Punch List Items.
- 1.21.2 Guarantees, Warranties, and Bonds: Submit all required guarantees, warranties and bonds.
- 1.21.3 Project Record Documents
 - 1.21.3.1 Provide an as-built survey by a Virginia licensed land surveyor. As-built survey shall be provided in AutoCAD, Version 21. Provide one complete set of drawings and project manual recording all changes to work to indicate actual installation. Changes shall be in AutoCAD, Version 21. These changes shall include, but are not limited to, the following:
 - 1.21.3.1.1 Exact alignment and elevation of water lines, including connections to existing water lines, valves, hydrants, blowoffs, sampling stations, and plugs for future water lines.
 - 1.21.3.1.2 Exact location and elevation of all water line services. The structure number, lot address, and the distance along the main water line shall be noted on the drawings for all new water services.
 - 1.21.3.1.3 Exact location and elevation of all underground utility services
 - 1.21.3.1.4 Changes in general construction, mechanical, or electrical work above or below ground.
 - 1.21.3.2 These records are a specific contract requirement, and final payment will not be made until these drawings and project manual have been submitted in an acceptable form
- 1.21.4 Spare parts and maintenance materials required by these contract documents shall be delivered to the Owner as directed by the Owner.
- 1.21.5 List of Manufacturers and Suppliers: At the conclusion of the project, the Contractor shall furnish WW Associates, Inc. with a complete list of subcontractors, manufacturers, and suppliers who participated in the construction or who furnished materials or equipment. The address of each firm shall be included, together with types of materials or work performed.
- 1.21.6 Affidavit of Payment of Debts and Claims
- 1.21.7 Affidavit of Release of Liens

End of Section

Section 01500
Supplementary Conditions

1 Supplements

- 1.1 These supplementary conditions amend or supplement the Standard General Conditions of the Construction Contract, EJCDC document C-700, 2013 edition, and other provisions of the contract documents to the extent indicated. All provisions, which are not so amended or supplemented, remain in full force and effect.

2 Definitions

- 2.1 The terms used in these supplementary conditions that are defined in the Standard General Conditions of the Construction Contract (EJCDC document C-700, 2013 edition) have the meanings assigned to them in the general conditions.
- 2.2 The terms “County” and “Culpeper County” refer to the Owner.

- 3 Copies of Documents: Modify Article 2.02 as follows: For construction purposes, the Contractor will be issued, free of charge, the following:

One (1) compact disc containing the “Issued for Construction” project manual and the project drawings in Adobe Acrobat (PDF) format

- 4 Physical Conditions: Explorations and Reports. Add the following to Article 4, Paragraph 4.02.A.

“Subsurface exploration by Soils Engineer, Underhill Engineering, LLC, Charlottesville, Virginia, has been performed, and the soil reports, dated December 12, 2019, and February 4, 2022, are appended to this project manual for convenient reference only and will not be part of the contract documents.

Soil reports were obtained by WW Associates, Inc. in design and are available for the Contractor’s information, but are not a warranty of subsurface conditions. The Contractor shall be responsible for his own interpretation for construction purposes.

Prior to bidding, the Contractor may make subsurface investigations.”

5 Bonds

- 5.1 Add the following to Article 6, Paragraph 6.01.

“The Contractor shall secure and provide all bonds called for in the General Conditions and Instructions to Bidders. All bonds shall be written by sureties or insurance companies licensed to do business in the Commonwealth of Virginia.”

6 Insurance

6.1 The Contractor shall purchase and maintain the insurance, required by Article 6 of the General Conditions, in at least the following amounts: (A sample Certificate of Insurance is attached for use as a template by your agent.)

6.1.1 Workers Compensation: Statutory

6.1.2 Employer's Liability

6.1.2.1 Each Accident \$100,000

6.1.2.2 Disease, Each Employee: \$100,000

6.1.2.3 Disease, Policy Limit: \$500,000

6.1.3 General Liability

6.1.3.1 Each Occurrence: \$1,000,000

6.1.3.2 Personal & Advertising Injury: \$1,000,000

6.1.3.3 Products Completed Operations Aggregate: \$2,000,000

6.1.3.4 General Aggregate: \$2,000,000

6.1.4 Excess or Umbrella Liability

6.1.4.1 Each Occurrence: \$10,000,000

6.1.4.2 General Aggregate: \$10,000,000

6.1.5 Automotive Liability

6.1.5.1 Combined Single Limit (Each Accident) \$1,000,000

6.1.6 Builder's Risk: Coverage Equal to Contract Amount

6.2 Contractor's workers compensation insurance as required by Federal, State, and Municipal laws for the protection of all Contractors' employees working on or in connection with the project, including broad form all states and voluntary compensation coverages and employers' liability coverage.

6.3 Contractor's general liability insurance shall include the following coverages:

6.3.1 Premises and Operations

6.3.2 Explosion

6.3.3 Collapse and Underground

6.3.4 Products Completed Operations

6.3.5 Contractual Liability

6.3.6 Personal and Advertising Injury.

6.4 The Automobile Liability Insurance shall include coverage for owned, non-owned, and hired autos.

6.5 All insurance shall be written by insurance companies licensed to do business in the Commonwealth of Virginia.

6.6 Culpeper County and WW Associates, Inc. shall be listed as additional insured on all policies except workers compensation.

6.7 A waiver of subrogation shall apply in favor of Culpeper County and WW Associates, Inc. on all policies as permitted by law.

6.8 Certificate Holder:

Culpeper County
Department of Environmental Services
118 West Davis Street, Suite 101
Culpeper, VA 22701

7 Contractor's Responsibilities

7.1 Labor, Materials, and Equipment: Add the following as Paragraph 7.03.D:

“All material incorporated in the work of this contract shall be free of asbestos and other hazardous materials.”

7.2 Laws and Regulations

7.2.1 Add the following as Subparagraph 7.10.D.:

“The Contractor shall be licensed in the Commonwealth of Virginia in accordance with Title 54.1, Chapter 11, Code of Virginia (1950) as amended.”

7.2.2 Add the following as Subparagraph 7.10 E.:

“The Contractor shall comply with the provisions set forth in Section 2.2-4311.1 of the Code of Virginia and shall not during the performance of the contract knowingly employ an unauthorized alien as defined in the Federal Immigration Reform and Control Act of 1986.”

7.3 Prohibition of Employment Discrimination

7.3.1 During the performance of this contract, the Contractor agrees as follows:

7.3.1.1 The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, The Contractor will not discriminate against any employee or applicant

for employment because of race, religion, color, sex, national origin, age, disability, or other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the Contractor. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

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

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

7.3.2 The Contractor will include the provisions of the foregoing paragraphs in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.

7.4 Permits: The Contractor shall obtain all required permits and bonds for this project at no additional cost to the Owner. The Contractor shall pay any associated fees for required permits and bonds. Required permits shall include, but not be limited to, the following:

7.4.1 Culpeper County Business Registration: Submit a Business Registration Form to the Commissioner of the Revenue. Telephone: (540) 727-3443.

7.4.2 Culpeper County Land Disturbance Permit: Contact the County Erosion and Sediment Control Administrator for additional information. Telephone: (540) 727-3404.

7.4.3 Virginia Department of Transportation Land Use Permit. Comply with all VDOT requirements and obtain any required permits for work in VDOT rights-of-way. Costs associated with VDOT permits shall be paid for by the Contractor.

7.5 OSHA Requirements: The Contractor shall be responsible for all safety at the job site and shall comply with OSHA Regulations for all work associated with this project.



CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

<p style="text-align: center;">PRODUCER</p> <p style="text-align: center;">PLEASE SEND THIS SAMPLE CERTIFICATE TO YOUR AGENT</p>	<p>CONTACT NAME:</p> <p>PHONE (A/C, No, Ext): _____ FAX (A/C, No): _____</p> <p>E-MAIL: _____</p> <p>ADDRESS: _____</p> <p>PRODUCER CUSTOMER ID #: _____</p>														
<p>INSURED</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 80%;">INSURER(S) AFFORDING COVERAGE</th> <th style="width: 20%;">NAIC #</th> </tr> <tr> <td>INSURER A : _____</td> <td>_____</td> </tr> <tr> <td>INSURER B : _____</td> <td>_____</td> </tr> <tr> <td>INSURER C : _____</td> <td>_____</td> </tr> <tr> <td>INSURER D : _____</td> <td>_____</td> </tr> <tr> <td>INSURER E : _____</td> <td>_____</td> </tr> <tr> <td>INSURER F : _____</td> <td>_____</td> </tr> </table>	INSURER(S) AFFORDING COVERAGE	NAIC #	INSURER A : _____	_____	INSURER B : _____	_____	INSURER C : _____	_____	INSURER D : _____	_____	INSURER E : _____	_____	INSURER F : _____	_____
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INSURER E : _____	_____														
INSURER F : _____	_____														

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
	GENERAL LIABILITY <input checked="" type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS-MADE <input checked="" type="checkbox"/> OCCUR <input checked="" type="checkbox"/> Primary Coverage <input checked="" type="checkbox"/> Contractual Liability & XCU GEN'L AGGREGATE LIMIT APPLIES PER: <input checked="" type="checkbox"/> POLICY <input type="checkbox"/> PROJ. <input type="checkbox"/> LOC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				EACH OCCURRENCE \$ 1,000,000 DAMAGE TO RENTED PREMISES (Ea occurrence) \$ MED EXP (Any one person) \$ PERSONAL & ADV INJURY \$ 1,000,000 GENERAL AGGREGATE \$ 2,000,000 PRODUCTS - COMPCIP AGG \$ 2,000,000
	AUTOMOBILE LIABILITY <input type="checkbox"/> ANY AUTO <input checked="" type="checkbox"/> ALL OWNED AUTOS <input type="checkbox"/> SCHEDULED AUTOS <input checked="" type="checkbox"/> HIRED AUTOS <input checked="" type="checkbox"/> NON-OWNED AUTOS	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				COMBINED SINGLE LIMIT (Ea accident) \$ 1,000,000 BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$ \$ \$
or	<input checked="" type="checkbox"/> UMBRELLA LIAB <input checked="" type="checkbox"/> OCCUR <input checked="" type="checkbox"/> EXCESS LIAB <input type="checkbox"/> CLAIMS-MADE DEDUCTIBLE \$ RETENTION \$	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				EACH OCCURRENCE \$ 10,000,000 AGGREGATE \$ 10,000,000 \$ \$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? <input type="checkbox"/> Y/N (Mandatory in NH) If yes, describe under SPECIAL PROVISIONS below Builders Risk	N/A	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/> WC STATUTORY LIMITS <input type="checkbox"/> OTHER E.L. EACH ACCIDENT \$ 100,000 E.L. DISEASE - EA EMPLOYEE \$ 100,000 E.L. DISEASE - POLICY LIMIT \$ 500,000 Coverage Equal to Contract Amount

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)
 Place owner's name and name of project here. (Owner's Name) and WW Associates, Inc. are listed as an additional insured on all policies except workers compensation. A waiver of subrogation shall apply in favor of (Owner's Name) and WW Associates, Inc. on all policies as permitted by law.

<p>CERTIFICATE HOLDER</p> <p style="text-align: center;">Defined in Supplementary Conditions</p>	<p>CANCELLATION</p> <p>SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.</p> <p>AUTHORIZED REPRESENTATIVE</p>
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Section 01600
Standard Contract Forms

The following Engineers Joint Contract Documents Committee (EJCDC) and American Institute of Architects (AIA) documents will be incorporated in this project manual. All forms shall be utilized in accordance with applicable EJCDC and AIA regulations and modified as needed for this particular Project:

Agreement

Completed EJCDC Document C-520 (2013) “Suggested Form of Agreement Between Owner and Contractor for Construction Contract”, will be a part of this contract.

Performance Bond, and Labor and Material Payment Bond

Completed EJCDC Document C-610, (2013) and EJCDC Document C-615 (2013), will be a part of this contract.

Supplemental Attachment for Accord Certificate of Insurance

Completed AIA Document G715, (1991), will be a part of this contract.

Application and Certificate for Payment and Continuation Sheet

Completed EJCDC Document C- 620, (2013), will be a part of this contract.

Affidavit of Payment of Debts and Claims, and Affidavit of Release of Liens

Completed AIA Documents G706 and G706A, (1994), will be part of this contract.

Standard General Conditions of the Construction Contract

EJCDC Document C-700 (2013) “Standard General Conditions of the Construction Contract”, modified as needed, will be a part of this contract.

EJCDC documents are available from the EJCDC online store at www.ejcdc.com.

AIA documents are available at www.AIA.org.

End of Section

Section 02050
Demolition

1 GENERAL

1.1 Description: This section specifies removal and offsite disposal or relocation of the following:

1.1.1 Asphalt and gravel pavement, fences, and other incidental demolition required to install new utilities.

1.1.2 Disconnecting, capping, or sealing and removal of existing utilities and site piping as indicated on the drawings.

1.2 Definitions

1.2.1 Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.

1.2.2 Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean and pack or crate items to protect against damage. Identify contents of containers and deliver to the Owner's designated storage area.

1.2.3 Remove and Reinstall: Remove items indicated; clean, service and otherwise prepare them for reuse; store and protect against damage. Reinstall items in locations indicated.

1.2.4 Existing to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by WW Associates, Inc., items may be removed to a suitable, protected storage location during demolition and then cleaned and reinstalled in their original location.

1.3 Materials Ownership

1.3.1 Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site and be disposed of by the Contractor.

1.3.2 Historical items, relics, and similar objects, which may be encountered during demolition, remain the Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.

1.4 Quality Assurance

1.4.1 Regulatory Requirements: Comply with governing Environmental Protection Agency (EPA) notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.5 Project Conditions

1.5.1 The Owner assumes no responsibility for actual condition of structures to be demolished.

1.5.2 Storage or sale of removed items or materials onsite will not be permitted.

1.5.3 Asbestos: It is not expected that asbestos will be encountered in the course of this contract. If any materials suspected of containing asbestos are encountered, do not disturb the materials. Immediately notify WW Associates and the Owner.

1.5.4 The following equipment items shall be salvaged as part of this project:

1.5.4.1 Items requested by the Owner or Engineer.

1.6 Scheduling

1.6.1 Arrange demolition schedule so as not to interfere with the Owner's onsite operations.

2 PRODUCTS: Not Used

3 EXECUTION

3.1 General

3.1.1 Work shall be performed in such manner as not to endanger the safety of the workmen or the public or cause damage to nearby structures.

3.1.2 Provide all barriers and precautionary measures in accordance with the Owner's requirements and other authorities having jurisdiction.

3.1.3 Prior to the execution of the work, the Contractor, Owner, and Engineer shall jointly survey the condition of the adjoining and/or nearby structures. Photographs and records shall be made of any prior settlement or cracking of structures, pavements, and the like, that may become the subject of possible damage claims.

3.2 Disposal of Material

3.2.1 All debris resulting from the demolition and removal work shall be disposed of by the Contractor as part of the work of this contract. Material designated by the Engineer to be salvaged shall be stored on the construction site as

directed. All other material shall be disposed of offsite by the Contractor at his expense in accordance with all federal, state, and local regulations.

3.2.2 Burning of any debris resulting from demolition activities will not be permitted at the site.

3.3 Utility Services

3.3.1 Utility Requirements: Locate, identify, disconnect, and seal or cap off utility services to be removed or abandoned in place as indicated on the drawings.

3.3.2 All pipes to be abandoned in place shall be filled with flowable fill and the area around each structure shall be restored to original condition, including seeding and patching of pavement as necessary.

3.3.3 Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

3.3.3.1 Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

3.3.4 Drain and dispose of water at the Contractor's expense before proceeding with abandonment or removal of existing water service piping.

3.4 Explosives: Explosives shall not be used for demolition activities.

3.5 Pollution Controls

3.5.1 Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.

3.5.1.1 Do not use water when it may create hazardous or objectionable conditions, such as ice, flooding, or pollution.

3.5.2 Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas. Keep pavement and area adjacent to the site clean and free of mud, dirt, and debris at all times.

3.5.3 Clean adjacent buildings and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to the condition existing before the start of demolition activities.

3.6 Remove above grade improvements such as posts, poles, fences, walls, and other items as specifically indicated or necessary to permit new construction.

- 3.7 Filling Below Grade Areas: Completely fill below grade areas and voids resulting from demolition of structures, and pavements with soil materials in accordance with Section 02200 - Earthwork. Fill material shall be completely free of debris and rubbish.
- 3.7.1 Prior to placement of fill materials, ensure that areas to be filled are free of standing water, frost, frozen material, trash, and debris.
- 3.7.2 After fill placement and compaction, grade surface to meet adjacent contours and to provide flow to surface drainage structures.
- 3.8 Pavement Removal: Saw cut and remove existing asphalt concrete pavement for pipe installation in accordance with Section 02500 – Paving and Surfacing.
- 3.9 Damages: Promptly repair damages to adjacent utilities or pavement caused by demolition activities.
- 3.10 Cleanup
- 3.10.1 Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site. If the Contractor fails to remove excess debris promptly, the Owner reserves the right to remove it at the Contractor's expense.
- 3.10.2 Remove promptly salvageable material that becomes property of the Contractor and is not to be reused in construction. Sale of material on the site will be prohibited.
- 3.10.3 Remove all tools, equipment, and materials from the demolition site, and all rubbish upon completion of the work.
- 3.10.4 Leave the site clean, neat, orderly, and in condition to begin new construction.

End of Section

Section 02055
Traffic Regulation

1 GENERAL

1.1 The Contractor shall perform all work occurring in rights-of-way in accordance with County and VDOT permits, as well as the latest edition of the following references:

1.1.1 Virginia Department of Transportation (VDOT) Road and Bridge Standards

1.1.2 VDOT Road and Bridge Specifications

1.1.3 U.S. Department of Transportation (USDOT) Federal Highway Administration Manual of Uniform Traffic Control Devices (MUTCD)

1.1.4 Virginia Supplement to MUTCD

1.1.5 Virginia Work Area Protection Manual

1.2 Requirements

1.2.1 Description: This work shall cover all of the measures necessary to maintain and to protect traffic, to protect the work in progress, and to protect adjacent property from excessive dust generated by public traffic and Contractor's construction equipment on the public travel lane. The work shall include labor, materials, and equipment necessary to keep the traveled road smooth; the construction of temporary structures when required; the furnishing and applying of aggregate and dust palliatives; the furnishing and maintenance of signs, auxiliary barriers, channeling devices, hazard warning lights, barricades, flares, and reflective markers and their prompt removal when the hazard is eliminated; the furnishing of pilot trucks and drivers when needed; and the furnishing of flagmen.

1.2.2 The Contractor shall conduct a preconstruction meeting with VDOT to obtain all traffic control requirements and discuss the required traffic control plan.

1.2.3 The Contractor shall maintain at least one lane open at all times during construction for two-way traffic. In any one lane roads, the contractor shall limit the work to an area between two cross streets to maximize access to properties adjacent to the road.

1.2.4 Submittals: Provide the following in a timely manner in accordance with the approved submittals schedule as specified in Section 01400 – General Requirements:

1.2.4.1 Detailed traffic control plan and written description of proposed traffic control measures prior to the start of construction.

- 1.2.4.2 Submit Traffic Control Plan to VDOT for all streets and comply with all VDOT requirements.
- 1.2.5 Flagmen: The Contractor shall furnish all flagmen, and all flagging shall be his responsibility. Flagmen shall be provided at the ends of projects where one-way traffic is required, at limits of one-way traffic lanes, at locations where project construction equipment is required to cross public roads, and at any other locations necessary. Hand signaling devices, orange caps and vests shall be furnished by the Contractor for use by the Contractor's personnel assigned to traffic control responsibilities.
- 1.2.6 Warning Devices: Warnings devices, such as signs, auxiliary barriers, channeling devices, hazard warning lights, barricades, flares, and reflective markers, shall be furnished, erected, and maintained by the Contractor for the protection and guidance of traffic. Devices shall be provided, erected, and maintained at the ends of the project and on roads intersecting the project. All devices shall be in place before work begins, be correctly maintained while in use, and be removed as soon as they are no longer necessary. If the devices do not apply to existing conditions during an intermediate period, they shall be removed or the face completely covered with an opaque weatherproof hood. All devices shall be moved as often as necessary to properly delineate the construction area.
- 1.2.7 Field Conditions: If actual field conditions are not illustrated on the drawings, engineering judgment and discretion shall be exercised to select devices that will be adaptable, but the general policies herein prescribed shall be adhered to. Final responsibility for the installation of adequate safety devices for the protection of the traveling public and workmen, as well as for the safeguard of the work in general, shall rest with the Contractor.
- 1.2.8 The Contractor shall notify the County a minimum of two weeks in advance of any road lane closures and specify the length of time of closure.
- 2 PRODUCTS: NOT USED
- 3 EXECUTION: NOT USED

End of Section

Section 02200
Earthwork

1 GENERAL

1.1 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.

1.1.1 American Society for Testing and Materials (ASTM)

1.1.1.1 ASTM C 136: Sieve analysis of fine and coarse aggregates.

1.1.1.2 ASTM D 698: Moisture-density relations of soils and soil-aggregate mixtures using 5.5-lb (2.49-kg) rammer and 12-inch (305-mm) drop.

1.1.1.3 ASTM D 1140: Amount of material in soils finer than the No. 200 (75-micrometer) sieve.

1.1.1.4 ASTM D 1556: Density of soil in place by the sand-cone method.

1.1.1.5 ASTM D 2487: Classification of soils for engineering purposes.

1.1.1.6 ASTM D 4318: Liquid limit, plastic limit, and plasticity index of soils.

1.1.1.7 ASTM D 6938: In-place density and water content of soil and soil-aggregate by nuclear methods (shallow depth)

1.2 Definitions

1.2.1 Hard Materials: Weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.2.2 Rock: Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding ½ cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

- 1.2.3 Cohesive Materials: Materials ASTM D 2487 classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesive only when the fines have a plasticity index greater than zero.
- 1.2.4 Cohesionless Materials: Materials ASTM D 2487 classified as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have plasticity index of zero.
- 1.3 Submittals: Provide the following in a timely manner in accordance with the approved submittals schedule as specified in Section 01400 – General Requirements.
 - 1.3.1 Two copies of field test reports for fill and backfill tests, select materials tests, and density tests.
- 1.4 Delivery, Storage, and Handling: Perform in a manner to prevent contamination or segregation of materials.
- 1.5 Criteria for Bidding
 - 1.5.1 Base bids on the elevations as indicated.
 - 1.5.2 The Contractor shall comply with the requirements specified herein, as well as the geotechnical recommendations presented in Appendices A and B of this project manual.
 - 1.5.3 All earthwork excavation shall be unclassified, regardless of material encountered. All earthwork excavation shall be performed to the indicated elevations at no additional cost to the Owner.
 - 1.5.4 Material character is generally indicated by the boring logs presented in Appendices A and B of this project manual. The soils reports (Appendices A and B) are available for the Contractor’s information, but will not be part of the contract documents. When there is a conflict between the soils reports, the drawings, and the project manual, the project manual shall take precedence.
 - 1.5.5 Groundwater elevations indicated by the boring logs were those existing at the time subsurface investigations were made and do not necessarily represent groundwater elevation at the time of construction.
 - 1.5.6 Blasting will not be permitted on this project.
 - 1.5.7 Remove material in an approved manner, and provide excavation support structures as required in accordance with the U.S. Army Corps of Engineers “Safety and Health Requirements Manual,” EM-385-1-1, Sections 25 A through E.

- 1.6 Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements not indicated to be removed, and improvements on adjoining properties.
 - 1.6.1 Restore all improvements damaged by this work to their original condition, and acceptable to the Owner or other parties or authorities having jurisdiction, unless indicated otherwise.
- 1.7 Protect existing trees and other vegetation indicated to remain in place against cutting, breaking, or skinning of roots; skinning and bruising of bark; smothering of trees by stockpiling construction materials or excavated materials within drip line; excess foot or vehicular traffic; or parking of vehicles within drip line. Provide temporary fences, barricades, or guards as required to protect trees and vegetation to be left standing.
- 1.8 Burning of site clearing debris will not be allowed.
- 1.9 Utility Location: The Contractor shall provide the services of a pipe utility location firm to use nondestructive, air vacuum excavation methods to pothole existing underground utilities within the limits of disturbance on this project to avoid utility conflicts. Pothole excavations shall be performed every 50 linear feet along pipe lines, and at additional locations where requested by WW Associates, Inc. Resolution of utility conflicts is the responsibility of the Contractor at no additional cost to the Owner. Utilities shall be marked by the pipe utility location firm prior to construction.

2 PRODUCTS

- 2.1 Soil Materials: Free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and frozen deleterious or objectionable materials. The maximum particle diameter shall be one-half the lift thickness at the specified location. The maximum particle diameter for pipe backfill material located less than 1-foot above the pipe crown shall be 1-inch.
 - 2.1.1 Common Fill: Approved, unclassified soil material with the characteristics required to compact to the soil density specified for the intended location.
 - 2.1.2 Backfill and Fill Material: ASTM D 2487, Classification GW, GP, GM, GC, SW, SP, SM, SC, ML with a maximum ASTM D 4318 liquid limit of 35, maximum ASTM D 4318 plasticity index of 12, and a maximum of 25 percent by weight passing ASTM D 1140, No. 200 sieve.
 - 2.1.3 Topsoil: Provide as specified in Section 02936 – Seeding.
 - 2.1.4 Select Material: ASTM D 2487, Classification GW, GP, SW, SP with a maximum of 10 percent by weight passing ASTM D 1140, No. 200 sieve.
 - 2.1.5 Pipe Bedding Material: VDOT No. 57 coarse aggregate.

2.1.6 Aggregate Fill: VDOT No. 57 coarse aggregate.

2.2 Borrow: Obtain borrow materials required in excess of those furnished from excavations from sources off the Owner's property. Provide and submit soil classification testing to ensure borrow materials meet the requirements of this specification.

3 EXECUTION

3.1 Clearing

3.1.1 Remove from the site trees, stumps, roots, brush, shrubs, down timber, rotten wood, rubbish, other vegetation, as well as fences and incidental structures necessary to allow for new construction.

3.1.2 Clearing work shall be restricted to area within "Construction Limits" specified in this Section and as indicated on the drawings.

3.1.3 Undisturbed stumps and roots, a minimum of 5 feet below finished grade and not located under or within 10 feet of any structure, may be left in place. Tops of stumps left in place shall not be more than 6 inches above original grade.

3.2 Existing Trees and Shrubs

3.2.1 Trees and shrubs that are to remain will be indicated on the drawings or conspicuously marked on site.

3.2.2 Ownership of Trees: Unless otherwise noted, trees removed to allow for new construction shall become the property of the Contractor and shall be removed from the site.

3.2.3 Provide protection for roots and branches over 1½ inches in diameter that are cut during construction operations. Coat the cut faces with an emulsified asphalt or other coating especially formulated for horticultural use on cut or damaged plant tissues. Temporarily cover all exposed roots with wet burlap to prevent roots from drying out. Provide earth cover as soon as possible.

3.3 Grubbing

3.3.1 Grub areas within and to a point 10 feet outside of all structures, areas to receive fill where finished grade will be less than 3 feet above existing grade, cut areas where finished grade will be less than 2 feet below existing grade, transitional areas between cut and fill, and any area to receive control fill.

3.3.2 Remove from the ground to a depth of 24 inches all stumps, roots ½-inch diameter and larger, organic material, and debris.

3.3.3 Use only hand methods for grubbing inside the drip lines of trees that are to remain.

3.4 Land Disturbance and Construction Limit Criteria for Utility Construction

3.4.1 General Requirements Applying to all Areas

3.4.1.1 The Contractor shall plan construction to minimize disturbance to properties adjacent to the proposed utilities. The Contractor shall flag the proposed limits of construction and mark all proposed trees to be cut for review and approval by the Engineer prior to any clearing being performed.

3.4.1.2 The Engineer reserves the right to limit the width of land to be disturbed and to designate on the drawings or in the field certain areas or items within this width to be protected from damage.

3.4.1.3 The Contractor shall be responsible for damages to area or items designated by the Engineer to be protected. Repairs to, replacement of, or reparations for areas or items damaged shall be made to the satisfaction of the Engineer before acceptance of the completed project.

3.4.1.4 Unless otherwise noted on the contract drawings, all trees cut shall be removed from this project. Brush, laps, roots, and stumps from trees shall also be removed from the site.

3.4.1.5 All buildings or structures located along the line shall be protected by the Contractor. Hand trenching, shoring, or other methods may be required.

3.4.1.6 Any fences disturbed by the Contractor shall be repaired with new materials to a condition equal to or better than their original condition or to the satisfaction of the Engineer. Provide new fencing where indicated on the drawings.

3.4.1.7 The Contractor shall obtain written permission from property owners for use of any access points other than ones located within right-of-ways. Written permission shall contain conditions for use and restoration agreements between property owner and Contractor.

3.4.1.8 All areas disturbed shall be restored to a condition equal to or better than their original condition and shall be graded to drain.

3.4.1.9 The Contractor shall replace or repair all damaged or destroyed property corners.

- 3.4.1.10 All trees located beyond 10 feet of the utility centerline shall be protected unless the Contractor obtains written authorization from the Engineer to remove them. The Engineer reserves the right to designate other trees located closer to the centerline for protection where possible.
- 3.4.1.11 All shrubs, hedge, or other ornamental plantings located along the line shall be protected or moved and replanted by the Contractor.
- 3.4.1.12 The Contractor shall grub only brush, roots, and stumps of removed trees. Damage to lawns shall be kept to an absolute minimum necessary for construction.
- 3.4.1.13 Topsoil shall be removed from trench line to a depth of 6 inches and stockpiled for use in final restoration. Topsoil shall be replaced to the same depth.
- 3.4.1.14 Excavated rock shall be removed from the site unless otherwise ordered by the Engineer.
- 3.4.1.15 Restoration and fine grading shall follow within 1 week from the time an area is disturbed or within 500 feet from the immediate work site, whichever occurs first. Seeding shall follow as specified in Section 02936 – Seeding.

3.4.2 Construction Limits

- 3.4.2.1 The Contractor shall not disturb any areas outside the right-of-way, easement boundaries, or construction limits indicated on the drawings without express written permission from the Engineer. Construction limits are defined as the limits of clearing.
- 3.4.2.2 No clear-cutting of timber shall be permitted within the construction limits. The Contractor shall make select cutting of trees, taking the smallest trees first, that are mandatory for the construction of the utility line. The Engineer's decision shall be final on determination of which trees are to be cut.

3.5 Clean up debris resulting from site clearing operations continuously with the progress of the work.

3.6 Remove debris from the site in such a manner as to prevent spillage. Keep pavement and areas adjacent to site clean and free from mud, dirt, and debris at all times.

3.7 Surface Preparation

- 3.7.1 Stripping: Strip existing topsoil, when present, to a depth of 6 inches without contamination by subsoil material. Stockpile topsoil separately from other excavated material and locate convenient to finish grading area.

3.7.2 Unsuitable Material: Remove unsuitable soil materials, waste material, vegetation, debris, decayed vegetable matter, sod, and mulch from the construction site. Dispose of the unsuitable material off the Owner's property in accordance with all federal, state, and local regulations.

3.8 Protections

3.8.1 Protection Systems: Provide shoring, bracing, and sheeting as required in accordance with the U.S. Army Corps of Engineers "Safety and Health Requirements Manual," EM-385-1-1, Sections 25 A through E.

3.8.2 Site Drainage: Provide for the collection and disposal of surface and subsurface water encountered during construction.

3.8.2.1 Surface Drainage: Completely drain the construction site during periods of construction to keep soil materials sufficiently dry. Provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified in this section at no additional cost to the Owner.

3.8.2.2 Subsurface Drainage: Consider site surface and subsurface conditions, available soil, and hydrological data. Remove water by benching, sump pumping, deep well pumping, or other methods to prevent softening of surfaces exposed by excavation. Use filters on dewatering devices to prevent removal of fines from soil. Provide erosion control at the outlet of piping to prevent erosion. Operate dewatering system continuously until construction work below existing water levels is complete.

3.8.3 Underground Utilities: Location of existing utilities indicated on the drawings is approximate. The Contractor shall physically verify the location and elevation of the existing utilities, whether indicated or not, prior to starting construction. The Contractor shall contact Miss Utility and respective utility owners for exact locations prior to any excavation near utilities. Protect, maintain in services, and prevent damage to utilities not designated to be removed. When utilities are encountered and are not shown on the drawings, notify the Engineer for instructions before proceeding.

3.8.4 Machinery and Equipment: Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged at no additional cost to the Owner.

3.8.5 Flotation: The Contractor shall take all necessary precautions to prevent the flotation of new piping and structures during installation and the period

before the new piping and associated structures are backfilled and placed in service.

3.9 Excavation

3.9.1 Excavate to the elevations and dimensions indicated and as specified in this section. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. When soil not meeting the requirements specified in this section is encountered during excavation, remove the unsuitable soil material and replace with select material as specified in this section. Removal and disposal of unsuitable soil material and placement and compaction of select material shall be performed at no additional cost to the Owner.

3.9.2 Keep excavations free from water. Excavate soil disturbed or weakened by the Contractor's operations, and soils softened or made unsuitable for subsequent construction due to exposure to weather. Refill with select material and compact to 95% of ASTM D 698 maximum density. Unless specified otherwise, refill excavations cut below indicated depth with select material and compact to 95% of ASTM D 698 maximum density. Side slopes when allowed shall be protected with 6-mil polyethylene sheeting.

3.9.3 Pipe Trenches: Excavate to the dimensions indicated and as specified herein. Trenches in public roadways shall be excavated in accordance with the latest edition of the VDOT Road and Bridge Specifications. Where rock is encountered, excavate and remove rock to a minimum depth of 6 inches below the pipe invert. Grade bottom of trenches to provide uniform support for each section of pipe after pipe bedding placement.

3.9.4 Unsuitable Subgrade Soil Materials: Subgrades which are determined to be unsuitable for bearing new equipment, structures, or piping, shall have the unsuitable subgrade soil materials removed and disposed of, and replaced with select material at no additional cost to the Owner.

3.10 Filling and Backfilling: Fill and backfill to elevations and dimensions indicated. Compact each lift before placing overlaying lift.

3.10.1 Common Fill Placement: Provide for general site. Place in 6-inch lifts. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Aerate material excessively moistened by rain to a satisfactory moisture content. Provide a smooth finish surface by blading, rolling with a smooth roller, or both.

3.10.2 Backfill and Fill Material Placement: Place in 6-inch lifts. Place backfill material adjacent to structures as the structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against structures. Place backfill and fill materials to 5 feet outside of structures.

- 3.10.3 Select Material Placement: Provide under all structures and concrete slabs. Select materials shall be provided from approved borrow areas. In addition, provide stone where indicated on the drawings. Place in 6-inch lifts. Backfill adjacent to structures shall be placed as structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against structures.
- 3.10.4 Trench Backfilling: Backfill as rapidly as construction, testing, and acceptance of work permits. Place and compact initial backfill and backfill materials in 6-inch lifts to the top of the trench. Trenches in public roadways shall be backfilled and compacted in accordance with the latest edition of the VDOT Road and Bridge Specifications.
- 3.10.5 Bedding Requirements: Except as specified otherwise in the individual piping sections, provide bedding for buried piping as specified herein. Piping shall be bedded in VDOT No. 57 coarse aggregate to a depth of $\frac{1}{4}$ the outside pipe diameter (minimum depth of 4 inches) beneath the pipe invert. Where rock is encountered, provide a minimum bedding depth of 6 inches beneath the pipe invert.
- 3.11 Compaction: Expressed as a percentage of maximum density. Determine in-place density of the existing subgrade; if required density exists, no compaction of the existing subgrade will be required. Backfill soil shall be provided with $\pm 3\%$ optimum soil moisture content before compaction.
- 3.11.1 General Site: Compact underneath areas designated for vegetation and areas outside the 10-foot line of structures to 90% of ASTM D 698.
- 3.11.2 Structures and Concrete Slabs: Compact top 12 inches of subgrade to 98% of ASTM D 698. Compact fill, backfill, and select materials to 98% of ASTM D 698.
- 3.11.3 Pipe Trenches: Compact fill, backfill, and select materials placed in pipe trenches to 95% of ASTM D 698.
- 3.11.4 Adjacent Areas: Compact areas within 10 feet of structures to 95% of ASTM D 698.
- 3.11.5 Paved Areas: Compact top 12 inches of subgrade to 100% of ASTM D 698. Compact fill, backfill, and select materials to 100% of ASTM D 698. In addition to the specified compaction requirements, fill and backfill materials shall be compacted to develop a California Bearing Ratio (CBR) of 10.
- 3.12 Finish Operations
- 3.12.1 Grading: Finish grades as indicated within one-tenth of 1 foot. Grade areas to drain water away from structures. For existing grades that will remain but which were disturbed by the Contractor's operations, grade as directed.

- 3.12.2 Seeding: Provide as specified in Section 02936 – Seeding.
- 3.12.3 Protection of Surfaces: Comply with all local requirements and the latest edition of the Virginia Erosion and Sediment Control Handbook to control erosion and sedimentation. Protect newly graded areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.
 - 3.12.3.1 No more than 100 feet of trench shall be open at any one time. Close and backfill pipe trench at the end of each day.
 - 3.12.3.2 During pipe installation activities, the Contractor shall provide seeding and mulch restoration to ensure no more than 10,000 square feet of disturbed area remains unrestored at any given time.
 - 3.12.3.3 Install silt fence on downhill side of pipe trenches and at other locations to prevent sediment from entering drainageways.
 - 3.12.3.4 Apply permanent or temporary soil stabilization to denuded areas within 15 days after final grade is reached on any portion of the site. In addition, apply soil stabilization within 15 days to denuded areas which may not be at final grade but will remain dormant (undisturbed) for longer than 60 days. Soil stabilization practices include vegetative establishment, mulching, and the early application of gravel base on areas to be paved.
 - 3.12.3.5 Install straw bale dam or silt fence around soil stockpiles and excavations.
 - 3.12.3.6 Take all applicable erosion and siltation control measures prior to grading.
 - 3.12.3.7 Protect and maintain storm sewer and culvert inlets with silt traps.
 - 3.12.3.8 Inspect all erosion and sediment control devices at the close of each work day and after each rainstorm. Make necessary repairs or clean up immediately to maintain effectiveness of the device.
 - 3.12.3.9 Where consistent with job safety requirements, easement conditions, and construction methods, place all excavated material on the uphill side of the trench. When the soil is placed on the downhill side of the trench, divert maximum drainage toward the trench.
 - 3.12.3.10 Repair after cleanup: Upon completion of construction work and after spoils and debris have been removed, regrade any areas disturbed by the operations.

- 3.12.3.11 Water discharged from dewatering activities shall not be discharged directly to any stream or body of water. Comply with Specification 3.26, "Dewatering Structure," of the latest edition of the Virginia Erosion and Sediment Control Handbook.
- 3.13 Disposition of Surplus Material: Waste unsuitable soil materials off the Owner's property as directed by the Owner and WW Associates, Inc. in accordance with federal, state, and local regulations.
- 3.14 Field Quality Control: The Contractor shall employ an independent testing firm to provide all soil testing required for this project.
- 3.14.1 Sampling: Take the number and size of samples required to perform the following tests.
- 3.14.2 Testing: Perform one of each of the required tests for each material used. Provide additional tests for each source change and as requested by WW Associates, Inc.
- 3.14.2.1 Fill and Backfill: Test fill and backfill material in accordance with ASTM C 136 for conformance to ASTM D 2487 gradation limits; ASTM D 1140 for material finer than the No. 200 sieve; ASTM D 423 for liquid limit and ASTM D 424 for plastic limits; ASTM D 698 for moisture density relations, as applicable.
- 3.14.2.2 Select Material: Test select material in accordance with ASTM C 136 for conformance to ASTM D 2487 gradation limits; ASTM D 1140 for material finer than the No. 200 sieve; ASTM D 698 for moisture density relations, as applicable.
- 3.14.2.3 Density Tests: Test soil density in accordance with ASTM D 1556, or ASTM D 6938. When ASTM D 6938 density tests are used, verify density test results by performing an ASTM D 1556 density test at a location already ASTM D 6938 tested as specified herein. Perform an ASTM D 1556 density test at the start of the project, and for every 10 ASTM D 6938 density tests thereafter. Test each lift at randomly selected locations every 500 square feet of existing grade in fills for structures and concrete slabs, every 500 square feet for other fill areas, every 1,000 square feet of subgrade in cut, and every 250 linear feet for pipe line installation (minimum one test per pipe line), and additional tests as requested by WW Associates.

End of Section

Section 02300
Boring/Tunneling

1. GENERAL
 - 1.1. Related Requirements: The following sections contain requirements that relate to this section.
 - 1.1.1. Section 02665 – Raw Water Piping System
 - 1.2. Reference specifications are referred to by abbreviation as follows:
 - 1.2.1. American Association of State Highway and Transportation Officials..... AASHTO
 - 1.2.2. American Railway Engineering and Maintenance-of-Way Association..... AREMA
 - 1.2.3. American Society for Testing and Materials..... ASTM
 - 1.2.4. American Water Works Association..... AWWA
 - 1.2.5. Virginia Department of Transportation..... VDOT
 - 1.3. Submittals: Provide the following shop drawings in a timely manner in accordance with the approved submittals schedule as specified in Section 01400 – General Requirements:
 - 1.3.1. Shop drawings and product data for liner plate, casing pipe, casing spacers, and end seals.
 - 1.3.2. Complete shop drawing details of the entire casing system installation operation to the Engineer for review at the preconstruction conference. Provide bore pit details for each casing system installation operation, including, but not limited to, shoring plans, drawings showing plan and section views indicating size, location, and depth of pits. The submittal shall also provide specific details for blasting and monitoring blasts for removal of rock, if allowed. The submittal shall also include design calculations for each casing pipe installation to verify casing pipe or plates will withstand loading based on AASHTO Section 16 "Steel Tunnel Liner Plate," or AREMA Specification, Chapter 1, Part 4, "Culverts." Review by the Engineer shall not relieve the Contractor of his responsibilities under this contract.
 - 1.4. Notify the Owner 2 weeks prior to beginning work.
 - 1.5. Perform all work in a manner approved by the Engineer.
 - 1.6. "Mixed Face" conditions may be encountered in the installation of casing system. The Contractor shall install the casing system by boring, tunneling (hand

mining), or a combination of boring and tunneling at no additional cost to the Owner.

- 1.7 The Contractor shall determine for himself the existing conditions both above and below ground. The Contractor shall be responsible for completing the installation of the casing system, including the carrier pipe, to the required lines and grade at no additional cost to the Owner.
- 1.8 The Contractor is advised that for the purpose of this specification, boring and tunneling are the same activity for pricing. No further payments will be allowed beyond the bid amounts whether the casing is bored or tunneled.

2. PRODUCTS

- 2.1. Carrier pipe shall be water main piping as specified in Section 02665 – Raw Water Piping System.
- 2.2. Grout mix for filling voids in between soil and tunnel liner plates/casing pipe shall consist of the following materials properly mixed in proportions by weight.
 - 2.2.1. 1.0 part cement
 - 2.2.2. 3.0 parts fine sand, 100 percent shall pass No.16 sieve.
 - 2.2.3. 0.5 to 0.6 part water
- 2.3 The steel lining shall consist of plates 16, 18, or 24 inches wide. Each circumferential ring shall be composed of the number and length plates necessary to complete the required shape shown on the drawings. The nominal tunnel diameter shall be of sufficient size to install the carrier pipe.
- 2.4 Plates shall be one-piece steel meeting the requirements of ASTM A 569, ASTM A 570, or ASTM A 611.
- 2.5 Plates shall have an ultimate tensile strength of at least 42,000-psi and yield strength of 28,000-psi. Gauge thickness shall be a minimum of 8 gauge.
- 2.6 Grout holes 2 inches or larger in diameter shall be provided in each ring to permit grouting as the erection of the tunnel liner plates progresses. Grout hole plugs shall be provided in plates.
- 2.7 Joints shall be joined by steel bolts meeting requirements of ASTM A 449 for plate thickness equal to or greater than 0.209-inch and ASTM A 307 for plate thickness less than 0.209-inch. The nut shall meet requirements of ASTM A 307, Grade A.
- 2.8 Steel casing pipe for boring or jacking through soil under highways shall meet requirements of ASTM A139, Grade B and shall conform to Section 232.02 C(7) of the VDOT Road and Bridge Specifications. Steel casing pipe for boring or jacking under railroads shall be in accordance with the current edition of the

American Railway Engineering and Maintenance-of-Way Association, (AREMA), Manual for Railway Engineering. Nominal pipe diameter and wall thickness shall be as indicated on the drawings. No interior lining and exterior coating, nor hydrostatic testing, will be required.

2.9 Casing Spacers

2.9.1 Casing spacers shall be bolt-on style with a two-piece shell made from T-304 stainless steel of a minimum 14-gauge thickness. Each shell section shall have bolt flanges formed with ribs for added strength. Each connecting flange shall have a minimum of three 5/16-inch T-304 bolts. The shell shall be lined with a ribbed PVC extrusion with a retaining section that overlaps the edge of the shell and prevents slippage.

2.9.2 Bearing surfaces (runners) made from UHMW polymer with a static coefficient of friction of 0.11-0.13 shall be attached to support structures (risers) at appropriate positions to properly support the carrier within the casing and to ease installation. The runners shall be attached mechanically by T-304 threaded fasteners that are inserted through the punched riser section and tig-welded for strength. Risers shall be made of T-304 stainless steel of a minimum 14-gauge. All risers over 2 inches in height shall be reinforced. Risers shall be mig-welded to the shell. All metal surfaces shall be fully chemically passivated.

2.9.3 Casing spacers shall be Model CCS as manufactured by Cascade Waterworks Manufacturing Company, 1213 Badger Street, Yorkville, Illinois 60560, Telephone Number: (800) 426-4301, or Model S8G-2 by Pipeline Seal and Insulator, Inc., 6525 Goforth Street, Houston, Texas 77021, Telephone Number: (800) 423-2410.

2.10 End Seals: End seals shall be Model C as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.

3. EXECUTION

3.1. Boring

3.1.1. Commence casing system installation from a pit, with the bottom excavated to grade, and sheeted or shored if necessary. Installation of the casing system shall be by boring through soil shall have a steel pipe jacked in place as a casing pipe. Joining of steel casing pipe shall meet requirements of AWWA C206 "Standard for Field Welding of Steel Water Pipe Joints." Boring through rock shall be oversized to allow installation of carrier pipe, but no casing pipe shall be required unless necessary for safety reasons.

3.1.2. Pull the carrier pipe in place a joint at a time. Securely block each section in place with casing spacers as specified herein.

3.1.3. Provide end seals at casing pipe ends to protect against entrance of foreign matter.

- 3.1.4. The Contractor shall determine for himself the existing conditions both above and below ground and shall physically verify the location and elevation of the existing utilities, whether indicated or not, prior to installation. The Contractor shall contact Miss Utility and respective utility owners for exact locations prior to any casing installation near utilities. The Contractor shall be responsible for installing the casing pipe and the carrier pipe to the required lines and grades.
 - 3.1.5. The carrier pipe shall be centered and restrained within the casing pipe by the use of casing spacers. Placement intervals for casing spacers shall be in accordance with the manufacturer's written recommendations.
 - 3.1.6. Should boring be unsuccessful, the Contractor shall provide tunneling at no additional cost.
- 3.2 Tunneling (Hand Mining)
- 3.2.1 Commence tunneling operation from a pit, with the bottom excavated to grade, and sheeted or shored if necessary.
 - 3.2.2 Trim the periphery of the tunnel smoothly to fit the outside of the steel liner plate as early as practical. All blasting, if allowed, shall conform to requirements for blasting in Section 02200 – Earthwork.
 - 3.2.3 Install the steel liner plates immediately after the excavated material has been removed, and remove the material not more than 24 inches ahead of the installed liner plates.
 - 3.2.4 Grout all voids between the soil and tunnel liner plates. The maximum grouting pressure shall be 30-psi. Start grouting at the bottom of the tunnel liner plates and proceed upward progressively and simultaneously on both sides of the tunnel. Install liner plates no more than 6 feet ahead of grouted section. Prohibit traffic over ungrouted sections of tunnel unless this section is in solid rock. Thoroughly dry-mix grout ingredients before adding water. After adding water, mix the batch 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. Placing shall be quick and continuous. Placement shall be under pressure with a grout pump.
 - 3.2.5 Smoothly pave the bottom of the tunnel with concrete. Pull the carrier pipe in place a joint at a time. Securely block each section in place with casing spacers as specified in in Section 02665 – Raw Water Piping System.
 - 3.2.6 Provide end seals at tunnel liner ends to protect against entrance of foreign matter.

End of Section

Section 02350
Trenchless Pipe Installation

- 1 GENERAL
 - 1.1 Description: Trenchless pipe installation shall consist of, but not be limited to, all work associated with the installation of raw and finished water main as indicated on the drawings by directional drilling methods.
 - 1.1.1 The method of installation of raw and finished water main piping shall be at the discretion of the Contractor, except where indicated on the drawings.
 - 1.2 Process Description
 - 1.2.1 Directional drilling is the process of directing a string of small pipe, known as a drill string, along a pre-determined profile to drill a pilot hole, enlarge the pilot hole, and pull the pipe into place. In general, the process uses a machine to rotate, advance and retract the drill string; a cutterhead for drilling the pilot hole; a backreamer to enlarge the pilot hole to the required diameter; a pulling head and bearing swivel to pull the pipe into place; a drill string head locating and guidance system; and drilling fluid to provide lubrication, remove the cuttings and spoil and maintain the integrity of the hole.
 - 1.3 Submittals: Provide the following shop drawings in accordance with the approved submittals schedule as specified in Section 01400 – General Requirements.
 - 1.3.1 Drilling fluid containment and disposal plan.
 - 1.3.2 Frack out plan.
 - 1.3.3 Drilling logs and a plot in plan and profile of the completed pilot hole for acceptance prior to reaming and pipe installation.
 - 1.3.4 Log and summary of stresses imposed on pipe during pulling.
 - 1.3.5 Log and summary of drilling fluid usage.
 - 1.4 Quality Assurance
 - 1.4.1 Submit qualifications for installing pipe by directional drilling.
 - 1.4.2 Use of a rotary compactor, cement slurry or other means necessary to maintain the integrity of the hole shall be at the discretion of the Contractor.

1.5 Regulatory Requirements

- 1.5.1 The Contractor shall secure necessary permits. Work shall not begin before permits are issued.
- 1.5.2 The Contractor shall be responsible for meeting the requirements of the governing authority, which may include approval of equipment to be used for installation of the pipe, and for notifying the governing authority prior to start of work.
- 1.5.3 The Owner and Engineer shall not be responsible for additional cost to Contractor for failure to meet governing authority's requirements.
- 1.5.4 The Contractor shall determine for himself the existing conditions both above and below ground. The Contractor shall be responsible for completing the directional drilling work to the required lines and grades at no additional cost to the Owner.

2 PRODUCTS

2.1 Raw Water Main Piping

- 2.1.1 Raw water main piping shall be high density polyethylene (HDPE) in accordance with Section 02665 – Raw Water Piping System.

2.2 Finished Water Main Piping

- 2.2.1 Finished water main piping for trenchless pipe installation methods shall be high density polyethylene (HDPE) in accordance with Section 02660 – Finished Water Distribution System.

2.3 Drilling Fluid

- 2.3.1 Drilling fluid shall be a mixture of clean water, premium Wyoming bentonite, and, if required, a small amount of polymer.
- 2.3.2 The Contractor shall comply with environmental requirements.

3 EXECUTION

3.1 Examination

- 3.1.1 Verify that area for installation is ready to receive work, and excavations, dimensions, and elevations are as indicated on drawings.
- 3.1.2 The Contractor accepts full responsibility for the Contractor's conclusions relative to the nature and probable difficulties of the work due to underground facilities and soil conditions.

- 3.1.3 Beginning of installation means the Contractor's acceptance of existing conditions.
- 3.2 Preparation
 - 3.2.1 Notify the Owner at least 48 hours prior to beginning the work.
 - 3.2.2 Establish drill staging area and pipe staging area as needed to accommodate workers, equipment, and drilling fluid containment, and to string, fuse, and inspect the pipe, while disturbing as little area as possible.
 - 3.2.3 Excavate entry and exit pits in accordance with Section 02200 – Earthwork. Provide excavation support systems in accordance with OSHA Regulations.
- 3.3 Pilot Hole
 - 3.3.1 Drill pilot hole along path shown to the following tolerances:
 - 3.3.1.1 For mains, ± 2 feet horizontal and vertical, but in no case shall depth of bury be less than the minimum indicated on the drawings.
 - 3.3.1.2 Curve radius shall not be less than the pipe manufacturer's instructed minimum.
 - 3.3.1.3 At no time shall pipe leave a road right-of-way or permanent easement limits.
 - 3.3.2 Determine cutterhead location every 25 feet.
 - 3.3.3 Install so as not to encounter materials which will cause interference with the guidance and locating system.
 - 3.3.4 Abandonment of all or part of a pilot hole for whatever reason and necessary re-drilling shall be the responsibility of the Contractor.
- 3.4 Reaming and Pipe Installation
 - 3.4.1 All high density polyethylene piping shall be installed in accordance with the Plastics Pipe Institute's "Handbook of Polyethylene Pipe" to include strict adherence to maximum joint deflection allowances.
 - 3.4.2 Ream pilot hole and install pipe in a simultaneous operation. Perform pre-reaming operations as necessary for proper pipe installation.
 - 3.4.3 Install pipe using a pulling head and bearing swivel assembly to minimize torsional stress on the pipe, and incorporating a device such as

a hydraulic pressure regulator or a load sensor to control and limit the pull applied to the pipe.

- 3.4.4 Support the pipe as it proceeds during the pulling operation so that it moves freely.
 - 3.4.5 Perform pulling of the pipe in one continuous operation.
 - 3.4.6 After pipe installation and making of connections, backfill entry and exit pits in accordance with Section 02200 – Earthwork.
- 3.5 Drilling Fluid
- 3.5.1 Prepare, handle, contain and dispose of drilling fluid in compliance with environmental regulations.
 - 3.5.2 Minimize drilling fluid returns at locations other than the entry and exit points. Immediately clean up inadvertent returns.
 - 3.5.3 Remove drilling fluid which enters the pipe by flushing or other approved means.
- 3.6 Field Quality Control
- 3.6.1 Furnish, operate and maintain instrumentation that will accurately locate the pilot hole, measure drilling fluid flow discharge rate and pressure, and measure stresses on pipe during installation.
 - 3.6.2 The Owner and the Engineer shall have access to instruments, gages, and readings at all times.
 - 3.6.3 Maintain drilling logs including dates, times and locations, soil condition, drilling data such as depth, angle and rate of penetration, and utility crossings.
 - 3.6.4 Monitor and record use of drilling fluid.
 - 3.6.5 Monitor and record stresses imposed on pipe during pulling.
- 3.7 Record Drawings
- 3.7.1 The Contractor shall submit record drawings in accordance with Section 01400 – General Requirements based on the final course followed by the reamer and installed pipe.

End of Section

Section 02500
Paving and Surfacing

1 GENERAL

1.1 Reference specifications where applicable to work under this section are referred to by abbreviation as follows:

1.1.1 American Association of State Highway and Transportation
Officials..... AASHTO

1.1.2 American Society for Testing and Materials..... ASTM

1.1.3 Virginia Department of Transportation VDOT

1.2 Submittals: Provide the following in a timely manner in accordance with the approved submittals schedule as specified in Section 01400 – General Requirements.

1.2.1 Load tickets for all asphalt trucks.

1.2.2 Materials certificates signed by material producer and Contractor. Certificates shall state that each material item meets specified requirements.

1.2.3 Job-mix formulas for each required asphalt-aggregate mixture. Mix designs shall be within allowable tolerances as specified for the particular application.

1.3 Apply prime and tack coats only when ambient temperature is above 50°F and when temperature has not been below 35°F for 12 hours immediately prior to application. Construct asphalt concrete surface course only when atmospheric temperature is above 40°F and base is dry. Base course may be laid when temperature is above 30°F and rising.

2 PRODUCTS

2.1 Aggregate base course for asphalt pavement shall be Type 1, Size No. 21A, graded aggregate base material as defined in VDOT Road and Bridge Specifications, Section 203, “Coarse Aggregate,” and Section 208, “Subbase and Aggregate Base Material.”

2.2 Aggregate base course for gravel driveway entrances and gravel roads indicated on the drawings shall be Size No. 25, graded aggregate base material as defined in VDOT Road and Bridge Specifications, Section 205, “Crusher Run Aggregate.”

2.3 Aggregate base course for construction entrances shall be Size No. 1, graded aggregate base material as defined in VDOT Road and Bridge Specifications, Section 203, “Coarse Aggregate.”

2.4 Materials for use with Asphalt Concrete

- 2.4.1 Prime coat shall be cutback asphalt RC-70 or RC-250, meeting the requirements of ASTM C 2028 and AASHTO M81.
- 2.4.2 Tack coat shall be emulsified asphalt CRS-1, meeting the requirements of VDOT Road and Bridge Specifications, Section 210, "Asphalt Materials."
- 2.5 Asphalt Concrete
 - 2.5.1 Asphalt concrete surface course shall be VDOT SM-9.5A, as indicated on the drawings, meeting requirements of VDOT Road and Bridge Specifications, Section 211, "Asphalt Concrete."
 - 2.5.2 Asphalt concrete base course shall be VDOT BM-25.0, as indicated on the drawings, meeting requirements of VDOT Road and Bridge Specifications, Section 211, "Asphalt Concrete."
 - 2.5.3 Limestone aggregate shall be used in accordance with VDOT Road and Bridge Specifications, Section 211, "Asphalt Concrete."
- 2.6 Cold patch asphalt pavement material for temporary repairs shall be Quick Pavement Repair (QPR) High Performance Pavement Repair as manufactured by Lafarge North America, Inc., QPR Division, 12735 Morris Road Extension, Alpharetta, Georgia 30004, Telephone: (800) 388-4338, Fax: (678) 746-2238, E-Mail: QPRinfo@lafarge-na.com, or approved equal.
- 2.7 Paint for pavement markings shall be traffic lane marking paint, factory mixed, quick drying, and nonbleeding. Paint shall meet the requirements of VDOT Road and Bridge Specifications, Section 231, "Paint," for traffic line marking paint, except that beads for reflectorizing will not be required.

3 EXECUTION

- 3.1 Aggregate base course construction methods and equipment shall conform to requirements of Section 309, "Aggregate Base Course," of VDOT Road and Bridge Specifications.
- 3.2 Subgrade Preparation: Subgrade preparation shall consist of the final machining of the subgrade immediately prior to placing the aggregate base course. The surface shall be true to line and grade. Construction methods and equipment shall conform to applicable portions of Section 305, "Subgrade and Shoulders," of VDOT Road and Bridge Specifications.
- 3.3 Asphalt concrete pavement construction methods shall conform to Section 315, "Asphalt Concrete Pavement," of VDOT Road and Bridge Specifications.
 - 3.3.1 Apply prime coat at rate of 0.20 to 0.50 gallon per square yard over compacted aggregate base in accordance with VDOT Road and Bridge Specifications, Section 311, "Prime Coat."
 - 3.3.2 Apply tack coat to contact surfaces of previously constructed asphalt or hydraulic cement concrete and surface abutting or projecting into asphalt

concrete pavement. Apply at rate of 0.05 to 0.15 gallon per square yard of surface in accordance with VDOT Road and Bridge Specifications, Section 310, "Tack Coat."

3.4 Pavement Repairs

- 3.4.1 Pavement repairs shall be performed at any point where excavations disturb existing asphalt and per the repair details shown on design drawings. Pavement repairs shall be performed using either permanent or temporary asphalt concrete pavement as specified herein as soon as possible or as directed by the Engineer. Unless directed otherwise, pavement repairs shall be made no later than fourteen (14) calendar days following disturbance of asphalt. Temporary stone repairs to match the existing pavement prior to pavement repairs shall be dressed at the end of each day and as directed. Repair costs shall be included in the lump sum of bid item 1 for this project.
- 3.4.2 Contractor shall match the existing subgrade, base, and overlay elevations when installing repairs. Repairs shall bring trench area to the same elevation as the surrounding area.
- 3.4.3 Pavement that will be disturbed must be saw cut. No jagged edges will be allowed. Make the cut in a straight line, parallel to, and 6 inches wider than the trench, on each side, to provide an undisturbed shoulder under the new work.
- 3.4.4 Where trenches cross a street, the Contractor shall disturb no more than one half of the street width at one time, and restore the first trench opening to satisfactory travelable condition before the second half is excavated. Avoid placement of excavated material on existing pavement wherever possible. Clean the pavement by an approved method. Do not use cleated equipment on pavements. Any pavements damaged by equipment or Contractor's operation shall be repaired at the Owner's discretion at no additional cost. Alter normal traffic flow only with permission from the Owner.
- 3.4.5 Replace aggregate base course in layers not to exceed 6 inches in thickness to a depth of 1½ times the thickness of the original aggregate base. In no case shall the replaced base be less than 8 inches thick.
- 3.4.6 Replace asphalt concrete base course equal to the original pavement asphalt base.
- 3.4.7 Replace asphalt finished surface course equal to the original pavement surface course.
- 3.4.8 Restore private entrances to the original condition or provide no less than 6 inches of aggregate base course, whichever condition is better.
- 3.4.9 Apply pavement markings following final asphalt patch.

3.5 Temporary Repairs

- 3.5.1 When existing asphalt pavement is disturbed in streets and parking lots and permanent pavement repairs cannot be performed immediately, or when asphalt concrete pavement is unavailable during winter months, furnish and place temporary cold patch asphalt material as required to maintain traffic until permanent asphalt concrete pavement repairs can be made. Cold patch material shall be installed in accordance with the manufacturer's written recommendations. Cold patch asphalt pavement material shall be placed at minimum 2-inch thickness. The Contractor shall maintain the temporary pavement repairs to the satisfaction of the Owner until permanent pavement repairs are made.
- 3.5.2 Within 30 calendar days of permanent hot patch asphalt concrete pavement becoming available, remove all temporary cold patch material and replace with permanent hot patch material.
- 3.6 All finished pavement edges shall be clean and straight. The final paving quality control shall be the responsibility of the Contractor and shall be acceptable to the Owner based on surface thickness and smoothness.
- 3.7 Do not block private entrances except for short periods, and maintain ingress and egress to adjacent property at all times.
- 3.8 Do not clog street drainage. Maintain shoulders, gutters, and ditches affected by trenching operations to carry drainage flows. New pavement overlays shall not block existing drainage flow conditions.
- 3.9 Sweep and clean surface prior to painting pavement markings. Restore pavement markings to the original condition after pavement repairs have been completed. Use yellow for no parking zones and white for all other markings.
- 3.10 Upon completion of construction work and after spoils and debris have been removed, regrade any areas disturbed by the operations.

End of Section

Section 02660
Finished Water Distribution System

- 1 GENERAL
- 1.1 Description: This section specifies all potable water distribution systems on this project.
- 1.2 Related requirements: The following sections contain requirements that relate to this section.
 - 1.2.1 Section 02350 – Trenchless Pipe Installation
- 1.3 All finished water main accessories shall comply with the latest edition of the Town of Culpeper and Culpeper County Water & Sewer Utility Standards Manual.
- 1.4 Reference specifications are referred to by abbreviation as follows:
 - 1.4.1 American Association of State Highway and Transportation Officials AASHTO
 - 1.4.2 American National Standards Institute ANSI
 - 1.4.3 American Society for Testing and Materials ASTM
 - 1.4.4 American Water Works Association AWWA
 - 1.4.5 Virginia Department of Health VDH
- 1.5 All products in contact with drinking water shall meet NSF/ANSI Standard 61, and either NSF/ANSI 61, Annex G or NSF 372 for compliance with new “lead free” content requirements.
- 1.6 Project Conditions: Separation of Water Lines and Sanitary Sewers.
 - 1.6.1 Follow VDH standards for separation of water mains and sewer lines.
 - 1.6.2 Parallel Installation
 - 1.6.2.1 Normal Conditions: Water lines shall be constructed at least 10 feet horizontally from a sewer or sewer manhole whenever possible, the distance shall be measured edge-to-edge.
 - 1.6.2.2 Unusual Conditions: When local conditions prevent a horizontal separation of at least 10 feet, the water line may be laid closer to a sewer or sewer manhole provided that:
 - 1.6.2.3 The bottom of the water line is at least 18 inches above the top of the sewer.

1.6.2.3.1 Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe pressure-tested in place to 50 psi without leakage prior to backfilling. The sewer manhole shall be of watertight construction and tested in place.

1.6.3 Crossing

1.6.3.1 Normal Conditions: Water lines crossing over sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible.

1.6.3.1.1 Unusual Conditions: When local conditions prevent a vertical separation described in crossing, normal conditions, paragraph above, the following construction shall be used.

1.6.3.1.2 Sewers passing over or under water lines shall be constructed of the materials described in parallel installation, unusual conditions, as specified above.

1.6.3.1.3 Water lines passing under sewers shall, in addition, be protected by providing:

- A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line,
- Adequate structural support for the sewers to prevent excessive deflection of the joints and settling on and breaking water line,
- That the length of the water line be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.

1.6.4 Sanitary Sewers or Sewer Manholes: No water pipes shall pass through or come in contact with any part of a sewer or sewer manhole.

1.7 Submittals: Provide the following shop drawings in accordance with the approved submittals schedule as specified in Section 01400 – General Requirements.

1.7.1 Pipe and Fittings: Catalog cuts and certificates of compliance for pipe, fittings, linings, and materials for approval. Certificates shall state that materials furnished comply with the standards specified in this section.

1.7.2 Pipe Restraint Devices

- 1.7.3 Valves: Catalog cuts and certificates of compliance for valves.
- 1.7.4 Air Release Valves
- 1.7.5 Valve Boxes/Meter Boxes
- 1.7.6 Blowoff Assemblies
- 1.7.7 Sampling Stations
- 1.7.8 Precast Concrete Manhole Details
- 1.7.9 Manhole Steps
- 1.7.10 Pipe to Manhole Connection Details
- 1.7.11 Water Piping Field Test Certification Reports
- 1.7.12 Bacteriological Test Reports (Submit to Owner)
- 1.8 NSF Compliance
 - 1.8.1 All products in contact with potable water shall be certified compliant with NSF 61-G, and shall bear the NSF-61-G certification mark.
- 2 PRODUCTS
 - 2.1 Piping Application
 - 2.1.1 All below grade finished water main piping, 6 inches or less in diameter, indicated to be installed at locations shown on the drawings, shall be constructed of PE4710 high density polyethylene (HDPE) pressure rated pipe, 200 psi pressure rating (SDR 11), except as specified below. Piping shall be provided with butt fused restrained joints.
 - 2.1.2 The following piping systems, 2 inches and smaller in diameter, shall be constructed of AWWA C901 CTS Class 200-NSF-PW Polyethylene tubing:
 - 2.1.2.1 Below grade finished water service lateral piping
 - 2.1.2.2 Below grade finished water service of air release valve and blowoff assemblies
 - 2.1.2.3 Below grade finished water piping not otherwise specified
 - 2.1.3 Accessories: Provide flanges, joint restraints, connecting pieces, transition glands, transition sleeves, tapping saddles, and other adapters as required for complete and operable piping systems for the service indicated.

Provide restrained joints where indicated on the drawings and as specified in this section.

- 2.1.4 The Contractor shall be responsible for the removal, disposal, and replacement of any existing concrete thrust blocking on existing water lines for connection of new water lines and appurtenances at no additional cost to the Owner.

2.2 Pipe

2.2.1 High Density Polyethylene (HDPE) Pipe

- 2.2.1.1 Pipe: PE4710 high density polyethylene meeting ASTM D2239 and PPI TR-4, ASTM D3350 cell classification 445474C for black and 445474E for color identification stripes, manufactured in accordance with ASTM F714 for ductile iron pipe size (DIPS), SDR 11, 200 psi pressure-rated.

- 2.2.1.2 Fittings: Fittings shall be of the same materials and classifications as the pipe.

- 2.2.1.3 Joints: Butt fused between plain ends of polyethylene pipe, fittings, and valves. Provide restrained mechanical joints for transition between pipe, fittings, and valves as necessary and indicated on the plans. HDPE mechanical joint restraints shall be Series 2000PV as manufactured by EBAA Iron, Inc. or approved equal.

- 2.2.1.4 Polyethylene fittings and custom fabrications shall be molded or fabricated by an approved manufacturer. All fittings and custom fabrications shall be pressure rated for the same internal pressure rating as the mating pipe.

- 2.2.1.5 Molded fittings shall be manufactured and tested in accordance with ASTM D 3261 and shall be so marked. Molded fittings shall be tested in accordance with AWWA C906.

- 2.2.1.6 Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock or molded fittings. Fabricated fittings shall be rated for internal pressure service at least equal to the full service pressure rating of the mating pipe. Fabricated fittings shall be tested in accordance with AWWA C906.

- 2.2.1.7 Manufacturers

- 2.2.1.7.1 ISCO Industries, or approved equal.

2.2.2 Polyethylene Tubing

- 2.2.2.1 Polyethylene tubing for service piping shall conform to AWWA C901 and ASTM D2737 and shall be Class 200, NSF-PW for drinking water use. Tubing shall have a uniform wall thickness and dimensions such that it can be adapted for use with copper tube size (CTS) standard waterworks compression type fittings. Tubing shall be clearly marked to show class, size, manufacturer's name, and NSF-PW symbol. Stainless steel insert stiffeners shall be required at all compression joint fittings.
- 2.3 Flexible couplings for connecting pipes of dissimilar materials shall be as manufactured by Fernco of Davison, Michigan.
- 2.4 Concrete shall be Class A4 as specified in Section 217 of the latest edition of the VDOT Road and Bridge Specifications.
- 2.5 Pipe Labeling
 - 2.5.1 Detectable tape shall be provided for all below grade piping systems and shall have a metallic core protected by a plastic jacket. The tape shall be continuously marked indicating that a water main is buried beneath the tape. In addition, a continuous no. 14 gauge copper wire with protective coating shall be provided for all below grade piping systems as indicated on the contract drawings.
 - 2.5.2 Detectable tracer wire for directional drilling and boring applications shall be a 12 AWG solid conductor of soft-drawn 21% IACS copper clad steel utilizing an AISI 1055 high carbon steel core, with a minimum break load of 1,150 pounds (200,000 psi). The conductor shall be rated for direct burial use at 30 volts and RoHS compliant. The insulation shall be 45 mil high-density, high molecular weight polyethylene (HDPE). Detectable tracer wire for directional drilling and boring shall be Pro-Trace HDD-CCS PE45, or Copperhead SoloShot Extra High Strength Tracer Wire.
- 2.6 Marker Posts
 - 2.6.1 Marker posts shall be provided for all non-metallic below grade piping at changes in direction, and where indicated on the contract drawings. Marker posts shall be provided with terminals for connection to pipe tracing wires. Marker posts shall indicate a water line is buried below and provide contact information for the County. Marker posts shall be manufactured by Bingham & Taylor, or approved equal.
- 2.7 Valves: Valve leakage will not be allowed.
 - 2.7.1 Gate Valves
 - 2.7.1.1 Nonrising stem gate valves 4 inches and larger shall meet requirements of AWWA C515 "AWWA Standard for Resilient Seated Gate Valves for Water and Sewerage Systems." Working

pressure shall be at least 250 psi for valve sizes 4 through 16 inches, or at the pressure rating specified for adjacent piping, whichever is greater. Valve ends shall be compatible with piping systems in which valves are installed including capability of fusion joining of polyethylene pipe ends for pipe types specified above. Valve shall be iron body, stainless steel stem, bronze mounted. Valves shall have o-ring seals and shall open counterclockwise. Asbestos packing will not be acceptable.

2.7.1.2 Valves listed above shall be manufactured by American AVK Company or approved equal.

2.7.2 Ball Valves:

2.7.2.1 Ball valves 2 inches and smaller shall be Class 200, meeting requirements of ANSI B16.40. Valves shall have HDPE bodies and balls. Valves shall be polyoxymethylene (POM) stems, and nitrile rubber seats, body seals, and stem seals. Valves shall be compatible with piping systems in which valves shall be installed including capability of fusion joining to polyethylene pipe ends for pipe types indicated above.

2.7.3 Tapping Sleeves and Valves

2.7.3.1 Tapping sleeves shall meet requirements of ANSI/AWWA C110 for pressure rating of piping. Sleeves shall be constructed in two sections and shall be mechanical joint type with flanged outlet. The tapping sleeve shall be for the size and type of piping shown on the drawings and specified herein.

2.7.3.2 Tapping valves shall meet requirements of gate valves specified in this section, except that seat opening shall be larger than nominal size and valve outlet end shall be mechanical joint.

2.7.4 Air Release Valves – Water (located on finished water main 6 inches or larger)

2.7.4.1 Air release valves shall be APCO Model 145C combination air valves as manufactured by DeZurik, or approved equal by Cla-Val Company (Series 36) or ARI USA, Inc. (Model D-040). Valves shall have the following dimensions:

2.7.4.1.1 Inlet Diameter: 2-inch NPT

2.7.4.1.2 Outlet Diameter: 2-inch NPT

2.7.4.1.3 Large Orifice Diameter: 2-inch

2.7.4.1.4 Small Orifice Diameter: 3/32-inch

- 2.7.4.2 Valves shall have ASTM A126 Grade B cast iron body, cover, and lever frame, ASTM B124 bronze plug, Buna-N needle and seat, and ASTM A240 stainless steel float.
- 2.7.5 Air Release Valves – Water (located on finished water main 4 inches or smaller)
 - 2.7.5.1 Air release valves shall be APCO Model 143C combination (single body double orifice) air valves manufactured by DeZurik Water Controls, or approved equal by Cla-Val, Val-Matic Valve and Manufacturing Company, or GA Industries, LLC. Valves shall have the following dimensions:
 - 2.7.5.1.1 Inlet Diameter: 1-inch NPT
 - 2.7.5.1.2 Outlet Diameter: 1-inch NPT
 - 2.7.5.1.3 Large Orifice Diameter: 1-inch
 - 2.7.5.1.4 Small Orifice Diameter: 0.078-inch
 - 2.7.5.2 Valves shall have ASTM A536 Grade 65-45-12 ductile iron body, cover, and lever frame, ASTM A276 stainless steel plug, Buna-N needle and seat, and ASTM A240 stainless steel float. Valve shall be suitable for 300 psig working pressure.

2.8 Sampling Stations

- 2.8.1 The water sampling station shall consist of a main shut-off ball valve, a spigot and throttling valve, and a built-in evacuation tube. The unit shall be constructed with a brass and/or stainless steel water way. The below grade water way portion of the station shall be encased in a non-corrosive housing. The above grade portion of the station shall be enclosed within a lockable polyethylene housing.
- 2.8.2 The main shut-off valve shall be ball valve type with brass body and a stainless steel ball. This valve shall be one-quarter turn operation and shall be of a maintenance free design. The throttling spigot shall consist of a ball valve of the same design and a stainless steel spigot. The throttling valve shall be placed in-line, above grade, at a distance from the spigot end which facilitates a steady flow of water containing no aeration.
- 2.8.3 The evacuation tube shall allow all water to be removed from the unit by means of a portable, hand-held pump. This tube shall allow all water to be removed from the station after each use to minimize bacteria growth and provide freeze protection.
- 2.8.4 All piping in the unit shall be constructed of brass or stainless steel or a combination of these materials. All waterway materials shall be non-

corrosive. The buried portion of the water way shall be completely enclosed in a non-corrosive, non-conductive outer housing.

- 2.8.5 The above grade portion of the unit shall be enclosed in a polyethylene enclosure. The enclosure shall have a removable top which, when removed, provides complete access to the throttling valve, spigot, main shut-off valve and evacuation tube. The removable top shall be lockable by means of a tamper proof lock. The enclosure shall be manufactured with ultraviolet inhibitors for maximum life expectancy in outdoor installations.
- 2.8.6 The unit shall be Eclipse Model 88 as manufactured by Kupferle Foundry, St. Louis, Missouri or approved equal.
- 2.9 Sleeves through concrete or masonry walls or slabs shall be cast iron or Schedule 40 steel. Provide sleeves through walls, floors, and ceilings for all pipe penetrations except where wall pipes are indicated.
- 2.10 Meter Box Enclosures: 18-inch diameter, protective, in-ground, traffic-rated, cast iron housing with "WATER" logo cast or embossed on the lid. Enclosure shall be manufactured by Mueller Company or approved equal. Provide minimum 6-inch layer of VDOT No. 57 stone bedding beneath each enclosure.
- 2.11 Corporation stops shall be one-piece bronze body with integral wrench flats, CC inlet taper threads, o-ring sealed, balanced pressure, ball type valve, having a round, full open unobstructed flow way and meeting requirements of AWWA C800, "Underground Service Line Valves and Fittings." Corporation stops shall be manufactured by Mueller Company, Ford Meter Box Company, or A.Y. McDonald.
- 2.12 Valve boxes shall be adjustable, traffic rated, cast iron valve boxes of the two-piece screw-type. Base shall be proper type and size for the valve with which it is used. The word "WATER" shall be cast or embossed on the valve box lid in letters not less than 1-inch high. Valve boxes shall be manufactured by Mueller Company, Dewey Brothers, Tyler, or Bingham-Taylor.
- 2.13 Manholes
 - 2.13.1 Precast Reinforced Concrete Manhole Section
 - 2.13.1.1 Precast reinforced concrete manhole sections shall meet requirements of ASTM C 478. Section ends shall have o-ring gasket groove provided during manufacturing process. Gaskets for section joints shall meet requirements of ASTM C 443. Joints may also be sealed with flexible butyl resin sealant as manufactured by Concrete Sealants, Inc. Sealant shall be installed in accordance with the manufacturer's written recommendations. Top sections for all manholes shall be designed to withstand HS-20 traffic loading.

- 2.13.1.2 Manhole frames and covers shall be roadway type with deep socket covers. Machine frames and covers to prevent rattling. Frames shall be provided with holes for bolting it down to manhole riser section. Provide cover with two ¾-inch diameter holes for ventilation. Castings shall be gray iron meeting requirements of ASTM A 48, Class 30, and have 24-inch diameter clear openings such as Neenah Foundry Company type R-1642 with Type “C” cover or approved equal by U.S. Foundry or East Jordan Iron Works. Other manufacturer substitutions will not be allowed. Each cover shall have cast or embossed on it in letters not less than 1-inch high “WATER” The frame and cover shall weigh at least 277 pounds.
 - 2.13.1.3 Manhole frames shall be anchored to the top of the manhole riser sections with ¾-inch expansion bolts. Two passes of “ConSeal” bitumastic sealant in 1-inch rope form shall be used to provide watertight seal between frame and manhole riser section. Clean manhole riser and frame thoroughly prior to installation.
 - 2.13.1.4 Manhole steps shall be “Surefoot” step constructed of a No. 4 steel reinforcing rod encased in corrosion-resistant rubber by Oliver Tire & Rubber Company.
 - 2.14 Pipe to sleeve sealant shall be grouting compound. Grouting compound shall be as manufactured by 3M Company or be an equivalent product having tensile strength of 80 psi and elongation property of 700% in accordance with ASTM D 3574 Test E, and linear dimension change shall not exceed 18% when subject to wet and dry cycles in accordance with ASTM D 756, Procedure G and ASTM D 1042.
 - 2.15 Mechanical Type Pipe to Wall Sleeve Seals: Mechanical type pipe to wall sleeve seals shall be “Link-Seal” pipe to wall closures manufactured by Thunderline Corporation, Wayne, Michigan. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to fill annular space between pipe and wall opening and shall provide watertight seal between pipe and wall opening.
- 3 EXECUTION
- 3.1 Pipe Laying
 - 3.1.1 Take all precautions necessary to insure that pipe, valves, fittings, and other accessories are not damaged in unloading, handling, and placing in trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.
 - 3.1.2 Exercise care to keep foreign material and dirt from entering pipe during storage, handling, and placing in trench. Close ends of in-place pipe at the

end of any work period to preclude the entry of animals and foreign material.

- 3.1.3 Bedding of pipe shall be as specified in Section 02200 – Earthwork.
- 3.1.4 Do not lay pipe when trench bottom is muddy or frozen, or has standing water.
- 3.1.5 Use only those tools specifically intended for cutting the size and material and type pipe involved. Make cut to prevent damage to pipe or lining and to leave a smooth end at right angles to the axis of the pipe.
- 3.2 Lay water main piping with bell ends facing the direction of laying. Where grade is 10 percent or greater, pipe shall be laid uphill with bell ends upgrade. Lay water main piping with a minimum cover of 36 inches unless otherwise indicated.
- 3.3 Make butt fusion joints in accordance with pipe manufacturer's and fusion machine manufacturer's instructions. The wall thickness of the adjoining pipes shall have the same dimension ratio (DR) at the point of fusion. HDPE pipe joints, connections to valves and fittings, and joint restraint shall be constructed in accordance with the Plastics Pipe Institute's "Handbook of Polyethylene Pipe."
- 3.4 Join pipe of dissimilar materials by using Fernco couplings in accordance with the manufacturer's written recommendations.
- 3.5 Install detectable tape in trench above all pipe per the manufacturer's written recommendations.
- 3.6 Provide marker posts above non-metallic pipe systems where shown on the contract drawings. Space marker posts as recommended by the manufacturer.
- 3.7 Set Valves and Valve Boxes as follows:
 - 3.7.1 Equip all underground valve operators with valve boxes. Set box in alignment with valve stem centered on valve nut. Set valve box to prevent transmitting shock or stress to the valve. Set box cover flush with the finished ground surface or pavement.
 - 3.7.2 The Contractor shall operate new gate valves during preliminary flushing activities.
- 3.8 Installation of Tapping Sleeves and Tapping Valves
 - 3.8.1 All tapping sleeves shall be set to avoid interference with existing pipe joints.
 - 3.8.2 After all tapping sleeves and valves have been set in place, a 150-psi pressure test shall be performed to insure that there are no leaks around the

sleeve or through the valve prior to tapping. All leakage shall be corrected.

- 3.8.3 Actual taps shall be made in the presence of the Owner's representative. The Owner shall be given a minimum of 48 hours notice before tapping operations commence.
- 3.9 For buried pressure piping, provide retainer gland type devices, restraining devices, or restrained joint type pipe at all changes in direction of pressure piping, at dead ends, and as shown on the drawings. Concrete reaction anchors will not be allowed as a means of joint restraint.
 - 3.9.1 Restrain all joints with retainer glands/devices in accordance with the written recommendations of the retainer gland/device manufacturer. All pipe joints shall be restrained with retainer glands/devices a minimum of 60 feet each side of a fitting or valve.
 - 3.9.2 Where retainer glands/devices are used, extreme care shall be taken so that each set screw is tightened as recommended by the manufacturer before the pipe is backfilled and tested.
- 3.10 Install air release valves, manholes, and blowoff assemblies as indicated on the drawings and in accordance with the latest edition of the Town of Culpeper and Culpeper County Water & Sewer Utility Standards Manual.
- 3.11 Install combination air valves at locations indicated on the drawings and at all high points on pressure piping in accordance with the manufacturer's written recommendations. Install ball valve between piping and air valve. Use tap, tapping saddle, tee, or other fittings as required for complete and operable installation.
- 3.12 Install sampling stations at locations as directed by the Owner in accordance with the manufacturer's written recommendations.
- 3.13 Construct manholes using precast reinforced concrete manhole sections except as otherwise noted. Install manhole frames and covers and manhole steps using materials specified under products.
- 3.14 Construct concrete cap or cradle in accordance with the latest edition of the VDOT Road and Bridge Standards at locations where the vertical separation between the new water main piping and adjacent utilities is less than 6 inches.
- 3.15 Use sleeves where pipes, valves, stem extensions, or equipment parts pass through concrete or masonry walls or slabs. Sleeves shall be of sufficient size to allow sealing around pipes and clearance for valve stem or equipment. Extend vertical sleeves through slabs 1-inch above top surface.
 - 3.15.1 Use cast iron or steel sleeves with intermediate collars to anchor and provide water stops on sleeves that pass through exterior walls below

grade. Seal around pipes using grouting compound or “Link-Seal” pipe to wall closures manufactured by Thunderline Corporation, Wayne, Michigan. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to fill annular space between pipe and wall opening and shall provide watertight seal between pipe and wall opening. Grouting compound shall be mixed and placed in accordance with the recommendations of the manufacturer. Mechanical pipe to wall seal shall be installed in accordance with the written recommendations of the manufacturer.

3.16 Acceptance Tests

3.16.1 After the line has been backfilled, subject the line or any valved section of the line to a hydrostatic pressure test. Fill the system with water at velocity of approximately 1 foot per second while necessary measures are taken to eliminate all air. After the system has been filled, raise the pressure by pump to 150 psi, or 1.5 times the working pressure, whichever is greater. Measure pressure at the low point on the system compensating for gage elevation. Maintain this pressure for 2 hours. If pressure cannot be maintained, determine cause, repair, and repeat the test until successful.

3.16.2 A leakage test shall be conducted concurrently with the pressure test. Leakage shall be determined with a calibrated test meter furnished by the contractor. Leakage will be defined as the quantity of water required to maintain a pressure within 5 psi of the specified test pressure, after air has been expelled, and the pipe filled with water. Leakage shall not exceed that quantity obtained by the formula below. If leakage exceeds that determined by the formula, find and repair the leaks and repeat the test until successful. The leakage formula shall be as follows:

$$L = SD(\sqrt{P})/148,000$$

Where: L = Allowable leakage, in gallons/hour
S = Length of pipeline tested, in feet
D = Nominal diameter of the pipe, in inches
P = Average test pressure during leakage test, in psig

3.16.3 All visible leaks shall be repaired regardless of the amount of leakage.

3.17 Disinfect and test water mains and accessories in accordance with AWWA standards and as specified herein.

3.17.1 Preliminary Flushing: The main shall be flushed prior to disinfection, except when the tablet method is used. Flushing shall be at a velocity of not less than 3.0 feet per second. Adequate provisions shall be made for drainage of flushing water.

3.17.2 Form of Chlorine for Disinfection

- 3.17.2.1 Liquid chlorine shall be used only when suitable equipment is available and only under the direct supervision of a person familiar with the physiological, chemical, and physical properties of this element and who is properly trained and equipped to handle any emergency that may arise. Introduction of chlorine-gas directly from the supply cylinder is unsafe and shall not be permitted.
- 3.17.2.2 Calcium hypochlorite contains 70% available chlorine by weight. It shall be either granular or tabular in form. The tablets, six to eight to the ounce, are designed to dissolve slowly in water. A chlorine-water solution shall be prepared by dissolving the granules or tablets in water in the proportion requisite for the desired concentration.
- 3.17.2.3 Sodium hypochlorite is supplied in strengths from 5.25% to 16% available chlorine. The chlorine-water solution shall be prepared by adding hypochlorite to water.
- 3.17.2.4 Application: The hypochlorite solutions shall be applied to the water main with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. For small applications, the solutions may be fed with a hand pump; for example, a hydraulic test pump. Feed lines shall be of such material and strength as to withstand safely the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the hypochlorite solution is applied to the main.

3.17.3 Methods of Chlorine Application

- 3.17.3.1 Continuous Feed Method: Water from the existing distribution system or other approved sources of supply shall be made to flow at a constant, measured rate into the newly laid pipeline. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two rates shall be proportioned so that the chlorine concentration in the water in the pipe is maintained at a minimum of 50 mg/L available chlorine. To assure that this concentration is maintained, the chlorine shall be measured at intervals not exceeding 1,200 feet in accordance with the procedures described in the current edition of "Standard Methods" and AWWA M12 – "Simplified Procedures for Water Examination." In the absence of a meter, the rate may be determined either by placing a pitot gage at the discharge or by measuring the time to fill a container of known volume.

During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back

into the line supplying the water. Chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24-hour period, the treated water shall contain no less than 25 mg/L chlorine throughout the length of the main.

- 3.17.3.2 Tablet Method: Use only when allowed by the Engineer. Do not use this method if trench water or foreign material has entered the main or if the water is below 41°F (5°C). This method may be used for mains up to 12 inches in diameter, and where the total length of the main is less than 2,500 feet.

Place tablets in each section of pipe and also in hydrants, hydrant branches, and other appurtenances. Enough tablets shall be used to ensure that a chlorine concentration of 25 mg/L is provided in the water. Attach tablets using Permatex No. 1 adhesive or other approved adhesive, except for the tablets placed in hydrants and in the joints between the pipe sections. Tablets shall be free of adhesive except on the one broad side to be attached. Place all tablets at the top of the main. If the tablets are attached before the pipe section is placed in the trench, mark the position of the tablet in the pipe and assure that the pipe is placed with the tablet at the top.

When installation is completed, fill the main with water at a velocity of less than 1 foot per second. The water shall remain in the pipe for at least 24 hours. Operate valves so that the strong chlorine solution will not flow back into the line supplying the water.

- 3.17.4 Final Flushing: After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than 1 mg/L. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipeline. Contractor shall provide dechlorination of all flushed water prior to discharge.

3.17.5 Bacteriologic Tests

- 3.17.5.1 After final flushing and before the water main is placed in service, samples shall be collected and tested for bacteriologic quality and shall show the absence of coliform organisms. Samples shall be collected at intervals not exceeding 1,200 feet, and tested by a VDH-approved laboratory and results submitted to the Owner. In addition, collect and test one sample at the end

of the piping, and at least one sample from each branch greater than one pipe length.

- 3.17.5.2 Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate. If laboratory results indicate the presence of coliform bacteria, the samples are unsatisfactory, and disinfection shall be repeated until the samples are satisfactory.
- 3.17.5.3 A sampling tap consisting of a corporation cock with metal pipe shall be installed within 2 feet of valves. The corporation stop inlet shall be male, 1-inch in size, and the outlet shall have 1-inch I.P. threads and a cap.
- 3.17.6 Cleaning, disinfection, and testing will be the responsibility of the Contractor. The Contractor shall furnish the water required for these operations at his own cost and expense. No separate payment, other than that included in the contract lump sum, will be allowed.
- 3.17.7 Testing and disinfection of the completed sections shall not relieve the Contractor of his responsibility to repair or replace any cracked or defective pipe. All work necessary to secure a tight line shall be done at the Contractor's expense.
- 3.17.8 The Contractor has the following options for bacteriological testing for total coliform analysis:
 - 3.17.8.1 Option A: Before approving a main for release, take an initial set of samples and then resample again after a minimum of 16 hours using the sampling site procedures outlined. Both set of samples must pass for the main to be approved for release.
 - 3.17.8.2 Option B: Before approving a main for release, let it sit for a minimum of 16 hours without any water use. Then collect, using the sampling site procedures outlined and without flushing the main, two sets of samples a minimum of 15 minutes apart while the sampling taps are left running. Both sets of samples must pass for the main to be approved for release.

End of Section

Section 02665
Raw Water Piping System

1 GENERAL

1.1 Description: This section specifies all raw water piping work on this project.

1.2 Related Requirements: The following sections contain requirements that relate to this section.

1.2.1 Section 02300 – Boring/Tunneling

1.2.2 Section 02350 – Trenchless Pipe Installation

1.3 All raw water main accessories shall comply with the latest edition of the Town of Culpeper and Culpeper County Water & Sewer Utility Standards Manual.

1.4 Reference specifications are referred to by abbreviation as follows:

1.4.1 American Association of State Highway and
Transportation Officials AASHTO

1.4.2 American Iron and Steel Institute AISI

1.4.3 American National Standards Institute ANSI

1.4.4 American Society for Testing and Materials ASTM

1.4.5 American Water Works Association AWWA

1.4.6 Plastics Pipe Institute PPI

1.4.7 Virginia Department of Health VDH

1.5 Project Conditions: Separation of Water Lines and Sanitary Sewers

1.5.1 Follow VDH standards for separation of water mains and sewer lines.

1.5.2 Parallel Installation

1.5.2.1 Normal Conditions: Water lines shall be constructed at least 10 feet horizontally from a sewer or sewer manhole whenever possible; the distance shall be measured edge-to-edge.

1.5.2.2 Unusual Conditions: When local conditions prevent a horizontal separation of at least 10 feet, the water line may be laid closer to a sewer or sewer manhole provided that:

1.5.2.3 The bottom of the water line is at least 18 inches above the top of the sewer.

1.5.2.3.1 Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe pressure-tested in place to 50 psi without leakage prior to backfilling. If a sewer manhole is involved, it shall be of watertight construction and tested in place. No water pipe shall pass through or come in contact with any part of a sewer manhole.

1.5.3 Crossing

1.5.3.1 Normal conditions: Water lines crossing over sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of the sewer whenever possible.

1.5.3.1.1 Unusual conditions: When local conditions prevent a vertical separation described in crossing, normal conditions, paragraph above, the following construction shall be used.

1.5.3.1.2 Sewers passing over or under water lines shall be constructed of the materials described above in parallel construction.

1.5.3.1.3 Water lines passing under sewers shall, in addition, be protected by providing:

1.5.3.1.3.1 A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line,

1.5.3.1.3.2 Adequate structural support for the sewers to prevent excessive deflection of the joints and settling on and breaking water line.

1.5.3.1.3.3 That the length of the water line be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.

1.5.4 Sanitary Sewers or Sewer Manholes: No water pipes shall pass through or come in contact with any part of a sewer or sewer manhole.

1.6 Submittals: Provide the following shop drawings in accordance with the approved submittals schedule as specified in Section 01400 – General Requirements.

1.6.1 Pipe and Fittings: Catalog cuts and certificates of compliance for pipe, fittings, linings, and materials for approval. Certificates shall state that materials furnished comply with the standards specified in this section.

- 1.6.2 Valves: Catalog cuts and certificates of compliance for valves. Certificates shall state that materials furnished comply with the standards specified in this section.
- 1.6.3 Valve Boxes
- 1.6.4 Meter Boxes
- 1.6.5 Pipe Restraint Devices
- 1.6.6 Fire Hydrants
- 1.6.7 Raw Water Piping Field Test Certification Reports

2 PRODUCTS

2.1 Piping Application

- 2.1.1 All below grade raw water main piping, 4 inches or less in diameter, shall be constructed of PE4710 high density polyethylene (HDPE) pressure rated pipe, 200 psi pressure rating (SDR 11), except as specified below. Piping shall be provided with butt fused restrained joints.
- 2.1.2 The following piping systems, 2 inches and smaller in diameter, shall be constructed of AWWA C901 CTS Class 200 NSF-PW polyethylene tubing unless otherwise indicated:
 - 2.1.2.1 Below grade raw water service at air release valve and blowoff assemblies
 - 2.1.2.2 Below grade raw water piping not otherwise specified
- 2.1.3 Accessories: Provide flanges, joint restraints, connecting pieces, transition glands, transition sleeves, tapping saddles, and other adapters as required for complete and operable piping systems for the service indicated. Provide restrained joints where indicated on the drawings and as specified in this section.

2.2 Pipe

2.2.1 High Density Polyethylene (HDPE) Pipe

- 2.2.1.1 Pipe: PE4710 high density polyethylene meeting ASTM D2239 and PPI TR-4, ASTM D3350 cell classification 445474C for black and 445474E for color identification stripes, manufactured in accordance with ASTM F714 for 4-inch diameter ductile iron pipe size (DIPS), SDR 11, 200 psi pressure-rated.
- 2.2.1.2 Fittings: Fittings shall be of the same materials and classifications as the pipe.

- 2.2.1.3 Joints: Butt fused between plain ends of polyethylene pipe, fittings, and valves. Provide restrained mechanical joints for transition between pipe, fittings, and valves as necessary and indicated on plans. HDPE mechanical joint restraints shall be Series 200PV as manufactured by EBAA Iron, Inc. or approved equal.
- 2.2.1.4 Polyethylene fittings and custom fabrications shall be molded or fabricated by an approved manufacturer. All fittings and custom fabrications shall be pressure rated for the same internal pressure rating as the mating pipe.
- 2.2.1.5 Molded fittings shall be manufactured and tested in accordance with ASTM D 3261 and shall be so marked. Molded fittings shall be tested in accordance with AWWA C906.
- 2.2.1.6 Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock or molded fittings. Fabricated fittings shall be rated for internal pressure service at least equal to the full service pressure rating of the mating pipe. Fabricated fittings shall be tested in accordance with AWWA C906.
- 2.2.1.7 Manufacturers
 - 2.2.1.7.1 ISCO Industries, or approved equal.

2.2.2 Polyethylene Tubing

- 2.2.2.1 Polyethylene tubing for service piping shall conform to AWWA C901 and ASTM D2737 and shall be Class 200, NSF-PW for drinking water use. Tubing shall have a uniform wall thickness and dimensions such that it can be adapted for use with copper tube size (CTS) standard waterworks compression type fittings. Tubing shall be clearly marked to show class, size, manufacturer's name, and NSF-PW symbol. Stainless steel insert stiffeners shall be required at all compression joint fittings.

2.3 Concrete shall be Class A4 as specified in Section 217 of the latest edition of the VDOT Road and Bridge Specifications.

2.4 Flexible couplings for connecting pipes of dissimilar materials shall be as manufactured by Fernco, Inc. of Davison, Michigan.

2.5 Pipe Labeling

- 2.5.1 Detectable tracer wire for directional drilling and boring applications shall be a 12 AWG solid conductor of soft-drawn 21% IACS copper clad steel utilizing an AISI 1055 high carbon steel core, with a minimum break load of 1,150 pounds (200,000 psi). The conductor shall be rated for direct burial

use at 30 volts and RoHS compliant. The insulation shall be 45 mil high-density, high molecular weight polyethylene (HDPE). Detectable tracer wire for directional drilling and boring shall be Pro-Trace HDD-CCS PE45, or Copperhead SoloShot Extra High Strength Tracer Wire.

2.6 Valves

2.6.1 Gate Valves

2.6.1.1 Nonrising stem gate valves 4 inches and larger shall meet requirements of AWWA C515 “AWWA Standard for Resilient Seated Gate Valves for Water and Sewerage Systems.” Working pressure shall be at least 250 psi for valve sizes 4 through 16 inches, or at the pressure rating specified for adjacent piping, whichever is greater. Valve ends shall be compatible with piping systems in which valves are installed including capability of fusion joining of polyethylene pipe ends for pipe types specified above. Valve shall be iron body, stainless steel stem, bronze mounted. Valves shall have o-ring seals and shall open counterclockwise. Asbestos packing will not be acceptable.

2.6.1.2 Valves listed above shall be manufactured by American AVK Company or approved equal.

2.6.2 Ball Valves

2.6.2.1 Ball valves 2 inches and smaller shall be Class 200, meeting requirements of ANSI B16.40. Valves shall have HDPE bodies and balls. Valves shall be polyoxymethylene (POM) stems, and nitrile rubber seats, body seals, and stem seals. Valves shall be compatible with piping systems in which valves shall be installed including capability of fusion joining to polyethylene pipe ends for pipe types indicated above.

2.6.3 Air Release Valves

2.6.3.1 Air release valves shall be APCO Model 143C combination (single body double orifice) air valves manufactured by DeZurik Water Controls, or approved equal by Cla-Val, Val-Matic Valve and Manufacturing Company, or GA Industries, LLC. Valves shall have the following dimensions:

2.6.3.1.1 Inlet Diameter: 1-inch NPT

2.6.3.1.2 Outlet Diameter: 1-inch NPT

2.6.3.1.3 Large Orifice Diameter: 1-inch

2.6.3.1.4 Small Orifice Diameter: 0.078-inch

- 2.6.3.2 Valves shall have ASTM A536 Grade 65-45-12 ductile iron body, cover, and lever frame, ASTM A276 stainless steel plug, Buna-N needle and seat, and ASTM A240 stainless steel float. Valve shall be suitable for 300 psig working pressure.
- 2.7 Sleeves through concrete or masonry walls or slabs shall be cast iron or Schedule 40 steel. Provide sleeves through walls, floors, and ceilings for all pipe penetrations except where wall pipes are indicated.
- 2.8 Valve boxes shall be adjustable cast iron valve boxes of the two-piece screw-type. Base shall be proper type and size for the valve with which it is used. The words "RAW WATER" shall be cast or embossed on the valve box lid in letters not less than 1-inch high. Valve boxes shall be manufactured by Mueller Company, Dewey Brothers, Tyler, or Bingham-Taylor.
- 2.9 Meter Box Enclosures: 18-inch diameter, protective, in-ground, traffic-rated, cast iron housing with "RAW WATER" logo cast or embossed on the lid. Enclosure shall be manufactured by Mueller Company or approved equal. Provide minimum 6-inch layer of VDOT No. 57 stone bedding beneath each enclosure.
- 2.10 Fire hydrants shall be the safety flange, breakaway top type, meeting requirements of AWWA C502, "AWWA Standard for Dry-Barrel Fire Hydrants." Hydrants shall be designed for a minimum working pressure of 200 psi. Hydrants shall have a 4-inch mechanical joint connection to the water main, a barrel diameter of no smaller than 7 inches, a hydrant valve diameter no smaller than 5¼ inches, and shall be equipped with two 2½-inch hose nozzles and one 4½-inch pumper connection. Connection caps shall be fitted with chains. Hose and pumper outlet threads shall conform to the National Standard and match local fire department equipment. Hydrants shall be equipped with a National Standard pentagon operating nut, opening counterclockwise. Hydrants shall be provided with a "Non-Potable Water" label and brown colored coating as selected from the manufacturer's standard list of color charts. Hydrants shall be Kennedy "Guardian" Model K-81-A or Mueller Company "Super Centurion" Model A-423.
- 2.11 Manholes
- 2.11.1 Precast Reinforced Concrete Manhole Section
- 2.11.1.1 Precast reinforced concrete manhole sections shall meet requirements of ASTM C 478. Section ends shall have o-ring gasket groove provided during manufacturing process. Gaskets for section joints shall meet requirements of ASTM C 443. Joints may also be sealed with flexible butyl resin sealant as manufactured by Concrete Sealants, Inc. Sealant shall be installed in accordance with the manufacturer's written recommendations. Top sections for all manholes shall be designed to withstand HS-20 traffic loading.
- 2.11.1.2 Manhole frames and covers shall be roadway type with deep socket covers. Machine frames and covers to prevent rattling. Frames shall

be provided with holes for bolting it down to manhole riser section. Provide cover with two ¾-inch diameter holes for ventilation. Castings shall be gray iron meeting requirements of ASTM A 48, Class 30, and have 24-inch diameter clear openings such as Neenah Foundry Company type R-1642 with Type “C” cover or approved equal by U.S. Foundry or East Jordan Iron Works. Other manufacturer substitutions will not be allowed. Each cover shall have cast or embossed on it in letters not less than 1-inch high “WATER” The frame and cover shall weigh at least 277 pounds.

2.11.1.3 Manhole frames shall be anchored to the top of the manhole riser sections with ¾-inch expansion bolts. Two passes of “ConSeal” bitumastic sealant in 1-inch rope form shall be used to provide watertight seal between frame and manhole riser section. Clean manhole riser and frame thoroughly prior to installation.

2.11.1.4 Manhole steps shall be “Surefoot” step constructed of a No. 4 steel reinforcing rod encased in corrosion-resistant rubber by Oliver Tire & Rubber Company.

2.12 Pipe to sleeve sealant shall be grouting compound. Grouting compound shall be as manufactured by 3M Company or be an equivalent product having tensile strength of 80 psi and elongation property of 700% in accordance with ASTM D 3574 Test E, and linear dimension change shall not exceed 18% when subject to wet and dry cycles in accordance with ASTM D 756, Procedure G and ASTM D 1042.

2.13 Mechanical Type Pipe to Wall Sleeve Seals: Mechanical type pipe to wall sleeve seals shall be “Link-Seal” pipe to wall closures manufactured by Thunderline Corporation, Wayne, Michigan. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to fill annular space between pipe and wall opening and shall provide watertight seal between pipe and wall opening.

3 EXECUTION

3.1 Pipe Laying

3.1.1 Take all precautions necessary to insure that pipe, valves, fittings, and other accessories are not damaged in unloading, handling, and placing in trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.

3.1.2 Exercise care to keep foreign material and dirt from entering pipe during storage, handling, and placing in trench. Close ends of in-place pipe at the end of any work period to preclude the entry of animals and foreign material.

3.1.3 Bedding of pipe shall be as specified in Section 02200 – Earthwork.

- 3.1.4 Do not lay pipe when trench bottom is muddy or frozen, or has standing water.
- 3.1.5 Use only those tools specifically intended for cutting the size and material and type pipe involved. Make cut to prevent damage to pipe or lining and to leave a smooth end at right angles to the axis of the pipe.
- 3.2 Lay water main piping with bell ends facing the direction of laying. Where grade is 10 percent or greater, pipe shall be laid uphill with bell ends upgrade. Lay water main piping with a minimum cover of 36 inches unless otherwise indicated.
- 3.3 Make butt fusion joints in accordance with pipe manufacturer's and fusion machine manufacturer's instructions. The wall thickness of the adjoining pipes shall have the same dimension ratio (DR) at the point of fusion. HDPE pipe joints, connections to valves and fittings, and joint restraint shall be constructed in accordance with the Plastics Pipe Institute's "Handbook of Polyethylene Pipe."
- 3.4 Join pipe of dissimilar materials by using Fernco couplings in accordance with the manufacturer's written recommendations.
- 3.5 Install detectable tracer wire suitable for directional drilling applications with all pipe per the manufacturer's written recommendations.
- 3.6 For buried pressure piping, provide retainer gland type devices, restraining devices, or restrained joint type pipe at all changes in direction of pressure piping, at dead ends, and as shown on the drawings.
 - 3.6.1 Restrain all joints with retainer glands/devices in accordance with the written recommendations of the retainer gland/device manufacturer. All pipe joints shall be restrained with retainer glands/devices a minimum of 60 feet each side of a fitting or valve.
 - 3.6.2 Where retainer glands/devices are used, extreme care shall be taken so that each set screw is tightened as recommended by the manufacturer before the pipe is backfilled and tested.
 - 3.6.3 Hydrants shall be tied to the pipe with suitable metal tie rods, clamps, or restrained joints as shown on the drawings. Tie rods, clips, or other components of dissimilar metal shall be protected against corrosion by hand application of a bituminous coating or by encasement of the entire assembly with 8-mil thick, loose polyethylene film in accordance with AWWA C105.
- 3.7 Install air release valves, manholes, and fire hydrant assemblies as indicated on the drawings and in accordance with the latest edition of the Town of Culpeper and Culpeper County Water & Sewer Utility Standards Manual.
- 3.8 Locate fire hydrants at such a distance from the curb or edge of pavement to provide ready access and minimize the possibility of damage from vehicles. Locate fire hydrants in dry, stable areas outside of high groundwater tables to prevent potential

cross connection. Orient the hydrant so that the pumper nozzle faces the road. Set hydrant plumb and with the bury line on the hydrant at grade. Provide anchorage and at least 7 cubic feet of crushed stone under the base to allow drainage from the hydrant drain valve, as indicated on the drawings.

- 3.9 Install air release valves at locations indicated on the drawings and at all high points on pressure piping in accordance with the manufacturer's written recommendations. Install ball valve between piping and air valve. Use tap, tapping saddle, tee, or other fittings as required for complete and operable installation.
- 3.10 Construct manholes using precast reinforced concrete manhole sections except as otherwise noted. Install manhole frames and covers and manhole steps using materials specified under products.
- 3.11 Construct concrete cap or cradle in accordance with the latest edition of the VDOT Road and Bridge Standards at locations where the vertical separation between the new water main piping and adjacent utilities is less than 6 inches.
- 3.12 Set Valves and Valve Boxes as follows:
 - 3.12.1 Equip all underground valve operators with valve boxes. Set box in alignment with valve stem centered on valve nut. Set valve box to prevent transmitting shock or stress to the valve. Set box cover flush with the finished ground surface or pavement.
 - 3.12.2 The Contractor shall operate new gate valves during preliminary flushing activities.
- 3.13 Use sleeves where pipes, valves, stem extensions, or equipment parts pass through concrete or masonry walls or slabs. Sleeves shall be of sufficient size to allow sealing around pipes and clearance for valve stem or equipment. Extend vertical sleeves through slabs 1-inch above top surface.
 - 3.13.1 Use cast iron or steel sleeves with intermediate collars to anchor and provide water stops on sleeves that pass through exterior walls below grade. Seal around pipes using grouting compound or "Link-Seal" pipe to wall closures manufactured by Thunderline Corporation, Wayne, Michigan. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to fill annular space between pipe and wall opening and shall provide watertight seal between pipe and wall opening. Grouting compound shall be mixed and placed in accordance with the recommendations of the manufacturer. Mechanical pipe to wall seal shall be installed in accordance with the written recommendations of the manufacturer.
- 3.14 Acceptance Tests
 - 3.14.1 After the line has been backfilled, subject the line or any valved section of the line to a hydrostatic pressure test. Fill the system with water at velocity of approximately 1 foot per second while necessary measures are taken to

eliminate all air. After the system has been filled, raise the pressure by pump to 150 psi, or 1.5 times the working pressure, whichever is greater. Measure pressure at the low point on the system compensating for gage elevation. Maintain this pressure for 2 hours. If pressure cannot be maintained, determine cause, repair, and repeat the test until successful.

- 3.14.2 A leakage test shall be conducted concurrently with the pressure test. Leakage shall be determined with a calibrated test meter furnished by the contractor. Leakage will be defined as the quantity of water required to maintain a pressure within 5 psi of the specified test pressure, after air has been expelled, and the pipe filled with water. Leakage shall not exceed that quantity obtained by the formula below. If leakage exceeds that determined by the formula, find and repair the leaks and repeat the test until successful. The leakage formula shall be as follows:

$$L = SD(\sqrt{P})/148,000$$

Where: L = Allowable leakage in gallons/hour

S = Length of pipeline tested in feet

D = Nominal diameter of the pipe in inches

P = Average test pressure during leakage test in psig

- 3.14.3 All visible leaks shall be repaired regardless of the amount of leakage.
- 3.14.4 Flushing: The main shall be flushed prior to startup. Flushing shall be at a velocity of not less than 3 feet per second. Adequate provisions shall be made for drainage of flushing water.
- 3.14.5 Cleaning and testing shall be the responsibility of the Contractor. The Contractor shall furnish the water required for these operations at his own cost and expense. No separate payment, other than that included in the contract lump sum, will be allowed.
- 3.14.6 Testing of the completed sections shall not relieve the Contractor of his responsibility to repair or replace any cracked or defective pipe. All work necessary to secure a tight line shall be done at the Contractor's expense.

End of Section

Section 02936
Seeding

1 GENERAL

1.1 Related Requirements: The following sections contain requirements that relate to this section.

1.1.1 Section 01400 – General Requirements

1.1.2 Section 02200 – Earthwork

1.2 Submittals: Provide the following items in accordance with the approved submittals schedule as specified in Section 01400 – General Requirements:

1.2.1 Seed Test Report

1.2.2 Fertilizer Analysis

1.3 Reference specifications are referred to by abbreviation as follows:

1.3.1 American Society of Testing and Materials ASTM

1.3.2 Virginia Department of Transportation VDOT

2 PRODUCTS

2.1 Topsoil: Topsoil shall be the top 6 inches of original soil from the site. Topsoil obtained off-site shall be fertile, friable loam, containing not less than 2% by weight of finely divided, decomposed vegetation. Topsoil shall be free of subsoil, clay lumps, brush, weeds, roots larger than 1½-inch in diameter, stones larger than 1½-inch in diameter, and other material toxic or harmful to growth.

2.2 Fertilizer: Fertilizer shall meet requirements of Federal Specification O-F-241. Provide fertilizer that is complete, inorganic, uniform in composition, and suitable for application with approved equipment. Proportions of fertilizer nutrients shall be the following:

2.2.1 Permanent Seeding

2.2.1.1 5% total nitrogen

2.2.1.2 10% available phosphoric acid

2.2.1.3 5% soluble potash

2.2.2 Temporary Seeding

2.2.2.1 10% total nitrogen

2.2.2.2 20% available phosphoric acid

2.2.2.3 10% soluble potash

2.3 Grass Seed: Grass seed, tested within 6 months of sowing, shall have the following characteristics:

2.3.1 Permanent Seeding (for Residential Lawn Areas)

<u>Species</u>	<u>%Weight</u>	<u>%Purity</u>	<u>%Germination</u>
Kentucky 31 tall fescue	85	98	90
Perennial ryegrass	15	98	90

2.3.2 Temporary Seeding

<u>Seeding Date</u>	<u>Species</u>	<u>%Wgt.</u>	<u>%Purity</u>	<u>%Germ.</u>	<u>Seed Rate (lb/acre)</u>
Feb.15-Apr.30	Oats	100	98	85	100
May 1-Aug.15	Millet	100	98	80	50
Aug. 16-Nov. 15	Rye	100	96	85	140

2.4 Lime: Lime shall be ground agriculture grade limestone containing not less than 85% calcium and magnesium carbonates. Fineness shall be such that 100% will pass a No. 20 sieve, and not less than 50% will pass a No. 100 sieve. Burnt lime or hydrated lime may be substituted in equivalent carbonates, if requested.

2.5 Mulch: Type II mulch composed of threshed straw of cereal grain, pine needles or wood fiber which shall be free of objectionable weed seeds or other harmful material.

2.6 Asphalt Adhesive: Asphalt adhesive for use with Type II mulch shall be emulsified asphalt meeting requirements of ASTM D 977, Grade SS-1.

2.7 Mulch Binder: Synthetic mulch binder for use with Type II mulch shall be Curasol, DCA-70 Petroset, or Terra Tack.

2.8 Jute Mesh (VDOT EC-2 Soil Stabilization Blanket): Jute mesh shall be as defined in the VDOT Road and Bridge Specifications, Section 244, "Roadside Development Materials." Installation locations shall be as specified herein.

2.9 VDOT EC-3 Soil Stabilization Matting: C 125 Erosion Control Blanket manufactured by North American Green, 14649 Highway 41 North, Evansville, Indiana 47711, Telephone: (800) 772-2040, or Curlex III High Velocity Blanket manufactured by American Excelsior Company, 850 Avenue H East, Arlington, Texas, 76011, Telephone: (800) 777-7645. Installation locations shall be as specified herein.

3 EXECUTION

3.1 General

- 3.1.1 Before seeding, 4 inches of topsoil shall be spread in areas to be seeded. In general, the topsoil shall come from the stockpiles created during the initial clearing of the site. If there is insufficient topsoil in the stockpiles, the Contractor shall provide topsoil from an offsite source at no additional cost to the Owner.
- 3.1.2 Material shall be delivered in unbroken containers, clearly marked by the manufacturer as to their contents. Seed, limestone, and fertilizer shall be labeled as to proportions, analysis, and quality. Store all materials in a manner affording protection from damage by weather or vandalism.
- 3.1.3 Seed only when the wind velocity is less than 15 miles per hour.
- 3.1.4 All areas disturbed by excavation, grading, or other construction operations, except areas to be paved or otherwise permanently stabilized, shall be seeded as specified for permanent seeding. Temporary seeding shall be provided when required at no additional cost to the Owner.
- 3.1.5 Remove all soiling or staining off finished structures or pavements resulting from seeding work. Maintain paved areas in clean condition.

3.2 Temporary Seeding

- 3.2.1 Use in areas when final grading has not been completed, when permanent seeding cannot be performed due to the specified permanent seeding dates, or when required for erosion control.
- 3.2.2 Apply fertilizer at a rate of 15 pounds per 1,000 square feet (600 pounds per acre) or equivalent. Apply lime at a rate of 50 pounds per 1,000 square feet.
- 3.2.3 For loose soil, work lime and fertilizer into soil and then seed. For packed or hard soil, loosen top layer while working lime and fertilizer into soil and then seed at the rate specified for the temporary seeding species.
- 3.2.4 Seed only between February 15 and November 15. Use mulch between November 16 and February 14.

3.3 Permanent Seeding

- 3.3.1 For all areas to receive permanent seeding, apply fertilizer at the rate of 50 pounds per 1,000 square feet and apply lime at the rate of 100 pounds per 1,000 square feet.

- 3.3.2 Apply fertilizer and lime uniformly and mix well into the top 4 inches of the seedbed.
- 3.3.3 Prepare soil for permanent seeding by tillage of topsoil in place to loosen thoroughly and break up all clods to a depth of 6 inches. Remove all stumps and roots, coarse vegetation, stones larger than 1½ inches, and all construction debris. Soil shall be worked by suitable agricultural equipment to a depth of not less than 4 inches. Surface shall be uniform, smooth, and drainable. A firm and compact seedbed is required.
- 3.3.4 Sow permanent grass seed between dates of March 1 and April 15 or September 1 and November 15.
- 3.3.5 Sow seed by mechanical seeder as follows:
 - 3.3.5.1 Mix seed thoroughly with clean dry sawdust and broadcast at rate of 6 pounds of seed per 1,000 square feet for permanent seeding or as specified elsewhere for temporary seeding.
 - 3.3.5.2 Apply Type II mulch uniformly to depth of approximately 1¼ inches.
 - 3.3.5.3 Anchor Type II mulch by the following methods:
 - 3.3.5.3.1 Apply light tack coat of asphalt emulsion or synthetic mulch binder.
 - 3.3.5.3.2 On slopes steeper than 4(H):1(V), anchor with VDOT EC-2 jute mesh fastened to wooden stakes.
 - 3.3.5.3.3 On slopes steeper than 2(H):1(V), anchor with VDOT EC-3 soil stabilization matting fastened in accordance with the manufacturer's written recommendations.
- 3.3.6 Sow seed by hydraulic seeder as follows:
 - 3.3.6.1 Prepare homogeneous slurry equal to the seed mixture used for mechanical seeding as specified in this section.
 - 3.3.6.2 Distribute slurry uniformly at rate equal to the rate specified for mechanical seeding.
 - 3.3.6.3 Apply mulch, jute mesh, and soil stabilization blankets as specified for sowing by mechanical seeder.

3.4 Maintenance of Seeded Areas

- 3.4.1 The Contractor is advised that final payment for the project will not be received until a uniform stand of grass acceptable to the Engineer has been established.
- 3.4.2 Reseed and mulch spots larger than one square foot without uniform stand of grass. In areas where jute mesh or soil stabilization blankets have been applied, the mesh or blanket shall be removed prior to reseeding, and reapplied after reseeding activities are complete. Reseeding shall include application of fertilizer, lime, and seed in accordance with the agronomic loading rates specified herein. Reseeding shall be performed multiple times during the course of a planting season and over the course of multiple planting seasons until a uniform stand of grass is established.
- 3.4.3 Maintain all seeded areas until uniform stand of grass is acceptable to the Engineer.
- 3.4.4 In the event that growth is not established by the final project inspection, continue the specified attention until the stand is accepted by the Engineer.
- 3.4.5 Correct or repair all undue settling for a period of one year after final inspection.
- 3.4.6 Water as necessary.
- 3.4.7 Mowing: Maintain grass height between 2 and 4 inches.

End of Section

Geotechnical Engineering Report

**Cherry Hill Water Treatment Facility
Cherry Hill Road
Culpeper County, Virginia**

Underhill Project No. 19055

December 12, 2019



December 12, 2019

Mr. Herbert F. White, III, PE
WW Associates
PO Box 4119
Lynchburg, VA 24502

Subject: Geotechnical Engineering Report, Cherry Hill Water System, Water Treatment Facility, Cherry Hill Road, Culpeper County, Virginia (Underhill Engineering Project No. 19055)

Dear Mr. White:

Underhill Engineering, LLC (Underhill) is pleased to present this Geotechnical Engineering Report for the above referenced project. The geotechnical engineering services for this project are provided in accordance with Underhill Engineering's revised proposal dated October 9, 2019. We proceeded with services based on WW Associate's email authorization of October 14, 2019.

Thank you for the opportunity to provide our services. If you have any questions or require additional information, please do not hesitate to contact the undersigned.

Sincerely,

UNDERHILL ENGINEERING, LLC



Susan E. Ray, EIT, GIT
Staff Geotechnical Engineer



O. Christopher Webster, PE
Principal



GEOTECHNICAL ENGINEERING REPORT
TABLE OF CONTENTS

1.0	Executive Summary.....	1
2.0	Scope of Services	2
3.0	Site Information	2
3.1	Site Description	2
3.2	Proposed Construction	2
4.0	Field Services.....	3
4.1	Subsurface Exploration Program	3
5.0	Site Geology, Subsurface Conditions, and Soil Laboratory Testing	4
5.1	Site Geology	4
5.2	Generalized Subsurface Stratigraphy	4
5.3	Groundwater.....	5
5.4	Laboratory Testing	5
6.0	Geotechnical Recommendations.....	7
6.1	Earthwork.....	7
6.2	Foundations	8
6.3	Floor Slabs.....	9
7.0	Construction Considerations	10
7.1	Site Grading and Earthwork.....	10
7.2	Shallow Foundations.....	10
7.3	Engineering Services During Construction.....	11
8.0	General Specification Recommendations.....	12
9.0	Limitations.....	13

References

Figures:

- Figure 1, Site Vicinity Map
- Figures 2 and 3, Location Plans

Appendices:

- Appendix A: Subsurface Exploration Data
- Appendix B: Soil Laboratory Test Results

1.0 Executive Summary

This report presents the results of the subsurface exploration, soil laboratory testing, and geotechnical engineering analysis for the project site. A summary of the recommendations follows:

- Borings indicate loose and soft alluvium/colluvium underlying the topsoil and extending to about 1.5 to 2.5 ft below the ground surface. These soft soils should be removed during the topsoil stripping operation to expose the underlying competent residual soils and disintegrated rock.
- Shallow foundations consisting of strip footings or a perimeter turndown foundation are considered suitable for support of the proposed building and raw water tank when footings bear in the competent residuum of Strata B2 and C; or on new Compacted Structural Fill. A net allowable soil bearing pressure of **3,000 PSF** should be considered for the footing design for these structures.
- Subgrade soils are considered suitable for support of the proposed finished water tank with an anticipated contact pressure not exceeding **2,000 PSF**. Competent subgrades are anticipated to consist of Stratum C disintegrated rock or new Compacted Structural Fill following the removal of the loose Stratum A soils as referenced above.
- Laboratory testing indicates that the on-site soils as encountered exhibit a low to medium potential for moisture-related volume change. Therefore, the bottom of footings should extend at least 2 feet below surrounding grades (the depth of local seasonal moisture change).
- Groundwater was not encountered during drilling. However, it will be important for the site grading to provide a positive slope away from the building areas.

Underhill is providing this Executive Summary solely as an overview of the findings and recommendations. Any party that relies on this report must read the full report since the Executive Summary omits several details, including those that are important to the proper interpretation and application of the report.

2.0 Scope of Services

Underhill's revised proposal dated October 9, 2019 defines the scope of services for this project. The scope is limited to the Geotechnical Engineering Services as presented therein.

3.0 Site Information

3.1 Site Description

The project site is located on the north side of Cherry Hill Road (Route 638), just west of the intersection of Cherry Hill Road and Sperryville Pike Road (Route 522) in Culpeper County, Virginia. The project site is east of the Republic Services Culpeper County Transfer station. The proposed development includes a new water treatment facility planned just northwest of the existing animal shelter building at Carol Anne & Andrews Landing, and a new 14-ft diameter, bolted-steel finished water tank east of an existing guyed-wire cellular tower.

The site for the proposed building and raw water tank is in the clearing across from the existing animal shelter building. The site for the proposed finished water tank is in the wooded area adjacent to the cellular tower, between the north and southeast guy wires. These two sites are shown in Figure 1.

Existing ground surface grades vary from about EL 608 to 610 at the proposed water treatment facility site, and from about EL 710 to 712 at the proposed bolted steel water tank site.

3.2 Proposed Construction

The proposed water treatment facility includes a new building, about 40 by 20-ft in plan dimensions, and an adjacent 10-ft diameter raw water tank, both with foundations planned as monolithic slabs with perimeter turn-down foundations. The building slab is planned at EL 610.25 and the adjacent tank slab is planned at EL 611.25, both within about 1 to 2 feet of existing grades.

The proposed 14-ft diameter, bolted-steel finished water tank is planned as a 24-ft tall structure supported by a mat slab bearing on a perimeter reinforced concrete ringwall and with 12 inches of crushed stone within the ringwall. The tank foundation is planned at EL 713.5, within about one foot of existing grades.

4.0 Field Services

4.1 Subsurface Exploration Program

Underhill's geotechnical engineering study included a subsurface exploration program consisting of four mechanically-advanced test borings drilled by Underhill's drilling subconsultant, SRM Drilling, LLC of Culpeper, Virginia.

The subsurface exploration program was performed to evaluate the subsurface conditions and develop generalized stratigraphy at the test hole locations. The evaluation of the soils' characteristics included visual and limited laboratory classification and evaluation of density or stiffness based on the results of Standard Penetration Test (SPT) N values obtained.

The approximate locations of the borings are presented in Figures 2 and 3 following the text of this report. The borings were drilled on October 24, 2019, under the observation of Underhill's engineering personnel.

The boring logs are included in Appendix A. Soil samples retrieved from the subsurface exploration program will be held for 45 days unless the Client requests other disposition.

5.0 Site Geology, Subsurface Conditions, and Soil Laboratory Testing

5.1 Site Geology

Underhill's review of the available geologic data, including the state geologic map of Virginia, indicates that the building and the raw water tank site geology consists of the Proterozoic-age Fauquier Formation, which consists of arkosic metasandstone. The finished water tank site's geology consists of layered biotite granulite and gneiss, part of the Blue Ridge Basement Complex. The boundary between the formations is just south of and runs parallel to Carol Anne & Andrews Landing.

The site's overburden stratigraphy consists of alluvium/colluvium (commonly silty sand and elastic silts), soil residuum (commonly sands and silts containing varying amounts of sand and mica), and weathered (disintegrated) rock overlying the parent material.

5.2 Generalized Subsurface Stratigraphy

Underhill developed the following generalized subsurface stratigraphy based on the results of the subsurface exploration program, the soil laboratory test results, and review of the local geology:

Topsoil:

- Boring locations B-2 and B-4 revealed topsoil to 6 inches below the surface. Boring locations B-1 and B-3 revealed topsoil to about 3 to 4 inches below the surface, respectively. The average topsoil depth encountered on the sites evaluated was 5 inches.

Stratum A (Alluvial/Colluvial Soils):

- Borings B-1 and B-2 encountered Stratum A beneath the topsoil to 2.5 and 1 foot below the surface, respectively. Borings B-3 and B-4 encountered Stratum A to 0.8 and 2.6 feet below the surface, respectively.
- Stratum A as encountered in B-1 and B-2 consists of very loose to loose SILTY SAND (SM), containing varying amounts of mica and root fragments.
- Stratum A as encountered in B-3 and B-4 consists of soft to very stiff SILT (ML) with sand, containing varying amounts of mica and root fragments.
- Natural Moisture Contents: 8.3% to 25.9% (three specimens).
- Standard Penetration Test (SPT) N values = 3 to 23.

Stratum B1 (Fine-Grained Residuum):

- Borings B-2 and B-4 encountered Stratum B1 below Stratum A to 2 and 5.3 feet below the surface, respectively. Stratum B1 was also encountered beneath Stratum C between the depths of 8.1 and 9.0 feet in Boring B-3B.
- Stratum B1 consists of very stiff to hard ELASTIC SILT (MH), containing varying amounts of sand and mica.
- Natural Moisture Contents: 6.6% and 25.3% (two specimens).
- SPT N values = 17 to 43.

Stratum B2 (Coarse-Grained Residuum):

- Borings B-2 and B-4 encountered Stratum B2 below Stratum B1 to the total depth of penetration, 15 and 20 feet, respectively. Boring B-3 encountered Stratum B2 below Stratum A

**Cherry Hill Water Treatment Facility
Culpeper County, Virginia**

to 2.5 feet below the surface. Borings B-3B encountered Stratum B2 from 4 to 4.5 feet and from 13.5 feet to the total depth (15 feet).

- Stratum B2 consists of medium dense to dense SILTY SAND (SM), containing varying amounts of mica and pyrrhotite and WELL GRADED SAND WITH SILT (SW-SM).
- Natural Moisture Contents: 13.2% to 14.2% (three specimens).
- SPT N value = 12 to 42.

Stratum C (Disintegrated Rock Residuum):

- Four of seven borings revealed Stratum C to the total depth of penetration. Borings B-1, B-1A, B-3, and B-3A encountered auger and/or sampler refusal in Stratum C at depths of 8.5, 11, 4.4, and 1 ft, respectively. Boring B-3B encountered Stratum C beneath Stratum B2 from 4.5 to 8.1 feet below the surface, and beneath Stratum B1 from 9 feet to 13.5 feet below the surface.
- Stratum C consists of very dense DISINTEGRATED ROCK.
- SPT N values = 50/5.0" to 50/0.25".

5.3 Groundwater

Groundwater was not encountered at the time of Underhill's subsurface exploration. Fluctuations in the hydrostatic water table should be expected to occur over time, depending on variations in precipitation, surface runoff, pumping, flooding, evaporation, stream levels, and similar factors.

5.4 Laboratory Testing

Eight samples were retrieved from the subsurface exploration program for soil laboratory testing. Soil laboratory testing assigned by Underhill consisted of the following:

- Eight natural water content tests (ASTM D2216),
- Three Atterberg Limits tests (ASTM D4318), and
- Three gradation tests (ASTM D422/D1140).

The soil laboratory testing was performed to aid in the classification of the soils encountered in the subsurface exploration program, and to provide index test values for use in the development of design recommendations. Laboratory testing was performed by Underhill's subconsultant laboratory and reviewed and interpreted by Underhill.

Natural water content values of the laboratory-tested specimens are presented in the respective logs and summarized above in Section 5.2. A summary of the soil laboratory test results is included in Appendix B.

Soil laboratory index testing indicated the following for specimens retrieved from Stratum A:

- ASTM Classification: SILTY SAND (SM)
- AASHTO Classification: A-4 (silt-clay soils)
- Liquid Limit value: 26
- Plasticity Index (PI) value: 4
- Plasticity of the Whole Sample (PI multiplied by the Percent Passing the No. 40 Sieve): 3
- The natural water content of the specimen was near to 14 percent dry of its Plastic Limit value
- Moisture-related Volume Change Potential (shrink-swell) (NAVFAC DM-7): **Low**

**Cherry Hill Water Treatment Facility
Culpeper County, Virginia**

Soil laboratory index testing indicated the following for specimens retrieved from Stratum B1:

- ASTM Classification: Sandy ELASTIC SILT (MH)
- AASHTO Classification: A-7-6 (clayey soils)
- Liquid Limit value: 71
- Plasticity Index (PI) value: 24
- Plasticity of the Whole Sample (PI multiplied by the Percent Passing the No. 40 Sieve): 21
- The natural water content of the specimen was about 21 percent dry of its Plastic Limit value, suggesting this material to be desiccated.
- Moisture-related Volume Change Potential (shrink-swell) (NAVFAC DM-7): **Medium**

Soil laboratory index testing indicated the following for specimens retrieved from Stratum B2:

- ASTM Classification: SILTY SAND (SM)
- AASHTO Classification: A-7-6 (clayey soils)
- Liquid Limit value: 49
- Plasticity Index (PI) value: 12
- Plasticity of the Whole Sample (PI multiplied by the Percent Passing the No. 40 Sieve): 11
- The natural water content of the specimen was about 23 percent dry of its Plastic Limit value, suggesting this material to be desiccated.
- Moisture-related Volume Change Potential (shrink-swell) (NAVFAC DM-7): **Low**

6.0 Geotechnical Recommendations

6.1 Earthwork

6.1.1 Stripping and Grading

The Contractor should remove the topsoil and the underlying loose/soft Stratum A soils to expose the competent residuum to receive compacted structural fill for structure support. Based on the average depth of topsoil and the loose Stratum A soils encountered during drilling, a stripping depth of 1.5 ft is recommended at most locations except for B-4, where at least 2.5 ft of stripping is recommended for preliminary planning purposes.

Considering the Final Floor Grade elevations supplied by the Client, subgrades should be undercut, at a minimum, to the following elevations:

Undercut Elevations (ft)	
Boring B-1 (14' dia. tank)	713
Boring B-2 (East building corner)	607.5
Boring B-3 (West building corner)	608
Boring B-4 (10' dia. tank)	606

Before any fill placement or additional undercutting below design subgrade level, the Geotechnical Engineer should evaluate the soils for suitability. Evaluation techniques may include probing with a penetrometer, observing proofrolling by a loaded dump truck, drilling hand augers, observing test pits, or a combination of these methods. The contractor should excavate areas deemed unsuitable by the Geotechnical Engineer and replace these areas with additional compacted structural fill.

Underhill recommends that undercut volumes be measured using cross sectioning survey methods. Other methods of calculating volumes of undercut, such as counting trucks, are less accurate and generally result in additional expense. If truck counts are used, Underhill recommends that the method of payment be in accordance with *Section 109 of the Virginia Department of Transportation (VDOT) Road and Bridge Specifications*.

Existing utilities are present on the site and may be encountered during excavation. Although not revealed by the subsurface exploration, excavation activities may encounter buried foundations and other associated debris. If these materials are encountered, existing structures should be completely removed from within the proposed structure areas. Existing utilities and drainage structures within the structure areas should be removed and replaced with new compacted structural fill.

6.1.2 Compacted Structural Fill

On-site soils free of deleterious materials may be re-used as compacted structural fill, provided that these materials are at a moisture content in the range suitable for compaction. Note that Stratum A soils contain varying amounts of root fragments; therefore, we anticipate only limited amounts of Stratum A materials to be suitable for re-use as compacted fill. The in situ natural water content value for Stratum B2 was between 13.2 to 14.2%. These values suggest that the residual soil are generally near the optimum moisture content needed to achieve compaction. However, depending on the weather conditions at the time of earthwork construction, portions of the on-site soils may be too wet

**Cherry Hill Water Treatment Facility
Culpeper County, Virginia**

for suitable compaction. Therefore, project planning should schedule the earthwork construction for the drier seasons or consider the need for select fill material imported to the site for use as Compacted Structural Fill.

Off-site borrow material used as Compacted Structural Fill should meet the following criteria:

- ASTM Classification: **CL, ML, SC, SM, SP, SW, GC, GM, GP, or GW.**
- Plasticity Index value: **15 or less.**
- Maximum Dry Density (ASTM D698): minimum **100 PCF.**
- Maximum Particle Size: **3 inches.**
- Laboratory CBR value: minimum **6.**

Compacted Structural Fill should be placed in maximum 8-inch thick horizontal, loose lifts and compacted to at least **95 percent** of maximum dry density in accordance with ASTM D698, Standard Proctor. The contractor should bench compacted structural fill subgrades steeper than 4H:1V to allow placement of horizontal lifts.

Compacted structural fill should extend laterally at least 3 feet beyond the structure limits, and slope as needed to meet existing grades. Slopes constructed of Compacted Structural Fill should not be designed and built steeper than 2.5H:1V.

6.2 Foundations

6.2.3 Proposed Building and Raw Water Tanks

Shallow foundations consisting of strip footings or a perimeter turndown foundation are considered suitable for support of the proposed building and the adjacent 10-ft diameter raw water tank.

Footings should be founded in competent residuum of Strata B2 and C; or on new Compacted Structural Fill. A design bearing pressure of **3,000 PSF** (net allowable soil bearing pressure) is recommended for the footing design. Note the recommended bearing pressure may be increased by 33 percent for wind and seismic loads only when used in conjunction with load combinations defined in IBC Section 1605.3.2, Alternate Basic Load Combinations for use with allowable stress design or other applicable code exceptions.

For conventional strip footings and turndowns, minimum footing widths of 16 inches and 12 inches, respectively, should be maintained for shear considerations. This bearing pressure provides a factor of safety of at least 3.0 against general shear failure. Compacted structural fill should meet the requirements outlined in Section 6.1.2 for Compacted Structural Fill.

Settlements of shallow spread footings founded as described above are not expected to exceed 1 inch. Differential settlements between similarly loaded footings are not expected to exceed ½ inch.

6.2.4 Proposed Finished Water Tank

A shallow foundation consisting of a ringwall is considered suitable for the 14-ft diameter finished water tank. Subgrades for the finished water tank should consist of competent residuum or new Compacted Structural Fill following the undercut of the loose Stratum A materials. An allowable contact pressure of **2,000 PSF** (net allowable soil bearing pressure) is anticipated for the finished water tank. A factor of safety of 3.0 should be considered against general shear failure for this condition. Total settlement at the center of the finished water tank is not anticipated to exceed 1 inch with an angular distortion of about 0.006 inch/inch between the center and the edge of the tank.

Correlations of the Plasticity Index of the Whole Sample to Volume Change Potential (NAVFAC DM-7) indicates that the on-site soils have a **Low to Medium Potential for Shrink-Swell**. Therefore, the bottom of foundation grades for structures should be set at least 2 feet below surrounding grades for frost protection.

6.2.5 Seismic Site Class and Site Coefficients

The proposed water tanks were evaluated as a Category IV structures. We evaluated the Seismic Site Class and Seismic Site Coefficients for this project following AWWA D100 guidelines (i.e. ASCE 7-10 Standard). Based on our review of the subsurface conditions, the structural design may use the following seismic criteria:

- Seismic Site Class: **D**, Stiff Soil, Risk Category IV (e.g. essential facilities)
- Site Coefficient, F_a : **1.6**
- Site Coefficient, F_v : **2.4**

The Site Class was evaluated based on Standard Penetration Test N values with borings terminating in very dense disintegrated rock.

6.3 Floor Slabs

The proposed building floor slabs should be supported in Strata B2 or C materials, or on Compacted Structural Fill as described in Section 6.1.2. Slabs on grade supported on these materials should be designed considering a modulus of subgrade reaction value, **$k = 125$ pci**. The Contractor should re-compact slab subgrades immediately before placing moisture barrier materials to repair any disturbance that may occur due to construction. Since the floor is anticipated as slab-on-grade, utility excavations should be backfilled with compacted structural fill as defined in Section 6.1.2.

A 4-inch crushed stone or washed gravel capillary moisture barrier should underlie the slabs on grade. Moisture barrier material should consist of VDOT No. 57 crushed stone. The Contractor should compact the stone in place with at least two passes of suitable vibratory compaction equipment.

7.0 Construction Considerations

7.1 Site Grading and Earthwork

The on-site soils are susceptible to moisture changes, will be easily disturbed, and difficult to compact under wet weather conditions. Drying and reworking of the soils are likely to be difficult and may not be possible during wet winter months. During periods of extended wet weather, project planning should consider that these soils cannot be effectively dried and should consider the need for importing select fill materials. Therefore, it will be important that the earthwork phases of this project be performed during the warmer, drier times of the year to limit the potential for disturbance of on-site soils and reduce the amount of fill imported to the site.

Traffic on stripped or undercut subgrades should be limited to reduce disturbance of underlying soils. The Contractor should provide site drainage to maintain subgrades free of water and to avoid saturation and disturbance of the subgrade soils before placing compacted structural fill or moisture barrier material. This will be important during all phases of the construction work. The Contractor should be responsible for reworking of subgrades and compacted structural fill that were initially considered suitable but were later disturbed by equipment and/or weather.

Note earthwork activities may encounter groundwater during excavation to grade, especially during times of heavy precipitation. Therefore, the Contractor may need to provide temporary dewatering such as trenching and/or pumping from sumps to control the surface and/or groundwater.

7.2 Shallow Foundations

The Contractor should place foundation concrete as soon as possible after excavation to limit the potential for moisture changes at the foundation level. Foundation concrete should be cast neat against the sides of the excavation. If footings are formed, the sides of the footings should be backfilled with compacted on-site soils to final grade to reduce the potential for water collecting beneath the footings. Final grades should provide positive drainage away from the structure so that water does not accumulate around the foundation.

The Contractor should exercise care during excavation for foundations so that as little disturbance as possible occurs at the foundation level. The Contractor should carefully clean loose or soft soils from the bottom of the excavation before placing concrete. Underhill's Engineer should observe actual foundation subgrades during construction to evaluate whether subgrade soils meet the requirements as recommended in this report.

Foundation subgrades needing undercut may be concreted at the elevation of undercut, backfilled with Controlled Low Strength Material (CLSM), locally known as "flowable fill;" or backfilled to the original design subgrade elevation with compacted structural fill as described in Section 6.1.2. Compacted structural fill should extend at least 12 inches laterally beyond the footing in all directions. Concreting should take place the same day as excavation of footings.

7.3 Engineering Services During Construction

The engineering recommendations provided in this report are based on the information obtained from the subsurface exploration and laboratory testing. However, conditions on the site may vary between the discrete locations observed at the time of the subsurface exploration. The nature and extent of variations between borings may not become evident until during construction. To account for this variability, Underhill should provide professional observation and testing of subsurface conditions revealed during construction as an extension of our design phase engineering services. These services will also help in evaluating the Contractor's conformance with the plans and specifications.

8.0 General Specification Recommendations

The Project Construction Documents should include an allowance to account for possible additional costs that may be required to construct the foundations and earthwork as recommended in this report. Costs may be incurred for a variety of reasons including variation of soil between borings, greater than anticipated unsuitable soils, need for borrow fill material, wet on-site soils, obstructions, rock excavation, temporary dewatering, etc. Add/deduct unit prices in the construction contract are recommended so adjustments can be made for the actual work performed for the following:

- Scarifying and drying wet and/or loose subgrade soils.
- Undercutting unsuitable soils and replacement with compacted structural fill.

The project documents should indicate the Contractor's responsibility for providing adequate site drainage during construction. Inadequate drainage can lead to disturbance of soils by construction traffic and increased volume of undercut. The project documents should also delegate the Contractor responsible for reworking of subgrades and compacted fill initially considered suitable, but later disturbed by equipment and/or weather.

This report may be made available to prospective bidders for informational purposes. The project specifications are recommended contain the following statement:

Underhill Engineering, LLC has prepared this geotechnical engineering report for this project. This report is for informational purposes only and is not part of the contract documents. The opinions expressed represent the Geotechnical Engineer's interpretation of the subsurface conditions, tests, and the results of analyses conducted. Should the data contained in this report not be adequate for the Contractor's purposes, the Contractor may make, before bidding, independent exploration, tests and analyses. This report may be examined by bidders at the office of the Owner, or copies may be obtained from the Owner at nominal charge.

Additional data and reports prepared by others that could have an impact upon the Contractor's bid should also be made available to prospective bidders for informational purposes.

9.0 Limitations

The analyses and recommendations submitted in this report study are based on the information revealed by the subsurface exploration. This report attempts to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction.

Underhill has prepared this study to aid in the evaluation of the site. It is intended for use concerning this specific project and should not be used for other purposes. The recommendations provided within are based on information on the site and proposed construction as described in this report. Changes regarding existing conditions or changes in loads, locations, or grades should be brought to Underhill's attention so that recommendations can be modified as needed. Underhill would appreciate an opportunity to review the plans and specifications as they pertain to the recommendations contained in this report, and to submit comments to you based on this review.

Underhill has endeavored to complete the services identified herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project. No other representation, express or implied, is included or intended, and no warranty or guarantee is included or intended in this report, or other instrument of service.

References

Conley, James F. (1989) Stratigraphy and Structure Across the Blue Ridge and Inner Piedmont in Central Virginia: Culpeper to Charlottesville, Virginia. American Geophysical Union, Washington, DC.

Evans, Nick H. and Rader, E.K. (1993) Geologic Map of Virginia, Virginia Division of Mineral Resources, Charlottesville, Virginia.

Sinha, A.K. and Bartholomew, M.J. (1984) Evolution of the Grenville Terrane in the Central Virginia Appalachians. Special Paper 194. Geological Society of America, Boulder, CO.

Figures

Figure 1, Site Vicinity Map

Figures 2 and 3, Location Plans

FIGURE 1



Image from Google Earth

No Scale



Cherry Hill Water Treatment Facility
Culpeper County, Virginia

Site Vicinity Map
Project 19055

FIGURE 2: LOCATION PLAN

Project 19055
Cherry Hill Water Treatment Facility
Culpeper County, Virginia



LEGEND



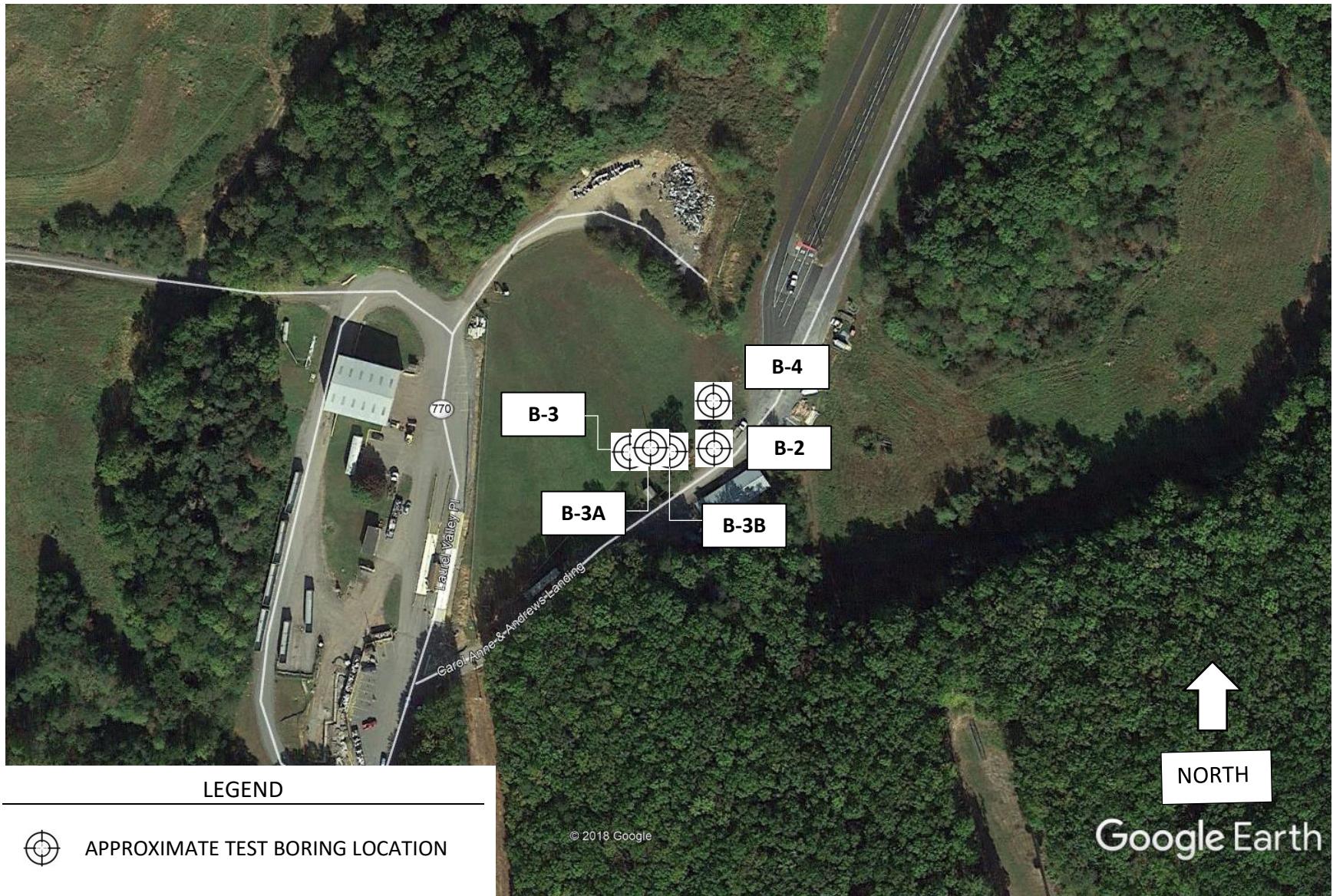
APPROXIMATE TEST BORING LOCATION

Scale: No scale

Note: Base image from Google Earth

FIGURE 3: LOCATION PLAN

Project 19055
Cherry Hill Water Treatment Facility
Culpeper County, Virginia



LEGEND



APPROXIMATE TEST BORING LOCATION

Scale: No scale

Note: Base image from Google Earth

Google Earth

Subsurface Exploration Data

Key to Logging and Soil Classification (2 Sheets)

Test Boring Logs, B-1 through B-4 (7 Sheets)

Note: Elevations at the test boring locations were obtained from the boring stakes placed by WW Associates. The elevations and locations should be considered no more accurate than the means and methods used to obtain them.

KEY TO LOGGING AND SOIL CLASSIFICATION

Particle Size and Proportion

Descriptions are assigned to each soil sample or stratum based on estimates of the particle size of each component of the soil and the percentage of each component in the soil.

Particle Size		Proportion		
Descriptive Terms		Descriptive Terms		
Soil Component	Particle Size	Component	Term	Percentage
Boulder	> 12 inches	Major	Uppercase Letters (e.g., SAND, SILT)	> 50%
Cobble	3 - 12 inches	Secondary	Adjective (e.g., sandy, clayey)	20% - 50%
Gravel-Coarse	¾ - 3 inch			
-Fine	#4 - ¾ inch			
Sand-Coarse	#10 - #4	Minor	With Trace Contains	15% - 20% < 15% presence of
-Medium	#40 - #10			
-Fine	#200 - #10			
Silt (non-cohesive)	< #200			
Clay (cohesive)	< #200			

Density or Consistency

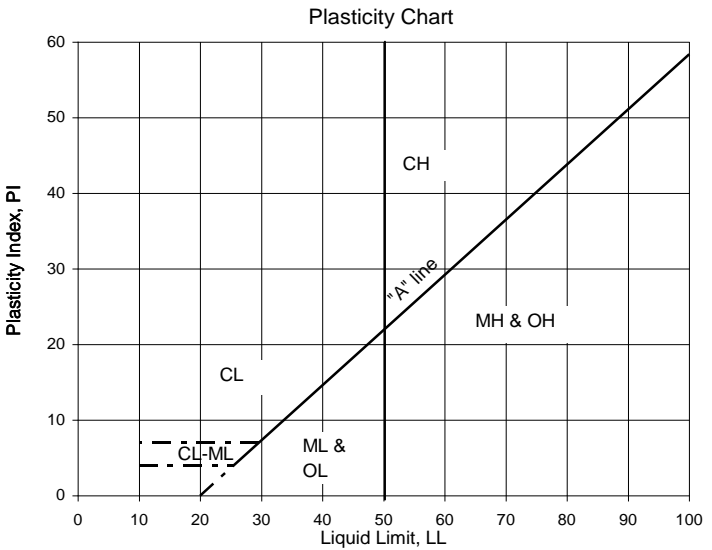
The Standard Penetration Test values (N-values) are used when soil test borings are performed, to describe the density of coarse-grained soils (gravel, sand) or the consistency of fine-grained soils (silt, clay). Sandy silts of low plasticity may be assigned a density instead of a consistency.







DENSITY		CONSISTENCY	
Term	N-value	Term	N-Value
Very Loose	0-4	Very Soft	0-2
Loose	5-10	Soft	3-4
Medium Dense	11-30	Medium Stiff	5-8
Dense	31-50	Stiff	9-16
Very Dense	>51	Very Stiff	17-32
		Hard	>33

Notes:

- The N-value is the number of blows of a 140-lb. hammer (falling 30 inches) required to drive a standard split-spoon sampler (2.0 in. O.D., 1-3/8 in. I.D.) 12 inches into the soil after properly seating the sampler six inches.
- When encountered, gravel may increase the N-value of the SPT and may not accurately represent the in-situ density or consistency of the soil sampled.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

Major Divisions		Group Symbols	Typical Names	Laboratory Classification Criteria			
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 Sieve), coarse-grained soils are classified as follows: Less than 5 per cent More than 12 per cent 5 to 12 per cent GW, GP, SW, SP GM, GC, SM, SC Borderline cases requiring dual symbols		
		Gravels with fines (Appreciable amount of fines)	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Gravels with fines (Appreciable amount of fines)	GM		Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or PI less than 4 Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
			Clean sands (little or no fines)	GC		Clayey gravels, gravel-sand-clay mixtures	Atterberg limits below "A" line or PI greater than 7
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines		$C_u = D_{60}/D_{10}$ greater than 4; $C_c = (D_{30})^2 / (D_{10} \times D_{60})$ between 1 and 3	
		Sands with fines (Appreciable amount of fines)	SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	Silty sands, sand-silt mixtures	SM		Silty sands, sand-silt mixtures	Atterberg limits above "A" line or PI less than 4 Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
			Clayey sands, sand-clay mixtures	SC		Clayey sands, sand-clay mixtures	Atterberg limits above "A" line or PI greater than 7
		Fine-grained soils (More than half material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	 <p style="text-align: center;">Plasticity Chart</p> <p style="text-align: center;">Y-axis: Plasticity Index, PI (0 to 60) X-axis: Liquid Limit, LL (0 to 100)</p> <p style="text-align: center;">Regions: CH, MH & OH, CL, ML & OL, Pt</p> <p style="text-align: center;">Line: "A" line</p>
				CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
OL	Organic silts and organic silty clays of low plasticity						
Silts and clays (Liquid limit greater than 50)	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts				
	CH		Inorganic clays of high plasticity, fat clays				
	OH		Organic clays of medium to high plasticity				
Highly organic soils	Pt		Peat and other highly organic soils				

 geotechnical geodesign geoconstruction		Project: Cherry Hill Water Treatment Facility			Boring No.	B-1	
		Culpeper County, Virginia			Project No. 19055		
		Drilling Contractor: SRM Drilling			Drill Rig Type: Diedrich D50		
		Foreman: S. Martin			Method: 2-1/4" HSA		
Logged By: S. Ray		Groundwater Observations					
Started: 10/24/19		Date	Time	Depth	Casing	Caved	
Finished: 10/24/19		Encountered	10/24/19	---	Dry	---	
Location: 14-ft ϕ tank		Completion	10/24/19	9:27 AM	Dry	---	
GS ELEV: 714.6'		Casing Pulled	10/24/19	9:33 AM	Dry	5.5'	
Depth (feet)	Sample Type	Stratum	Blow Counts (blows/foot)	Soil Group Name: modifier, color, moisture, density/consistency, grain size, other descriptors		USCS	Remarks
				Rock Description: modifier, color, hardness/degree of concentration, bedding and joint characteristics, solutions, void conditions			
0.0-1.5		A	4+8+15	Forest litter, root mat, and topsoil			
2.0-3.5			19+36+	0.2	Fine to coarse SILTY SAND, contains mica and root fragments, dry - tan, W = 8.3%	SM	ALLUVIUM / COLLUVIUM
4.0-5.5			50/5.0"	2.5	DISINTEGRATED ROCK, dry - white and tan		Relict structure
7.0-8.5		C	50/3.75"				Rig chatter @ 4.5'
8.5			50/3.0"				Auger and sampler refusal @ 8.5'
			50/0.25"	Test Boring Terminated @ 8.5 FT			

Key:


Boring Log: Sheet 1 of 1

 Standard Penetration Split Spoon Sampler (SPT)




 Bulk/ Bag Sample

WOH Weight of Hammer

 Stabilized Groundwater

 Groundwater at time of drilling


- NOTES:**
1. Boring elevations obtained from boring stakes placed by WW Associates
 2. Boring backfilled upon completion

 geotechnical geodesign geoconstruction				Project: Cherry Hill Water Treatment Facility Culpeper County, Virginia			Boring No.	B-1A	
				Drilling Contractor: SRM Drilling			Project No. 19055		
				Foreman: S. Martin			Drill Rig Type: Diedrich D50		
							Method: 2-1/4" HSA		
Logged By: S. Ray				Groundwater Observations					
Started: 10/24/19				Date	Time	Depth	Casing	Caved	
Finished: 10/24/19				Encountered	10/24/19	---	Dry	---	
Location: 14-ft φ tank				Completion	10/24/19	10:15 AM	Dry	---	
GS ELEV: 714.6'				Casing Pulled	10/24/19	10:31 AM	Dry	---	
				W.O.W.	11/05/19	3:02 PM	Dry	---	
Depth (feet)	Sample Type	Stratum	Blow Counts (blows/foot)	Soil Group Name: modifier, color, moisture, density/consistency, grain size, other descriptors Rock Description: modifier, color, hardness/degree of concentration, bedding and joint characteristics, solutions, void conditions			USCS	Remarks	
0.0-1.5				See Boring B-1 for Strata Description				Auger probe to 9 ft	
2.0-3.5									
4.0-5.5									
7.0-8.5									
9.0-10.5		C	50/4.25"	9.0	DISINTEGRATED ROCK, dry - white & tan			Rig chatter @ 8.5' Auger refusal @ 10.9'	
10.9-11.0			50/1.0"	Test Boring Terminated @ 11.0 FT				Sampler refusal @ 11 ft	

Key:


Boring Log: Sheet 1 of 1

 Standard Penetration Split Spoon Sampler (SPT)








 Bulk/ Bag Sample

WOH Weight of Hammer

 Stabilized Groundwater

 Groundwater at time of drilling

- NOTES:**
1. Boring elevations obtained from boring stakes placed by WW Associates
 2. Boring backfilled upon completion

 geotechnical geodesign geoconstruction			Project: Cherry Hill Water Treatment Facility Culpeper County, Virginia			Boring No.	B-2	
			Drilling Contractor: SRM Drilling			Project No. 19055		
			Foreman: S. Martin			Drill Rig Type: Diedrich D50		
						Method: 2-1/4" HSA		
Logged By: S. Ray			Groundwater Observations					
Started: 10/24/19			Date	Time	Depth	Casing	Caved	
Finished: 10/24/19			Encountered	10/24/19	---	Dry	---	
Location: Building corner			Completion	10/24/19	11:51 AM	Dry	---	
GS ELEV: 609.3'			Casing Pulled	10/24/19	12:02 PM	Dry	11.4'	
Depth (feet)	Sample Type	Stratum	Blow Counts (blows/foot)	Soil Group Name: modifier, color, moisture, density/consistency, grain size, other descriptors Rock Description: modifier, color, hardness/degree of concentration, bedding and joint characteristics, solutions, void conditions			USCS	Remarks
0.0-1.5		A	4+4+5	Root mat and topsoil				
		B1		0.5	Fine to medium SILTY SAND with root fragments, moist - brown		SM	ALLUVIUM / COLLUVIUM
				1.0	Fine to coarse sandy ELASTIC SILT with quartz fragments, contains mica, moist - red-brown		MH	Relict structure
2.0-3.5			7+11+12	2.0	Fine to medium SILTY SAND, contains mica, moist - tan and gray		SM	W = 13.7%
4.0-5.5			10+13+15		do, tan, gray, and red			W = 13.2%
7.0-8.5		B2	11+15+17		do, contains pyrrhotite			RESIDUUM
9.0-10.5			14+19+23					
13.5-15.0			17+12+14					
				Test Boring Terminated @ 15.0 FT				

Key:


Boring Log: Sheet 1 of 1

 Standard Penetration Split Spoon Sampler (SPT)





 Bulk/ Bag Sample

WOH Weight of Hammer

 Stabilized Groundwater

 Groundwater at time of drilling

- NOTES:**
1. Boring elevations obtained from boring stakes placed by WW Associates
 2. Boring backfilled upon completion

 geotechnical geodesign geoconstruction			Project: Cherry Hill Water Treatment Facility Culpeper County, Virginia			Boring No.	B-3	
			Drilling Contractor: SRM Drilling			Project No. 19055		
			Foreman: S. Martin			Drill Rig Type: Diedrich D50		
						Method: 2-1/4" HSA		
Logged By: S. Ray			Groundwater Observations					
Started: 10/24/19			Date	Time	Depth	Casing	Caved	
Finished: 10/24/19			Encountered	10/24/19	---	Dry	---	
Location: Building corner			Completion	10/24/19	12:29 PM	Dry	---	
GS ELEV: 609.12"			Casing Pulled	10/24/19	12:30 PM	Dry	---	
Depth (feet)	Sample Type	Stratum	Blow Counts (blows/foot)	Soil Group Name: modifier, color, moisture, density/consistency, grain size, other descriptors		USCS	Remarks	
				Rock Description: modifier, color, hardness/degree of concentration, bedding and joint characteristics, solutions, void conditions				
0.0-1.5		A	1+6+11	0.3	Topsoil	MH	ALLUVIUM / COLLUVIUM	
		B2		0.8	ELASTIC SILT with sand, contains mica and root fragments, moist - red, W = 15.0%	SM	Relict structure RESIDUUM	
2.0-3.5		C	12+14+ 50/4.5"	2.5	Fine to medium SILTY SAND, contains mica, moist - brown, white, and gray		Rig chatter @ 3.0'	
4.0-4.4			50/5.0"		DISINTEGRATED ROCK, contains mica, moist - brown, white, and gray		Auger deflecting on rock	
Test Boring Terminated @ 4.4 FT								

Key:


Boring Log: Sheet 1 of 1

 Standard Penetration Split Spoon Sampler (SPT)


 Bulk/ Bag Sample

WOH Weight of Hammer

 Stabilized Groundwater

 Groundwater at time of drilling

- NOTES:**
1. Boring elevations obtained from boring stakes placed by WW Associates
 2. Boring backfilled upon completion

 geotechnical geodesign geoconstruction				Project: Cherry Hill Water Treatment Facility			Boring No.	B-3A	
				Culpeper County, Virginia			Project No. 19055		
				Drilling Contractor: SRM Drilling			Drill Rig Type: Diedrich D50		
				Foreman: S. Martin			Method: 2-1/4" HSA		
Logged By: S. Ray				Groundwater Observations					
Started: 10/24/19				Date	Time	Depth	Casing	Caved	
Finished: 10/24/19				Encountered	10/24/19	---	Dry	---	
Location: Building corner				Completion	10/24/19	12:36 PM	Dry	---	
GS ELEV: 609.12"				Casing Pulled	10/24/19	12:36 PM	Dry	---	
Depth (feet)	Sample Type	Stratum	Blow Counts (blows/foot)	Soil Group Name: modifier, color, moisture, density/consistency, grain size, other descriptors			USCS	Remarks	
				Rock Description: modifier, color, hardness/degree of concentration, bedding and joint characteristics, solutions, void conditions					
0.0-1.5				See Boring B-3 for Strata Description			Auger probe to 1 ft		
				Test Boring Terminated @ 1.0 FT			Auger Refusal @ 1 ft		

Key:


Boring Log: Sheet 1 of 1

 Standard Penetration Split Spoon Sampler (SPT)






 Bulk/ Bag Sample

WOH Weight of Hammer

 Stabilized Groundwater

 Groundwater at time of drilling

- NOTES:**
1. Boring elevations obtained from boring stakes placed by WW Associates
 2. Boring backfilled upon completion

 geotechnical geodesign geoconstruction			Project: Cherry Hill Water Treatment Facility Culpeper County, Virginia			Boring No.	B-3B	
			Drilling Contractor: SRM Drilling			Project No. 19055		
			Foreman: S. Martin			Drill Rig Type: Diedrich D50		
						Method: 2-1/4" HSA		
Logged By: S. Ray			Groundwater Observations					
Started: 10/24/19			Date	Time	Depth	Casing	Caved	
Finished: 10/24/19			Encountered	10/24/19	---	Dry	---	
Location: Building corner			Completion	10/24/19	1:09 PM	Dry	---	
GS ELEV: 609.12'			Casing Pulled	10/24/19	1:18 PM	Dry	10.0'	
Depth (feet)	Sample Type	Stratum	Blow Counts (blows/foot)	Soil Group Name: modifier, color, moisture, density/consistency, grain size, other descriptors		USCS	Remarks	
				Rock Description: modifier, color, hardness/degree of concentration, bedding and joint characteristics, solutions, void conditions				
0.0-1.5				See Boring B-3 for Strata Description			Auger probe to 4 ft	
2.0-3.5								
4.0-5.5		B2	21+50/5.5"	4.0	Fine to medium SILTY SAND, contains mica, moist - brown, white, and gray	SM	Relict structure	
		C		4.5	DISINTEGRATED ROCK, contains mica and pyrrhotite, dry - white, brown, and gray			
7.0-8.5		B1	20+20+23	8.1	ELASTIC SILT with sand, contains mica, moist - red and orange	MH	W = 6.6% RESIDUUM	
9.0-10.5		C	37+50/4.75"	9.0	DISINTEGRATED ROCK, contains mica and pyrrhotite, moist - gray, tan, and orange			
13.5-15.0		B2	17+15+14	13.5	Fine SILTY SAND, contains mica, moist - brown	SM		
				Test Boring Terminated @ 15.0 FT				

Key:


Boring Log: Sheet 1 of 1

 Standard Penetration Split Spoon Sampler (SPT)









 Bulk/ Bag Sample

WOH Weight of Hammer

 Stabilized Groundwater

 Groundwater at time of drilling


- NOTES:**
1. Boring elevations obtained from boring stakes placed by WW Associates
 2. Boring backfilled upon completion

 geotechnical geodesign geoconstruction		Project: Cherry Hill Water Treatment Facility			Boring No.	B-4	
		Culpeper County, Virginia			Project No. 19055		
		Drilling Contractor: SRM Drilling			Drill Rig Type: Diedrich D50		
		Foreman: S. Martin			Method: 2-1/4" HSA		
Logged By: S. Ray		Groundwater Observations					
Started: 10/24/19		Date	Time	Depth	Casing	Caved	
Finished: 10/24/19		Encountered	10/24/19	---	Dry	---	
Location: 10-ft ϕ tank		Completion	10/24/19	2:26 PM	Dry	---	
GS ELEV: 608.46'		Casing Pulled	10/24/19	2:44 PM	Dry	---	
		W.O.W.	11/05/19	3:07 PM	17.3'	---	
Depth (feet)	Sample Type	Stratum	Blow Counts (blows/foot)	Soil Group Name: modifier, color, moisture, density/consistency, grain size, other descriptors		USCS	Remarks
				Rock Description: modifier, color, hardness/degree of concentration, bedding and joint characteristics, solutions, void conditions			
0.0-1.5		A	1+2+1	0.5	Topsoil	MH	ALLUVIUM / COLLUVIUM
2.0-3.5		B1	4+6+11	2.6	ELASTIC SILT with sand, contains mica, moist - red	MH	W = 25.9%
4.0-5.5		B1	8+13+20	5.3	Fine to coarse sandy ELASTIC SILT, contains mica, moist - red	SM	Relict structure W = 25.3%
7.0-8.5		B1	14+20+21	7.0	Fine to coarse SILTY SAND, contains mica, moist - white and red	SW-SM	
9.0-10.5		B2	7+8+11	10.0	Fine to coarse WELL GRADED SAND with silt, moist - white and gray	SM	W = 14.2%
14.0-15.5		B2	4+6+6	do,	Fine to medium SILTY SAND, contains mica, moist - white, tan, and red	SM	RESIDUUM
18.5-20.0		B2	4+6+7	do,	do, contains pyrrhotite		
				Test Boring Terminated @ 20.0 FT			

Key:


Boring Log: Sheet 1 of 1

 Standard Penetration Split Spoon Sampler (SPT)

 Bulk/ Bag Sample

WOH Weight of Hammer

 Stabilized Groundwater

 Groundwater at time of drilling

- NOTES:**
1. Boring elevations obtained from boring stakes placed by WW Associates
 2. Boring backfilled upon completion

Soil Laboratory Test Results

Summary of Soil Laboratory Tests (1 Sheet)
Sieve Analysis – ASTM D4318 (3 Sheets)

Summary of Soil Laboratory Tests			
Sample Location	B-1	B-2	B-4
Sample Type	JAR	JAR	JAR
Sample Depth (ft)	0.0-1.5	2.0-3.5	2.0-3.5
Stratum	A	B2	B1
Description, Symbol USCS (AASHTO)	SILTY SAND, SM (A-4)	SILTY SAND, SM (A-7-6)	Sandy ELASTIC SILT, MH (A-7-6)
Natural Water Content (%)	8.3	13.7	25.9
% Passing No. 40 Sieve	67.6	92.3	87.7
% Passing No. 200 Sieve	36.6	48.6	69.3
Liquid Limit	26	49	71
Plastic Limit	22	37	47
Plasticity Index	4	12	24

GEOTECHNICAL ENGINEERING REPORT

**Cherry Hill Rock Evaluation
Culpeper County, Virginia**

**Underhill Project No. 21093
February 4, 2022**

February 4, 2022

Mr. Jason A. Clark, PE
The County of Culpeper
PO Box 4119
Lynchburg, VA 24502

Geotechnical Data Report, Cherry Hill Rock Evaluation Culpeper County, Virginia (Underhill Engineering Project No. 21093)

Dear Mr. Clark:

Underhill Engineering, LLC (Underhill) is pleased to present this Geotechnical Data Report, summarizing the results of the mechanically advanced auger probe borings for the proposed Cherry Hill Waterline project. These services are provided in accordance with Underhill's Contract Addendum for Geotechnical Services dated December 7, 2021.

Site and Project Description

The project area is north of Sperryville Pike, between Stonehouse Mountain Road and 0.67 mile southwest of the intersection of Cherry Lane and Randle Lane, in Culpeper County, Virginia. The project includes two phases, consisting of Phase I (raw and finished water lines) and Phase II (raw water lines).

Phase I waterline route is between the well location east of the intersection of Cherry Hill Road (Route 638) and Woodland Church Road (Route 616) at TMP 30-52A and the New Cherry Hill Water Treatment Facility/Finished Water Storage Tank, northeast of Laurel Valley Place.

The Phase II route starts at the New Cherry Hill Water Treatment Facility, northeast of Laurel Valley Place. The line splits west of Laurel Valley Road with one section extending south to Sperryville Pike Road and terminating near TMP 29-62 with a valve and plug for future connection. The other portion of the line extends west, generally parallel to and north of Sperryville Pike Road, terminating on Stonehouse Mountain Road, northwest of its intersection with Clark Lane, also at a valve and plug for future connection.

The site of the proposed waterline routes varies considerably in terrain and topography. The topographic data in the 7/9/2020 plan sets provided by WW Associates indicates ground surface grades varying from EL 458 to EL 664 in Phase I and from EL 554 to EL 677 in Phase II.

The project includes new raw and treated water lines running between treatment facilities and out to new service areas. The Phase I 4-inch diameter finished water line installation consists of approximately 3,025 feet of open cut trench and 6,420 feet of directional drilling placement. The Phase II section of line placement consists of approximately 4,430 feet of open cut trench and 470 feet of directional drilling placement.

The above project description is based on information provided by WW Associates and Culpeper County.

Site Geology

Underhill's review of the available geologic data, including the state geologic map of Virginia, indicates that the project encounters three distinct geologic units throughout the proposed water line and associated structure layout.

An approximately 3,300-foot-wide protrusion of Proterozoic-age porphyroblastic biotite-plagioclase augen gneiss extends from 900 feet northwest of the Cherry Hill Road and Sperryville Pike intersection, the southern end of the dump and along the south side of Carol Anne and Andrews Landing. The protrusion encompasses the proposed buildings and structures and the intersection of Cherry Hill Road and Woodland Church Road. A small area of layered biotite granulite and gneiss lies beneath the northwestern portion of Hickory Mountain Lane, the entirety of the 29-147C1 parcel, and the southeastern portion of parcel 29-144. Both formations are part of the Blue Ridge Basement Complex.

The remainder of the both sites The Proterozoic-age Fauquier Formation consists of arkosic metasandstone containing quartz, plagioclase, potassium feldspar, and sericite. The Fauquier Formation is part of the Blue Ridge Anticlinorium.

Subsurface Exploration Results

The subsurface exploration program consisted of 15 mechanically advanced auger probe borings for the Phase I and Phase II water system lines. Note that Standard Penetration Test ((SPT) N values were not performed, and samples were not collected. Instead, the subsurface exploration was limited to auger probes to evaluate whether shallow rock was present at the respective auger probe locations. The approximate locations of the auger probe borings are shown in Figures 1 and 2, following the text of this letter report.

The boring locations were staked in the field by Underhill. Underhill obtained LAT/LNG coordinates at the boring locations, as indicated on the respective logs, and referencing Google Earth.

The elevations at the test boring locations were referenced to the January 2022 topographic site drawing by the Monteverde. A Boring Location Plan is included as Figure 2 following the text of this report. The locations and elevations should be considered no more accurate that the methods and means used to obtain them.

Underhill's subcontractor, Ayers & Ayers, Inc., drilled the auger probe borings on December 9, 2021, under the observation of Underhill's personnel. The auger probe locations are shown in Figures 1 and 2.

A summary of the subsurface exploration is provided in Exhibit A, following the text of this report. Fourteen of the fifteen auger probes reached the maximum depth of penetration, 6.0 feet below the surface. Auger probe B-102 refused at 4.5 feet below the surface.

Underhill has endeavoured to complete the services identified herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project. No other representation, express or implied, is included or intended, and no warranty or guarantee is included or intended in this report.

Thank you for the opportunity to provide our services. If you have any questions or require additional information, please do not hesitate to contact the undersigned.

Sincerely,

UNDERHILL ENGINEERING, LLC



Susan E. Ray, P.E., G.I.T.
Susan E. Ray, PE, GIT
Geotechnical Engineer



O. Christopher Webster, PE, F ASCE
Principal

Figure:

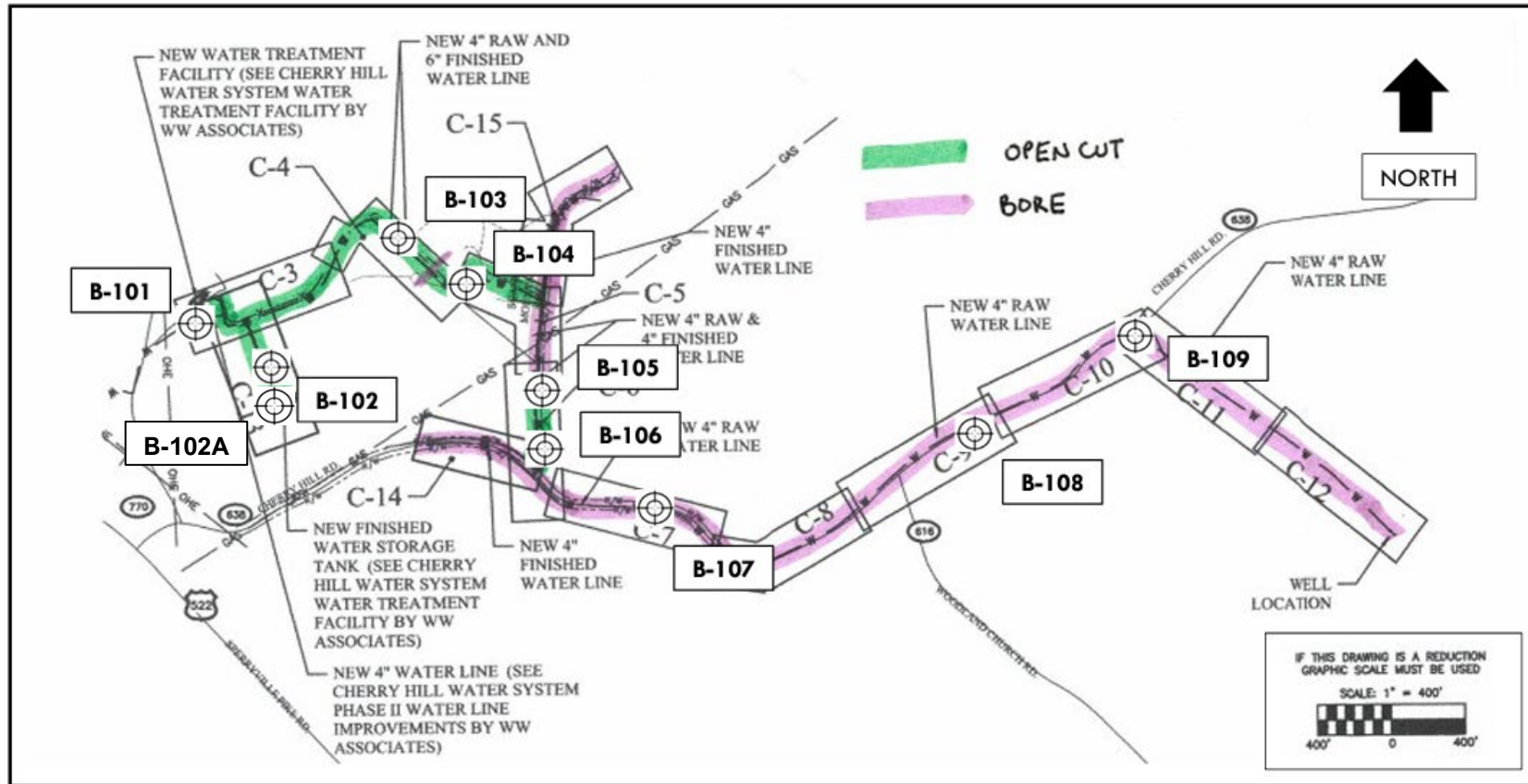
Figures 1 and 2: Auger Probe Location Plan

Exhibit:

Exhibit A: Subsurface Exploration Results

cc: Mr. Paul Howard, Jr., Director of Environmental Services – The County of Culpeper

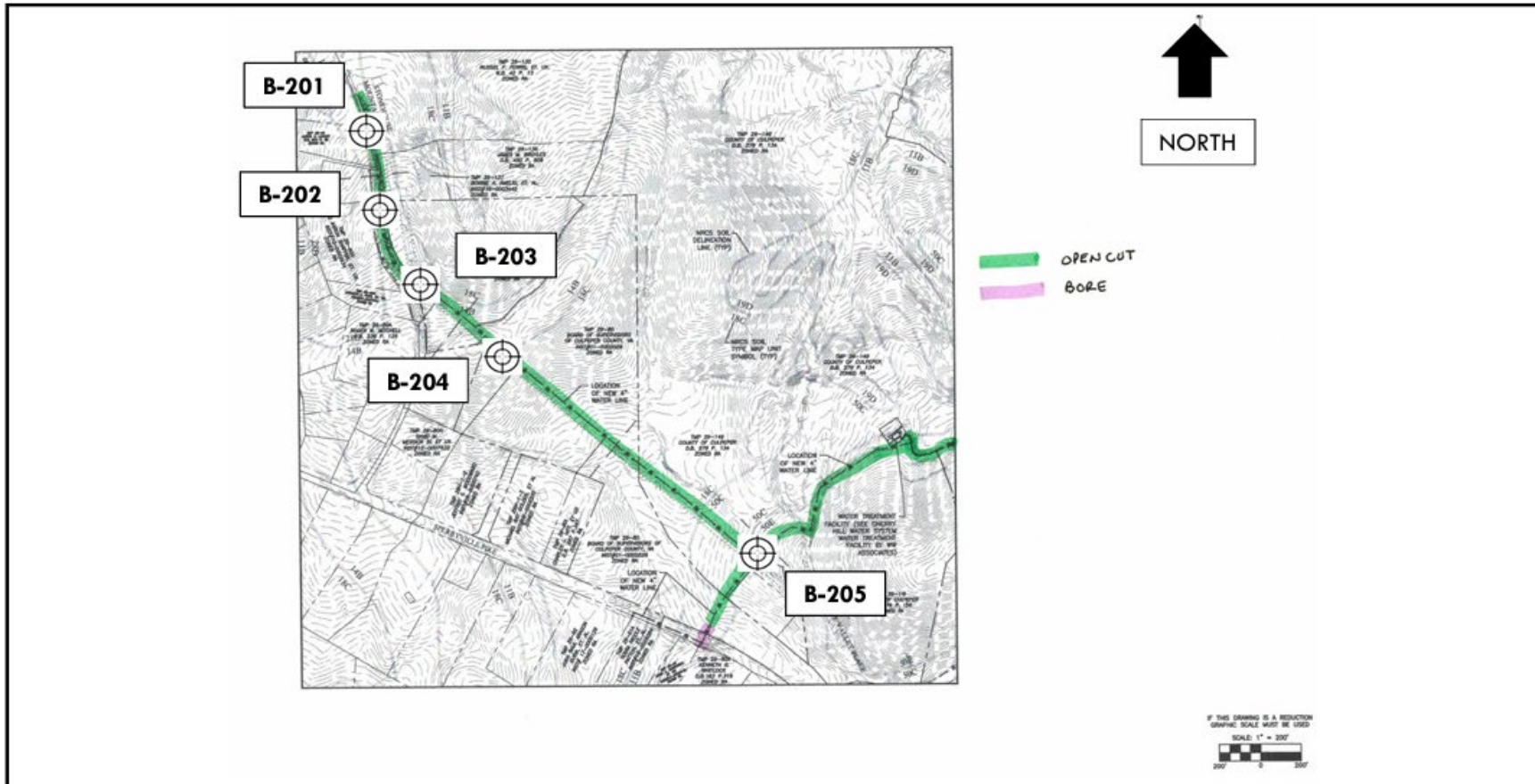
Figure 1: Auger Probe Location Plan, Waterline Phase 1



 **APPROXIMATE AUGER PROBE LOCATION**

Base drawing provided by WW Associates

Figure 2: Auger Probe Location Plan, Waterline Phase II



 APPROXIMATE AUGER PROBE LOCATION

Base drawing provided by WW Associates

Exhibit A: Subsurface Exploration Results

Subsurface Exploration Results

Summary of Auger Probe Total Depths (1 sheet)

Summary of Auger Probe Total Depths			
Auger Probe Number	Latitude	Longitude	Total Depth (feet)
B-101	38.511865	-78.051901	6.0
B-102	38.511050	-78.050852	4.5
B-102A	38.511056	-78.050845	6.0
B-103	38.513195	-78.048653	6.0
B-104	38.512292	-78.046792	6.0
B-105	38.510094	-78.045693	6.0
B-106	38.509834	-78.045691	6.0
B-107	38.508800	-78.043531	6.0
B-108	38.509713	-78.038314	6.0
B-109	38.511086	-78.035229	6.0
B-201	38.516440	-78.060582	6.0
B-202	38.515175	-78.060334	6.0
B-203	38.514149	-78.059843	6.0
B-204	38.510460	-78.054269	6.0
B-205	38.509374	-78.055145	6.0