

**CONTRACT DOCUMENTS
AND
TECHNICAL SPECIFICATIONS**

FOR

**± 1,555-LF EIGHT (8)-INCH PHASE I WATERMAIN EXTENSION
ALONG INDUSTRIAL PARK LANE WITHIN THE ± 139-ACRE
LYNCHES RIVER INDUSTRIAL PARK SOUTH ALONG DOVE
SUTTON ROAD NEAR THE TOWN OF PAGELAND IN THE
UNINCORPORATED CHESTERFIELD COUNTY, SOUTH CAROLINA**



**ALLIANCE CONSULTING ENGINEERS, INC.
CHESTERFIELD COUNTY BID NO.: 06-23/24
PROJECT NO. 23183-0013**

NOVEMBER 2023

BID DOCUMENTS

CONTRACTOR:

ADDRESS:

CONTRACTOR'S LICENSE NUMBER:



Alliance Consulting Engineers, Inc.
Post Office Box 8147
Columbia, SC 29202-8147
(803) 779-2078 • (803) 779-2079 fax
www.allianceCE.com

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Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South
Along Dove Sutton Road Near the Town of Pageland in the
Unincorporated Chesterfield County, South Carolina
For
Chesterfield County and Chesterfield Economic Development**

**PROJECT NO. 23183-0013
Chesterfield County Bid Number: 06-23/24
November 2023**

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ADVERTISEMENT FOR BIDS

Owner: Chesterfield County

Alliance Consulting Engineers, Inc. Project No.: 23183-0013

Chesterfield County Bid Number: 06-23/24

Separate sealed bids for construction of the **±1,555-LF Eight (8)-Inch Phase I Watermain Extension along Industrial Park Lane within the ±139-Acre Lynches River Industrial Park South along Dove Sutton Road near the Town of Pageland in unincorporated Chesterfield County, South Carolina** for Chesterfield County will be received by Chesterfield County Finance Department, until **2:00 PM** on **Thursday, December 14, 2023**. Oral statements may not be relied upon and will not be binding or legally effective. The deadline for submitting questions is **Wednesday, December 6, 2023 by 5:00 pm.**

Sealed BIDS may be mailed or hand delivered to:

Chesterfield County Finance Department
Attention: Michelle Stanley, Financial Director
178 Mill Street
Chesterfield, South Carolina 29709

Base Bid: This project consists of providing all required materials, equipment, and labor necessary to complete the construction **±1,555-LF Eight (8)-Inch Phase I Watermain Extension along Industrial Park Lane within the ±139-Acre Lynches River Industrial Park South along Dove Sutton Road near the Town of Pageland in unincorporated Chesterfield County, South Carolina**. Approximately 1,555 Linear Feet of Eight (8)-Inch Water C900 PVC, One (1) Air Release Valve and Vault, Four (4) Fire Hydrants, and all necessary appurtenance along Industrial Park Lane.

The Instructions to Bidders, Bid Form, Contract, Plans, Specifications, Bid Bond, Performance Bond, Payment Bond and other Contract Documents may be examined at the following locations:

HCAC and iSqFt Planroom Partnership: hcacarolinas@isqft.com

Dodge Plan Rooms: Dodge.Docs@construction.com

Chesterfield County Website: <http://www.chesterfieldcountysc.com/proposalListings>

Engineers: Alliance Consulting Engineers, Inc., Columbia, SC P.O. Box 8147 Columbia, SC 29202-8147

Drawings, Specifications, and Contract Documents may be obtained from the office of Alliance Consulting Engineers, Inc., Post Office Box 8147, Columbia, South Carolina 29202-8147 upon a non-refundable payment of **\$150** for each set. When requesting drawings, specifications, or contract documents, provide the following information about your company: Mailing address; street (FedEx) address; telephone number; FAX number (if applicable) and email address to Ms. Wendy Culley at wculley@alliancece.com.

Bidders should check Chesterfield County's "Project Listings" web page noted above for any addenda, updates, bid tab and award.

Bidders must deposit security with all bids. Security shall be in the form of a certified check or bid bond made payable to the Owner, and shall be for an amount equal to not less than five percent (5%) of the amount of the bid. Provisions of the security shall be as described in the Information for Bidders.

No bid will be considered unless the bidder is legally qualified under the provisions of the South Carolina Contractor's Licensing Law (SC Code of Laws as amended in 1999, Chapter 11, Sections 40-11-10 through 40-11-428). Contractors shall have current South Carolina and Chesterfield County licensure and bond capacity prior to Bid Submission.

NOTICE TO BIDDERS: Each bidder shall fully acquaint themselves with the conditions relating to the scope and restrictions attending the execution of the work under the conditions of this Bid. The failure or omission of a bidder to acquaint themselves with existing conditions shall in no way relieve them of any obligation with respect to this Bid or to the contract. All amendments to and interpretations of this solicitation shall be in writing and issued by Alliance Consulting Engineers, Inc. Neither Chesterfield County nor Alliance Consulting Engineers, Inc. shall be legally bound by any amendment or interpretation that is not in writing.

Contractors shall have a proper and active South Carolina License Classification for public watermain installation.

No bidder may withdraw the bid within sixty (60) days after the actual date of the opening and thereof.

The Owner reserves the right to waive any informality or to reject any or all bids. This Invitation for Bids does not commit Chesterfield County reserves the right to accept or reject any, all or any part of bids received as a result of this request, to waive any informalities; to negotiate with any or all qualified bidders; or to cancel in part or in its entirety this request, if it is in its best interest to do so. Chesterfield County will be sole judge as to whether bids submitted meet all requirements. All bids submitted shall become the property of Chesterfield County. This solicitation does not commit Chesterfield County to award a contract, to pay any cost incurred in the preparation of bids or to procure or contract for goods or services. Chesterfield County is an Equal Opportunity Employer.

ENGINEERS

Alliance Consulting Engineers, Inc.
Post Office Box 8147
Columbia, South Carolina 29202-8147
1201 Main Street, Suite 2020 (Physical/FedEx)
Columbia, South Carolina 29201-8147

OWNER

Chesterfield County Finance Department
178 Mill Street – Finance Office
Chesterfield, South Carolina 29709

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INSTRUCTIONS TO BIDDERS

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ARTICLE 1 - DEFINED TERMS

- 1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:
- A. Issuing Office - The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

- 2.01 Complete sets of the Bidding Documents in the number and for the deposit sum, if any, stated in the Advertisement or Invitation to Bid may be obtained from **Alliance Consulting Engineers, Inc., Post Office Box 8147, Columbia, South Carolina 29202-8147**. The deposit will be nonrefundable and a FedEx account number must be provided for FedEx delivery of Plan Sets. Request for bid documents can be addressed to Wendy Culley at wculley@alliancece.com.
- 2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not confer a license or grant for any other use.

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

- 3.01 To demonstrate Bidder's qualifications to perform the Work, within five (5) days of Owner's request, Bidder shall submit written evidence such as financial data, previous experience, and present commitments.

ARTICLE 4 - EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

- 4.01 Subsurface and Physical Conditions
- A. The General Conditions identify:
1. The reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Bidding Documents.
 2. The drawings of physical conditions in or relating to existing surface and subsurface structures at or contiguous to the Site (except Underground Facilities) that Engineer has used in preparing the Bidding Documents.
- B. Copies of reports and drawings referenced in Paragraph 4.01.A are included herein. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Paragraph 4.02 of the General Conditions has been identified and established. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions or information contained in such reports or shown or indicated in such drawings.
- 4.02 Underground Facilities
- A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

- 4.03 Hazardous Environmental Condition
- A. The General Conditions identify those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that Engineer has used in preparing the Bidding Documents.
 - B. Those reports and drawings are not part of the Contract Documents, but the “technical data” contained therein upon which Bidder is entitled to rely as provided in Paragraph 4.06 of the General Conditions has been identified and established. Bidder is responsible for any interpretation or conclusion Bidder draws from any “technical data” or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.
- 4.04 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated conditions appear in Paragraphs 4.02, 4.03, and 4.04 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work appear in Paragraph 4.06 of the General Conditions.
- 4.05 On request, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates. Engineer and Owner shall be notified prior to any site visits.
- 4.06 Reference is made to Article 7 of the General Conditions for the identification of the general nature of other work that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) that relates to the Work contemplated by these Bidding Documents. On request, Owner will provide to each Bidder for examination access to or copies of Contract Documents (other than portions thereof related to price) for such other work.
- 4.07 It is the responsibility of each Bidder before submitting a Bid to:
- A. Examine and carefully study the Bidding Documents, the other related data identified in the Bidding Documents, and any Addenda.
 - B. Visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
 - C. Become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.
 - D. Carefully study all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities), which have been identified in Paragraph 4.02 of the General Conditions, and (2) reports and drawings of Hazardous Environmental Conditions at the Site which have been identified in Paragraph 4.06 of the General Conditions.
 - E. Obtain and carefully study (or accept consequences of not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning

conditions (surface, subsurface, and Underground Facilities) at or contiguous to the Site, which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents, and safety precautions and programs incident thereto.

- F. Agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.
 - G. Become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
 - H. Correlate the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.
 - I. Promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder.
 - J. Determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work.
- 4.08 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 – PRE-BID CONFERENCE - DELETE

ARTICLE 6 - SITE AND OTHER AREAS

- 6.01 The Site is identified in the Bidding Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding Documents. All additional land and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor.

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

- 7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to the Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Engineer as having received the Bidding Documents. Any questions for clarification will be emailed to David Novotny at dnovotny@alliancece.com prior to **5:00 PM on December 6, 2023**. Questions received less than

seven (7) days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

- 7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or Engineer.

ARTICLE 8 - BID SECURITY

- 8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of five percent (5%) of Bidder's maximum Bid price and in the form of a certified check, bank money order, or a Bid Bond (on the form attached) issued by a surety meeting the requirements of Paragraphs 5.01 and 5.02 of the General Conditions.
- 8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within fifteen (15) days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven (7) days after the Effective Date of the Agreement or sixty-one (61) days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.
- 8.03 Bid security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be returned within seven (7) days after the Bid opening.

ARTICLE 9 - CONTRACT TIMES

- 9.01 The time allotted for completion is as follows:

± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina is to be completed within seventy-five (75) calendar days after the Notice to Proceed has been issued.

ARTICLE 10 - LIQUIDATED DAMAGES

- 10.01 Provisions for liquidated damages are set forth in the Agreement.

ARTICLE 11 - SUBSTITUTE AND "OR-EQUAL" ITEMS

- 11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, or "or-equal" materials and equipment as defined in paragraph 6.05 of the General Conditions, or those substitute materials and equipment approved by the Engineer and identified by Addendum. The materials and equipment described in the Bidding Documents establish a standard of required type, function and quality to be met by any proposed substitute or "or-equal" item. Request for Engineer's clarification of materials and equipment considered "or equal" prior to the Effective Date of the Agreement must be received by the Engineer at least five (5) days prior to the date for the receipt of Bids. No items of material or equipment will be considered by the Engineer as a substitute unless written request for approval has been submitted by Bidder and has been received by Engineer at least fifteen (15) days prior to the date for receipt of Bids. Each request shall conform to the requirements of paragraph 6.05 of the General Conditions. The burden of proof of the merit of the proposed item is upon the Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If the Engineer approves any proposed substitute item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner.

ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS AND OTHERS

- 12.01 If the General Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five (5) days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by Owner. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute, in which case apparent Successful Bidder shall submit an acceptable substitute, without an increase in Bid.
- 12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 6.06 of the General Conditions.
- 12.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.
- 12.04 The Contractor shall not award work to Subcontractor(s) in excess of the limits stated in SC 6.06.

ARTICLE 13 - PREPARATION OF BID

- 13.01 The Bid Form is included with the Bidding Documents. Additional copies may be obtained from Engineer.
- 13.02 All blanks on the Bid Form shall be completed by printing in ink or by typewriter and the Bid signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each unit price item listed therein, or the words "No Bid," "No Change," or "Not Applicable" entered.
- 13.03 A Bid by a corporation shall be executed in the corporate name by the president, vice-president, or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown below the signature.
- 13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown below the signature.
- 13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown below the signature.
- 13.06 A Bid by an individual shall show the Bidder's name and official address.
- 13.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture shall be shown below the signature.
- 13.08 All names shall be typed or printed in ink below the signatures.

- 13.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.
- 13.10 The postal address and telephone number for communications regarding the Bid shall be shown.
- 13.11 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the Contract. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

ARTICLE 14 - BASIS OF BID; COMPARISON OF BIDS

- 14.01 Unit Price
 - A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid schedule.
 - B. The total of all estimated prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accordance with Paragraph 11.03 of the General Conditions.
 - B. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.
- 14.02 The Bid price shall include such amounts as the Bidder deems proper for overhead and profit on account of cash allowances, if any, named in the Contract Documents as provided in Paragraph 11.02 of the General Conditions.
- 14.03 Bid prices will be compared after adjusting for differences in the time designated by Bidders for Substantial Completion. The adjusting amount will be determined at the rate set forth in the Contract Documents for liquidated damages for failing to achieve Substantial Completion for each day before or after the desired date appearing in Article 9.

ARTICLE 15 - SUBMITTAL OF BID

- 15.01 With each copy of the Bidding Documents, a Bidder is furnished one (1) separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with all the attachments outlined in Article 7 of the Bid Form.
- 15.02 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the Advertisement for Bids and shall be enclosed in an opaque sealed envelope plainly marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED". When using the mail or other delivery system, the Bidder is totally responsible for the mail or other delivery system delivering the Bid at the place and prior to the time indicated in the Advertisement for Bid. A mailed Bid shall be addressed to Owner at address in Article 1.01 of Bid Form.

ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BID

- 16.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.

16.02 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid or negotiated, that Bidder will be disqualified from further bidding on the work. The provision to withdraw a Bid without forfeiting the Bid security does not apply to Bidder's errors in judgment in preparing the bid.

ARTICLE 17 - OPENING OF BIDS

17.01 Bids will be opened publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids in the form of a Bid Tabulation and Bid Comparison.

ARTICLE 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

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

ARTICLE 19 - EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, non-responsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to not be responsible. Owner may also reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.

19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

19.03 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

19.04 In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the General Conditions.

19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities to perform the Work in accordance with the Contract Documents.

19.06 If the Contract is to be awarded, Owner will award the Contract to the responsible Bidder whose Bid, conforming with all the material terms and conditions of the Instructions to Bidders, is lowest, price and other factors considered. If detailed in the bid form, factors such as discounts, transportation costs, and life cycle costs may be used to determine which bidder, if any, is to be offered award.

19.07 The Owner reserves the right not to Award the Project.

ARTICLE 20 - CONTRACT SECURITY AND INSURANCE

20.01 Article 5 of the General Conditions sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it shall be accompanied by such bonds.

ARTICLE 21 - SIGNING OF AGREEMENT

21.01 When Owner gives a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement with the other Contract Documents which are identified in the Agreement as attached thereto. Within 15 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within 10 days thereafter, Owner shall deliver one (1) fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

ARTICLE 22 – RETAINAGE

22.01 Retainage from progress payments to the Contractor shall be ten percent (10%) of each payment for work completed and materials stored on-site

END OF SECTION

SECTION 00 41 00

BID FORM

**± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension
Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South
Along Dove Sutton Road Near the Town of Pageland in the
Unincorporated Chesterfield County, South Carolina
For
Chesterfield County and Chesterfield Economic Development**

TABLE OF ARTICLES

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ARTICLE 1 - BID RECIPIENT

1.01 This Bid is submitted to: By mail : In Person:

**Chesterfield County Finance Department
178 Mill Street – Finance Office
Chesterfield, South Carolina 29709**

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

ARTICLE 2 - BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for sixty (60) days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 - BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged.

<u>Addendum No.</u>	<u>Addendum Date</u>	<u>Initials</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____

B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities), which have been identified in Paragraph 4.02 of General Conditions, and (2) reports and drawings of Hazardous Environmental Conditions that have been identified in Paragraph 4.06 of General Conditions.

- E. Bidder has obtained and carefully studied (or accepts the consequences for not doing so) all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the Site, which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto.
- F. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.
- G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.
- I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.
- J. Bidder will submit written evidence of its authority to do business in the state where the Project is located not later than the date of its execution of the Agreement.

ARTICLE 4 - FURTHER REPRESENTATIONS

4.01 Bidder further represents that:

- A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation.
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding.
- D. Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following unit price(s):

Phase I Existing Roadways (Industrial Park Lane and East Park Lane) ±139-Acre Lynches River Industrial Park Chesterfield County, South Carolina					
<u>Item No.</u>	<u>Description</u>	<u>Unit</u>	<u>Estimated Quantity</u>	<u>Unit Price</u>	<u>Bid Price</u>
1	Mobilization/Bonds	LS	1	\$	\$
2	Construction Safety/Traffic Control	LS	1	\$	\$
3	Clearing and Grubbing	AC	0.5	\$	\$
4	Silt Fence	LF	1,500	\$	\$
5	Inlet Protection	EA	4	\$	\$
6	Check Dam	EA	2	\$	\$
7	16-Inch Steel Casing (Bore and Jack under existing Roadways)	LF	220	\$	\$
8	8-Inch C900 PVC Watermain (include all necessary appurtenances)	LF	1,570	\$	\$
9	8-inch Tee Cut-in on Existing 8-inch on Dove Sutton Road	EA	1	\$	\$
10	Fire Hydrant Assembly	EA	4	\$	\$
11	8-inch Plug and Blocking	LS	4	\$	\$
12	Air Release Valve and Vault	EA	1	\$	\$
13	Grassing	AC	0.5	\$	\$

Total Base Bid: \$ _____

Dollars _____ Cents

(\$ _____)

Amounts are to be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.

The above unit prices shall include all labor, materials, bailing, shoring, removal, overhead, profit, insurance, etc., to complete the finish work as stipulated in the Bid Documents.

Unit Prices have been computed in accordance with Paragraph 11.03.B of the General Conditions.

- A. Bidder acknowledges that estimated quantities are not guaranteed and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

ARTICLE 6 - TIME OF COMPLETION

6.01 Bidder agrees that the Work: ±1,555-LF Eight (8)-inch Watermain along Industrial Park Along Dove Sutton Road (S-682) Near the Town of Pageland Chesterfield County, South Carolina is to be completed within seventy-five (75) calendar days for the Base Bid scope of work after the Notice to Proceed has been issued.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the Contract dates in the amount of **\$500** per day for each calendar day required to complete the work in the manner and within the dates as stated in Paragraph 6.01 above.

ARTICLE 7 - ATTACHMENTS TO THIS BID

7.01 The following documents are attached to and made a condition of this Bid:

- A. Required Bid security in the form of five percent (5%) of the total bid amount.
- B. Power of Attorney.

ARTICLE 8 - DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders and General Conditions.

ARTICLE 9 - BID SUBMITTAL

9.01 This Bid submitted by:

An Individual

Name (typed or printed): _____

By: _____ (SEAL)

(Individual's signature)

Title: _____

Doing business as: _____

A Partnership

Partnership Name: _____ (SEAL)

By: _____

(Signature of general partner -- attach evidence of authority to sign)

Title: _____

Name (typed or printed): _____

A Corporation

Corporation Name: _____ (SEAL)

State of Incorporation: _____

Type (General Business, Professional, Service, Limited Liability): _____

By: _____

(Signature -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____ (CORPORATE SEAL)

Attest _____

Date of Authorization to do business in [South Carolina] is ____ / ____ / ____.

A Joint Venture

Name of Joint Venture: _____

First Joint Venturer Name: _____ (SEAL)

By: _____

(Signature of first joint venture partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Second Joint Venturer Name: _____ (SEAL)

By: _____

(Signature of second joint venture partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

(Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.)

Bidder's Business Address _____

Telephone No.: _____ Fax No.: _____

SUBMITTED on _____, 2023.

State Contractor License No. _____.

SECTION 00 43 00

BID BOND

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where applicable.

BIDDER (Name and Address):

SURETY (Name and Address of Principal Place of Business):

OWNER (Name and Address): **Chesterfield County
178 Mill Street
Chesterfield, South Carolina 29708**

BID

Bid Due Date: **Thursday, December 14, 2023 at 2:00 PM**

Project (Brief Description Including Location): **± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension
Along Industrial Park Lane Within the ± 139-Acre
Lynches River Industrial Park South Along Dove
Sutton Road Near the Town of Pageland in the
Unincorporated Chesterfield County, South Carolina**

BOND

Bond Number:

Date (Not later than Bid due date):

Penal sum _____ (Words) _____ (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms printed on the reverse side hereof, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER

SURETY

Bidder's Name and Corporate Seal (Seal)

Surety's Name and Corporate Seal (Seal)

By: _____
Signature and Title

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title

Attest: _____
Signature and Title

Note: Above addresses are to be used for giving required notice.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Surety's liability.
2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation shall be null and void if:
 - 3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2. All Bids are rejected by Owner, or
 - 3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default by Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable

SECTION 00 43 93

BIDDER'S SUBMITTAL CHECKLIST

PROJECT: ± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina
PROJECT NO.: 23183-0013
CHESTERFIELD BID NO.: 06-23/24

BIDDER NAME: _____

DATE: _____

1.0 This checklist shall be included as the first page of the submitted bidding documents. As outlined in ARTICLE 7 of the BID FORM the following items shall be included with the submitted bidding documents:

CHECK (✓)	ITEM	DESCRIPTION
	-	Properly Executed Bid Form (Including the acknowledgement of all Addenda)
	A.	Required Bid security in the form of a Bid Bond (EJCDC No. C-430) or Certified Check in the amount of five percent (5%) of the total bid amount
	B.	List of Proposed Subcontractors; (must be submitted within five (5) days of the Bid Opening)
	C.	List of Proposed Suppliers; (must be submitted within five (5) days of the Bid Opening)
	D.	List of Project References; (must be submitted within five (5) days of the Bid Opening)
	E.	Evidence of authority to do business in the State of South Carolina, or written covenant to obtain such license within the time frame for acceptance of Bids;
	F.	Contractor License Number or evidence of Bidder's ability to obtain a State Contractor's License and covenant by Bidder to obtain said license within the time for acceptance of Bids.
	G.	Required Bidder Qualification Statement with Supporting Data; (must be submitted within five (5) days of the Bid Opening)

END OF SECTION

SECTION 00 45 13

CONTRACTOR/SUBCONTRACTOR QUALIFICATIONS

PART 1 GENERAL

1.01 The following information and completed forms may be requested by the Owner of the three lowest bidders. The request will be made the day of the Bid Opening or within five (5) days following the Bid Opening. If requested, this data must be submitted to the Engineer or Owner within ten (10) days of the request. Failure to provide the data in this section, upon request, may subject bidder to disqualification.

1.02 DESCRIPTION

Contractor shall provide with its bid, the following 1 original and 3 copies which should be collated, fastened together, and clearly labeled.

- A. Information provided will be used by the Engineer or Owner to determine the competency and ability of the Contractor and/or Subcontractor to perform the scheduled work in a manner that is satisfactory to the Engineer or Owner. The Engineer's or Owner's decision shall be final.
- B. Any Subcontractor being used by the General Contractor, whose portion of the project exceeds 5% of the total bid price amount, will be required to provide the same information as the General Contractor.
- C. The Contractor and Subcontractor shall include with this section a detailed financial statement indicating the Contractor's or Subcontractor's financial resources. The information on that statement shall be certified by a Certified Public Accountant and shall be submitted on the Associated General Contractor's of America form "Standard Questionnaires and Financial Statement for Bidders".
- D. The Contractor and Subcontractor shall certify by attaching his signature to this Section as provided that all information contained herein is complete and all statements and answers are accurate and true. Providing misinformation, incomplete information, inaccurate information, or failure to certify the information, will subject bidder to disqualification.

1.03 QUALIFICATIONS

- A. Complete the following for General Contractor and any Subcontractors (attach additional sheets as required):
 - 1. Name: _____
 - 2. Address: _____
 - 3. City, State, Zip: _____
 - 4. Principle: _____
- B. Number of years the company has been in business: _____

C. List and describe at least five (5) projects that have been completed, that are similar in size and type, and that has been completed within the last ten (10) years:

1. _____

2. _____

3. _____

4. _____

5. _____

D. For the projects listed above provide the following:

1. Project Owner: _____
Contact Name and Title: _____
Telephone Number: _____
2. Project Owner: _____
Contact Name and Title: _____
Telephone Number: _____
3. Project Owner: _____
Contact Name and Title: _____
Telephone Number: _____
4. Project Owner: _____
Contact Name and Title: _____
Telephone Number: _____
5. Project Owner: _____
Contact Name and Title: _____
Telephone Number: _____

E. For each of the projects listed in Items C & D provide the following:

1. Original Bid Amount: _____
Final Construction Cost: _____
Contract Period: _____
Actual Contract Period: _____
Explanation: _____
2. Original Bid Amount: _____
Final Construction Cost: _____
Contract Period: _____
Actual Contract Period: _____
Explanation: _____

3. Original Bid Amount: _____
Final Construction Cost: _____
Contract Period: _____
Actual Contract Period: _____
Explanation: _____

4. Original Bid Amount: _____
Final Construction Cost: _____
Contract Period: _____
Actual Contract Period: _____
Explanation: _____

5. Original Bid Amount: _____
Final Construction Cost: _____
Contract Period: _____
Actual Contract Period: _____
Explanation: _____

F. Provide the following for any portion of the work that is being subcontracted (5% or more of the Bid Amount):

1. Name of Subcontractor: _____
Address: _____
Telephone Number: _____
Work being Completed: _____

2. Name of Subcontractor: _____
Address City/State/Zip: _____
Telephone Number: _____
Work being Completed: _____

3. Name of Subcontractor: _____
Address City/State/Zip: _____
Telephone Number: _____
Work being Completed: _____

4. Name of Subcontractor: _____
Address City/State/Zip: _____
Telephone Number: _____
Work being Completed: _____

5. Name of Subcontractor: _____
Address City/State/Zip: _____
Telephone Number: _____
Work being Completed: _____

G. Provide a list of equipment that is owned by the Contractor and is available for this project.

H. Provide a list of equipment that will be purchased, leased or rented for this project.

I. Provide a list of the superintendent(s) or others that will be in charge of this project (Provide resumes and qualifications):

J. Provide the following for current projects being completed:

1. Project Name: _____
Owner: _____
Current Status: _____
Estimated Schedule of Completion: _____
2. Project Name: _____
Owner: _____
Current Status: _____
Estimated Schedule of Completion: _____
3. Project Name: _____
Owner: _____
Current Status: _____
Estimated Schedule of Completion: _____
4. Project Name: _____
Owner: _____
Current Status: _____
Estimated Schedule of Completion: _____
5. Project Name: _____
Owner: _____
Current Status: _____
Estimated Schedule of Completion: _____

K. Provide a list of projects that have been completed with the Owner over the past fifteen (15) years:

1. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____
2. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____
3. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____
4. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____
5. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____

L. Provide a list of projects that Bid with the Owner over the past fifteen (15) years:

1. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____
2. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____
3. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____
4. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____
5. Project Name: _____
Contact Name and Title: _____
Telephone Number: _____

M. Provide a list of projects completed with the Engineer over the past fifteen (15) years:

1. Project Name: _____
Project Engineer: _____
Original Bid Amount: _____
Final Construction Cost: _____
Contract Period: _____
Actual Contract Period: _____
Explanation: _____
2. Project Name: _____
Project Engineer: _____
Original Bid Amount: _____
Final Construction Cost: _____
Contract Period: _____
Actual Contract Period: _____
Explanation: _____
3. Project Name: _____
Project Engineer: _____
Original Bid Amount: _____
Final Construction Cost: _____
Contract Period: _____
Actual Contract Period: _____
Explanation: _____
4. Project Name: _____
Project Engineer: _____
Original Bid Amount: _____
Final Construction Cost: _____
Contract Period: _____
Actual Contract Period: _____
Explanation: _____

- 5. Project Name: _____
 Project Engineer: _____
 Original Bid Amount: _____
 Final Construction Cost: _____
 Contract Period: _____
 Actual Contract Period: _____
 Explanation: _____

N. Provide a list of projects involved with litigation, arbitration and/or mediation over the past twenty (20) years:

- 1. Project Name: _____
 Project Owner: _____
 Project Engineer: _____
 Date: _____
 Explanation: _____
- 2. Project Name: _____
 Project Owner: _____
 Project Engineer: _____
 Date: _____
 Explanation: _____
- 3. Project Name: _____
 Project Owner: _____
 Project Engineer: _____
 Date: _____
 Explanation: _____
- 4. Project Name: _____
 Project Owner: _____
 Project Engineer: _____
 Date: _____
 Explanation: _____
- 5. Project Name: _____
 Project Owner: _____
 Project Engineer: _____
 Date: _____
 Explanation: _____

O. Attach a rate schedule associated with equipment that includes labor, overhead and profit.

_____ Rate Schedule Attached.

P. Additional information if Necessary.

1.04 I HEREBY CERTIFY that as a duly authorized representative of _____
_____(bidder), the
information provided is to the best of my knowledge accurate and that failure to provide
accurate information will result in disqualification of my bid.

Signature

Name (Please Print)

Title

Date

Notary Public for South Carolina
My Commission Expires: _____

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 00 50 50

NOTICE OF INTENT TO AWARD

OWNER: Chesterfield County
(Name)

PROJECT: ± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane
Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road
Near the Town of Pageland in the Unincorporated Chesterfield County, South
Carolina

**Alliance Consulting Engineers, Inc. Project No. 23183-0013
Chesterfield County Bid Number: 06-23/24**

TO ALL BIDDERS

This is to notify all bidders that it is the intent of the owner to award a contract as follows:

NAME OF
BIDDER: _____

DATES BIDS WERE
RECEIVED: _____

AMOUNT OF BASE BID: \$ _____

ALTERNATE(S) ACCEPTED: # \$ _____

TOTAL AMOUNT OF BASE BID WITH ALTERNATE(S): \$ _____

The owner has determined that the above-named bidder is responsible and has submitted the lowest responsive bid. Following a ten (10)-day protest period, the owner may enter into a contract with this bidder.

(PRINT OR TYPE NAME) (AWARD AUTHORITY TITLE)

(SIGNATURE) (DATE POSTED)

.....
POST A COPY OF THIS FORM AT THE LOCATION ANNOUNCED AT BID OPENING

SECTION 00 51 02

NOTICE OF AWARD

Date _____

Project: ± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina	Owner: Chesterfield County	Owner's Contract No.: 06-23/24
--	-----------------------------------	---------------------------------------

Contract:	Engineer's Project No.: 23183-0013
-----------	--

Bidder: _____

Bidder's Address: (send Certified Mail, Return Receipt Requested): _____

You are notified that your Bid dated _____ for the above Contract has been considered.

You are the Successful Bidder and are awarded a Contract for the **± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina**. The Contract Price of your Contract is _____ (\$ _____)

____ copies of each of the proposed Contract Documents (except Drawings) accompany this Notice of Award.
____ sets of the Drawings will be delivered separately or otherwise made available to you immediately.

You must comply with the following conditions precedent within fifteen (15) days of the date you receive this Notice of Award.

1. Deliver to the Owner five (5) fully-executed counterparts of the Contract Documents.
2. Deliver with the executed Contract Documents the Contract security [Bonds] as specified in the Instructions to Bidders (Article 20), [and] General Conditions (Paragraph 5.01).
3. Other conditions precedent: None

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

Within **ten (10) days** after you comply with the above conditions, Owner will return to you one (1) fully executed counterpart of the Contract Documents.

Chesterfield County
Owner

By: _____
Authorized Signature
Tim Eubanks, County Administrator
Title

Acceptance of Notice

Receipt of the above Notice of Award is hereby acknowledged by _____
This the _____ day of _____, 20____.

Contractor

By: _____
Authorized Signature
Title

Copy to Engineer

SECTION 00 52 00

CONTRACT

THIS AGREEMENT is by and between Chesterfield County

("Owner") and _____

("Contractor") Owner and Contractor hereby agree as follows:

ARTICLE 1 - WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina

ARTICLE 2 - THE PROJECT

2.01 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina

ARTICLE 3 - ENGINEER

3.01 The Project has been designed by: Alliance Consulting Engineers, Inc., who is to act as Owner's representative, assume all duties and responsibilities and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

4.01 Time of the Essence

A. All time limits for Milestones for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 Days to Achieve Substantial Completion and Final Payment

Contractor agrees that the work: ± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina is to be completed within seventy-five (75) calendar days for the scope of work after Notice to Proceed has been issued.

4.03 Liquidated Damages

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and

difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay Owner **\$500** for each day that expires after the time specified in Paragraph 4.02 above for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner **\$500** for each day that expires after the time specified in Paragraph 4.02 above for completion and readiness for final payment until the Work is completed and ready for final payment.

ARTICLE 5 - CONTRACT PRICE

- 5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts determined pursuant to Paragraphs 5.01.A, and 5.01.B below:
- A. All specific cash allowances are included in the above price in accordance with Paragraph 11.02 of the General Conditions.

ARTICLE 6 - PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments

- A. Contractor shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 Progress Payments; Retainage

- A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the 25th day of each month during performance of the Work as provided in Paragraphs 6.02.A.1 below. All such payments will be measured by the schedule of values established as provided in Paragraph 2.07.A of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements:
1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Engineer may determine or Owner may withhold, including but not limited to liquidated damages, in accordance with Paragraph 14.02 of the General Conditions:
 - a. 90% of Work completed (with the balance being Retainage).
 - b. 90% of cost of materials and equipment not incorporated in the Work (with the balance being Retainage).
- B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 100% of the Work completed, less such amounts as Engineer shall determine in accordance with Paragraph 14.02.B.5 of the General Conditions and less 100% of Engineer's estimate of the value of Work to be completed or corrected as shown on the tentative list of items to be completed or corrected attached to the certificate of Substantial Completion.

6.03 Final Payment

- A. Upon final completion and acceptance of the Work in accordance with Paragraph 14.07 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 14.07.

ARTICLE 7 – INTEREST

- 7.01 All moneys not paid when due as provided in Article 14 of the General Conditions shall bear interest at the rate of 3% percent per annum.

ARTICLE 8 – CONTRACTOR’S REPRESENTATIONS

- 8.01 In order to induce Owner to enter into this Agreement Contractor makes the following representations:
 - A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
 - B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
 - C. Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.
 - D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) and (2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site have been identified as containing reliable "technical data."
 - E. Contractor has considered the information known to Contractor; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Contract Documents; and (3) Contractor’s safety precautions and programs.
 - F. Based on the information and observations referred to in Paragraph 8.01.E above, Contractor does not consider that further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.
 - G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
 - H. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
 - I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 9 - CONTRACT DOCUMENTS

9.01 Contents

- A. The Contract Documents consist of the following:
1. This Agreement - Section 00 52 00 (pages 1 to 6, inclusive).
 2. Performance Bond - Section 00 61 13.13 (pages 1 to 3, inclusive).
 3. Payment Bond - Section 00 61 13.16 (pages 1 to 3, inclusive).
 4. Other bonds (N/A).
 5. General Conditions - Section 00 70 00 (pages 1 to 60, inclusive).
 6. Specifications as listed in the Table of Contents of the Project Manual. The following Sections included within Division 0 are considered part of the "Technical Specifications."
- Drawings consisting of **nine (9)** sheets with each sheet bearing the following general title:
± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina
7. Addenda (numbers ____ to ____, inclusive).
 8. Exhibits to this Agreement (enumerated as follows):
 - a. Contractor's Bid Form - Section 00 41 00 (pages 1 to 7, inclusive).
 - b. Documentation submitted by Contractor prior to Notice of Award as detailed within the Bidder's Submittal Checklist - Section 00 43 93 (pages 1 to 1, inclusive).
 9. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
 - a. Notice to Proceed - Section 00 55 00 (pages 1 to 1, inclusive).
 - b. Work Change Directives.
 - c. Change Orders.
- B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 9.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in Paragraph 3.04 of the General Conditions.

ARTICLE 10 - MISCELLANEOUS

10.01 Terms

- A. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

10.02 Assignment of Contract

- A. No assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.03 Successors and Assigns

- A. Owner and Contractor each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.04 Severability

- A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.05 Contractor's Certifications

- A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph
 1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;
 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

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

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement. One counterpart each has been delivered to Owner, Contractor, Engineer and provided to the Contractor for his Bonding Agency. All portions of the Contract Documents have been signed or identified by Owner and Contractor or on their behalf.

This Agreement will be effective on _____
(which is the Effective Date of the Agreement).

OWNER: Chesterfield County

CONTRACTOR:

By: Tim Eubanks

By: _____

Title: County Administrator

Title: _____

If Contractor is a corporation, a Partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____

Attest: _____

Title: _____

Title: _____

Address for giving notices:

Address for giving notices:

Chesterfield County

178 Mill Street – Finance Office

Chesterfield, South Carolina 29709

License No.: _____

(Where applicable)

(If Owner is a corporation, attach evidence of authority to sign. If Owner is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)

Agent for service of process:

SECTION 00 55 00

NOTICE TO PROCEED

Date _____

Project: ± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina	Owner: Chesterfield County	Owner's Contract No.: 06-23/24
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Contract:	Engineer's Project No.: 23183-0013
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Contractor: _____

Contractor's Address: (send Certified Mail, Return Receipt Requested): _____

You are notified that the Contract Times under the above contract will commence to run on _____. On or before that date, you are to start performing your obligations under the Contract Documents. In accordance with Article 4 of the Agreement, the date of Substantial Completion is _____, and the date of readiness for final payment is _____.

Before you may start any Work at the Site, Paragraph 2.01.B of the General Conditions provides that you and Owner must each deliver to the other (with copies to Engineer and other identified additional insured and loss payees) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents.

Also, before you start any work at the site, you must: notify the Engineer and Owner.

_____	Chesterfield County
Contractor	Owner
by: _____	Given by: _____
Authorized Signature	Authorized Signature
_____	Mr. Tim Eubanks, County Administrator
Title	Title
_____	_____
Date	Date

Copy to Engineer

SECTION 00 61 13.13

PERFORMANCE BOND

CONTRACTOR *(name and address):*

SURETY *(name and address of principal place of business):*

OWNER: **Chesterfield County
178 Mill Street
Chesterfield, South Carolina 29078**

CONSTRUCTION CONTRACT

Effective Date of the Agreement:

Amount:

Description: **± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina**

BOND

Bond Number:

Date *(not earlier than the Effective Date of the Agreement of the Construction Contract):*

Amount:

Modifications to this Bond Form: None See Paragraph 16

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

CONTRACTOR AS PRINCIPAL

SURETY

Contractor's Name and Corporate Seal *(seal)*

Surety's Name and Corporate Seal *(seal)*

By: _____
Signature

By: _____
Signature *(attach power of attorney)*

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

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

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.
2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.
 - 3.1 The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;
 - 3.2 The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
 - 3.3 The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after:
 - 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:
 - 5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
 - 5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.
 6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.
 7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:
 - 7.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
 - 7.2 additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and
 - 7.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.
 8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.
 9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.
 10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
 11. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit shall be applicable.
4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.
5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:
 - 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;
 - 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;
 - 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

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

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

14. Definitions

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

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

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

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

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

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

16. Modifications to this Bond are as follows:

FOR INFORMATION ONLY – Name, Address and Telephone

Surety Agency or Broker:

Owner's Representative (Engineer): **Alliance Consulting Engineers, Inc., P.O. Box 8147, Columbia, SC 29202-8147, (803) 779-2078**

END OF SECTION

SECTION 00 61 13.16

PAYMENT BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER: **Chesterfield County
178 Mill Street
Chesterfield, South Carolina 29708**

CONSTRUCTION CONTRACT

Effective Date of the Agreement:

Amount:

Description: **± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane
Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road
Near the Town of Pageland in the Unincorporated Chesterfield County, South
Carolina**

BOND

Bond Number:

Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:

Amount:

Modifications to this Bond Form: None See Paragraph 18

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

CONTRACTOR AS PRINCIPAL

SURETY

Contractor's Name and Corporate Seal *(seal)*

Surety's Name and Corporate Seal *(seal)*

By: _____
Signature

By: _____
Signature *(attach power of attorney)*

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

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

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

make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
12. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.
14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.
15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

- 16.1 **Claim:** A written statement by the Claimant including at a minimum:
1. The name of the Claimant;
 2. The name of the person for whom the labor was done, or materials or equipment furnished;
 3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
 4. A brief description of the labor, materials, or equipment furnished;
 5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
7. The total amount of previous payments received by the Claimant; and
8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

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

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

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

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

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

18. Modifications to this Bond are as follows:

END OF SECTION

SECTION 00 62 76

APPLICATION FOR PAYMENT

Contractor's Application For Payment No. _____

Application Period:		Application Date:
To (Owner): Chesterfield County	From (Contractor):	Via (Engineer): Alliance Consulting Engineers, Inc.
Project: <u>± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina</u>	Contract: <u>± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina</u>	
Owner's Contract No.: 06-23/24	Contractor's Project No.:	Engineer's Project No.: 23183-0013

APPLICATION FOR PAYMENT

Change Order Summary

Approved Change Orders		
Number	Additions	Deductions
TOTALS		
NET CHANGE BY CHANGE ORDERS		

1. ORIGINAL CONTRACT PRICE	\$	_____
2. Net change by Change Orders	\$	_____
3. CURRENT CONTRACT PRICE (Line 1 ± 2).....	\$	_____
4. TOTAL COMPLETED AND STORED TO DATE (Column F on Progress Estimate)	\$	_____
5. RETAINAGE:		
a. ____ % x \$ _____ Work Completed	\$	_____
b. ____ % x \$ _____ Stored Material	\$	_____
c. Total Retainage (Line 5a + Line 5b)	\$	_____
6. AMOUNT ELIGIBLE TO DATE (Line 4 - Line 5c).....	\$	_____
7. LESS PREVIOUS PAYMENTS (Line 6 from prior Application)	\$	_____
8. AMOUNT DUE THIS APPLICATION.....	\$	_____
9. BALANCE TO FINISH, PLUS RETAINAGE (Column G on Progress Estimate + Line 5 above)	\$	_____

CONTRACTOR'S CERTIFICATION

The undersigned Contractor certifies that: (1) all previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with Work covered by prior Applications for Payment; (2) title of all Work, materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to Owner at time of payment free and clear of all Liens, security interests and encumbrances (except such as are covered by a Bond acceptable to Owner indemnifying Owner against any such Liens, security interest or encumbrances); and (3) all Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Payment of: \$ _____
(Line 8 or other - attach explanation of other amount)

is recommended by: _____
Benjamin S. Whaley, P.E. (Date)

Payment of: \$ _____
(Line 8 or other - attach explanation of other amount)

is approved by: _____
Tim Eubanks, County Administrator (Date)

By: _____ Date: _____

Stored Material Summary

Contractor's Application

For (contract): ± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina									
Application Period:					Application Date:				
A	B	C	D		E		F		G
Invoice No.	Shop Drawing Transmittal No.	Materials Description	Stored Previously		Stored this Month		Incorporated in Work		Materials Remaining in Storage (\$) (D + E - F)
			Date (Month/Year)	Amount (\$)	Amount (\$)	Subtotal	Date (Month/Year)	Amount (\$)	
		Totals							

SECTION 00 63 49

WORK CHANGE DIRECTIVE

No. _____

Date of Issuance: _____ Effective Date: _____

Project: ± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina	Owner: Chesterfield County	Owner's Contract No.: 06-23/24
Contract: : ± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina		Date of Contract:
Contractor:		Engineer's Project No.: 23183-0013

You are directed to proceed promptly with the following change(s):

Item No.	Description

Attachments (list documents supporting change):

Purpose for Work Change Directive:

- Authorization for Work described herein to proceed on the basis of Cost of the Work due to:
 - Disagreement on pricing of proposed change.
 - Necessity to expedite Work described herein prior to agreeing to changes on Contract Price and Contract Time.

Estimated change in Contract Price and Contract Times:

Contract Price \$ _____ (increase/decrease) Contract Time _____ days (increase/decrease)

If the change involves an increase, the estimated amounts are not to be exceeded without further authorization.

Recommended for Approval by Engineer: Benjamin S. Whaley, P.E.	Date
Authorized for Owner by: Tim Eubanks, County Administrator	Date
Accepted for Contractor by:	Date

SECTION 00 63 63

CHANGE ORDER

No. _____

Date of Issuance: _____ Effective Date: _____

Project: ± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina	Owner: Chesterfield County	Owner's Contract No.: 06-23/24
Contract: : ± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina		Date of Contract:
Contractor:		Engineer's Project No.: 23183-0013

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

Description:

Attachments: (List documents supporting change):

CHANGE IN CONTRACT PRICE:	CHANGE IN CONTRACT TIMES:
Original Contract Price: \$ _____	Original Contract Times: <input type="checkbox"/> Working days <input type="checkbox"/> Calendar days Substantial completion (days or date): _____ Ready for final payment (days or date): _____
[Increase] [Decrease] from previously approved Change Orders No. _____ to No. _____: \$ _____	[Increase] [Decrease] from previously approved Change Orders No. _____ to No. _____: Substantial completion (days): _____ Ready for final payment (days): _____
Contract Price prior to this Change Order: \$ _____	Contract Times prior to this Change Order: Substantial completion (days or date): _____ Ready for final payment (days or date): _____
[Increase] [Decrease] of this Change Order: \$ _____	[Increase] [Decrease] of this Change Order: Substantial completion (days or date): _____ Ready for final payment (days or date): _____
Contract Price incorporating this Change Order: \$ _____	Contract Times with all approved Change Orders: Substantial completion (days or date): _____ Ready for final payment (days or date): _____

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____ Engineer: Benjamin S. Whaley, P.E.	By: _____ Owner: Tim Eubanks, County Administrator	By: _____ Contractor (Representative)
Date: _____	Date: _____	Date: _____
Approved by Funding Agency (if applicable): _____	Date: _____	

Change Order

Instructions

A. GENERAL INFORMATION

This document was developed to provide a uniform format for handling contract changes that affect Contract Price or Contract Times. Changes that have been initiated by a Work Change Directive must be incorporated into a subsequent Change Order if they affect Price or Times.

Changes that affect Contract Price or Contract Times should be promptly covered by a Change Order. The practice of accumulating Change Orders to reduce the administrative burden may lead to unnecessary disputes.

If Milestones have been listed in the Agreement, any effect of a Change Order thereon should be addressed.

For supplemental instructions and minor changes not involving a change in the Contract Price or Contract Times, a Field Order should be used.

B. COMPLETING THE CHANGE ORDER FORM

Engineer normally initiates the form, including a description of the changes involved and attachments based upon documents and proposals submitted by Contractor, or requests from Owner, or both.

Once Engineer has completed and signed the form, all copies should be sent to Owner or Contractor for approval, depending on whether the Change Order is a true order to the Contractor or the formalization of a negotiated agreement for a previously performed change. After approval by one contracting party, all copies should be sent to the other party for approval. Engineer should make distribution of executed copies after approval by both parties.

If a change only applies to price or to times, cross out the part of the tabulation that does not apply.

END OF SECTION

SECTION 00 65 16

CERTIFICATE OF SUBSTANTIAL COMPLETION

Project: ± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina	Owner: Chesterfield County	Owner's Contract No.: 06-23/24
Contract: ± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina	Date of Contract:	
Contractor:		Engineer's Project No.: 23183-0013

This [tentative] [definitive] Certificate of Substantial Completion applies to:

- All Work under the Contract Documents: The following specified portions:

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above is hereby declared and is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below.

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

The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as provided in the Contract Documents except as amended as follows:

- Amended Responsibilities Not Amended

Owner's Amended Responsibilities:

Contractor's Amended Responsibilities:

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

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

Executed by Engineer: Benjamin S. Whaley, P.E. Date

Accepted by Contractor: Date

Accepted by Owner: Mr. Tim Eubanks, County Administrator Date

SECTION 00 65 19.13

CONTRACTOR'S AFFIDAVIT

The State of _____ Date: _____

The County of _____

The City/Town of _____

_____ of _____
(Officer's Name) (Officer's Title) (Contractor's Name)

being duly sworn, deposes and says that
(Contractor's Name)

has furnished all labor and material entering into the ± 1,555-Lf Eight (8)-Inch Phase I Watermain Extension Along Industrial Park Lane Within the ± 139-Acre Lynches River Industrial Park South Along Dove Sutton Road Near the Town of Pageland in the Unincorporated Chesterfield County, South Carolina

called for in the Contract Documents dated _____ with **Chesterfield County** states further that this officer has full knowledge of all obligations for such labor and materials, which have entered into and become part of that certain project known and designated above, and that this officer further deposes and says that all debts and other obligations for such labor and materials have been fully and completely paid for in good and lawful money of the United States of America and that there are no suits for damages against them proceeding, prospective and/or otherwise, in consequence of their operations on the above said project.

The said _____ will hold the Owners,
(Contractor's Name)
Chesterfield County, blameless of any and all mechanic's
(Owner's Name)
liens that may be hereafter entered or filed for record, so as to constitute charge against said premises for work or labor done or materials furnished by them.

IN WITNESS HEREOF, this officer has heretofore put his hand and seal:

(Officer's Name) (Seal)

I, _____, Notary Public in and for the above-named County and State do
hereby certify that _____ personally known to me to be the affiant in the
(Officer's Name)
foregoing Affidavit, personally appeared before me this day and, having been duly sworn, deposes and says that the facts set forth in the above Affidavit are true and correct.

WITNESS my hand and seal this ____ day of _____, 20____

(Seal)

Notary Public for the State of _____ My Commission Expires: _____

SECTION 00 70 00

GENERAL CONDITIONS

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. Addenda—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. Agreement—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 3. Application for Payment—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. Bid—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. Bidder—An individual or entity that submits a Bid to Owner.
 6. Bidding Documents—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
 7. Bidding Requirements—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. Change Order—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. Change Proposal—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. Claim—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer has declined to address. A demand for money or services by a third party is not a Claim.
 11. Constituent of Concern—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. ("CERCLA"); (b) the Hazardous Materials Transportation

Act, 49 U.S.C. §§5501 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. ("RCRA"); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. **Contract**—The entire and integrated written contract between the Owner and Contractor concerning the Work.
13. **Contract Documents**—Those items so designated in the Agreement, and which together comprise the Contract.
14. **Contract Price**—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .
15. **Contract Times**—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
16. **Contractor**—The individual or entity with which Owner has contracted for performance of the Work.
17. **Cost of the Work**—See Paragraph 13.01 for definition.
18. **Drawings**—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
19. **Effective Date of the Contract**—The date, indicated in the Agreement, on which the Contract becomes effective.
20. **Engineer**—The individual or entity named as such in the Agreement.
21. **Field Order**—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
22. **Hazardous Environmental Condition**—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.
23. **Laws and Regulations; Laws or Regulations**—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
24. **Liens**—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
25. **Milestone**—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.
26. **Notice of Award**—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.
27. **Notice to Proceed**—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
28. **Owner**—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

29. Progress Schedule—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor’s plan to accomplish the Work within the Contract Times.
30. Project—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
31. Project Manual—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
32. Resident Project Representative—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or “RPR” includes any assistants or field staff of Resident Project Representative.
33. Samples—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
34. Schedule of Submittals—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals and the performance of related construction activities.
35. Schedule of Values—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.
36. Shop Drawings—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
37. Site—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.
38. Specifications—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
39. Subcontractor—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.
40. Substantial Completion—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.
41. Successful Bidder—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
42. Supplementary Conditions—The part of the Contract that amends or supplements these General Conditions.
43. Supplier—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

44. Technical Data—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
45. Underground Facilities—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
46. Unit Price Work—Work to be paid for on the basis of unit prices.
47. Work—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.
48. Work Change Directive—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 Terminology

- A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. Intent of Certain Terms or Adjectives:
 1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.
- C. Day:
 1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. Defective:
 1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents; or

- b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 - c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).
- E. Furnish, Install, Perform, Provide:
- 1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 - 2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
 - 3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
 - 4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.
- F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 Delivery of Bonds and Evidence of Insurance

- A. Bonds: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. Evidence of Contractor's Insurance: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.
- C. Evidence of Owner's Insurance: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 Copies of Documents

- A. Owner shall furnish to Contractor five printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 Before Starting Construction

- A. Preliminary Schedules: Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:
1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;
 2. a preliminary Schedule of Submittals; and
 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 Preconstruction Conference; Designation of Authorized Representatives

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 Initial Acceptance of Schedules

- A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.
1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
 3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

2.06 Electronic Transmittals

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.
- B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.

- C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 Intent

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 Reference Standards

- A. Standards Specifications, Codes, Laws and Regulations
 - 1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
 - 2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 Reporting and Resolving Discrepancies

- A. Reporting Discrepancies:
 - 1. Contractor's Verification of Figures and Field Measurements: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
 - 2. Contractor's Review of Contract Documents: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the

Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. Resolving Discrepancies:

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
 - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 Requirements of the Contract Documents

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.
- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 Reuse of Documents

- A. Contractor and its Subcontractors and Suppliers shall not:
 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 Commencement of Contract Times; Notice to Proceed

- A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

4.02 Starting the Work

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to such date.

4.03 Reference Points

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 Progress Schedule

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.
1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
 2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.
- B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 Delays in Contractor's Progress

- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and

interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
 - 1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
 - 2. abnormal weather conditions;
 - 3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and
 - 4. acts of war or terrorism.
- D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.
- E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.
- F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.
- G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 Availability of Lands

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 Use of Site and Other Areas

- A. Limitation on Use of Site and Other Areas:
 - 1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise,

and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.
- B. Removal of Debris During Performance of the Work: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.
 - C. Cleaning: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
 - D. Loading of Structures: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 Subsurface and Physical Conditions

- A. Reports and Drawings: The Supplementary Conditions identify:
 1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;
 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and
 3. Technical Data contained in such reports and drawings.
- B. Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 Differing Subsurface or Physical Conditions

- A. Notice by Contractor: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site either:
1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or
 2. is of such a nature as to require a change in the Drawings or Specifications; or
 3. differs materially from that shown or indicated in the Contract Documents; or
 4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

- B. Engineer's Review: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- C. Owner's Statement to Contractor Regarding Site Condition: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. Possible Price and Times Adjustments:
1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
 - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

- c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- 2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or
 - b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice as required by Paragraph 5.04.A.
- 3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
- 4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 Underground Facilities

- A. Contractor's Responsibilities: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
 - 1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and
 - 2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
 - c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 - d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. Notice by Contractor: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.
- C. Engineer's Review: Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or

was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

- D. Owner's Statement to Contractor Regarding Underground Facility: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. Possible Price and Times Adjustments:
 - 1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;
 - b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;
 - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and
 - d. Contractor gave the notice required in Paragraph 5.05.B.
 - 2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
 - 3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 Hazardous Environmental Conditions at Site

- A. Reports and Drawings: The Supplementary Conditions identify:
 - 1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
 - 2. Technical Data contained in such reports and drawings.
- B. Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer,

or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.
- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.
- H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and

charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.H shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

- J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6 – BONDS AND INSURANCE

6.01 Performance, Payment, and Other Bonds

- A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.
- B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.
- C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.
- D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.
- E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

- F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 Insurance—General Provisions

- A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.
- G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.
- H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.
- I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.
- J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 Contractor's Insurance

- A. Workers' Compensation: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:
 - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.
 - 2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).
 - 3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).
 - 4. Foreign voluntary worker compensation (if applicable).
- B. Commercial General Liability—Claims Covered: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:
 - 1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.
 - 2. claims for damages insured by reasonably available personal injury liability coverage.
 - 3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- C. Commercial General Liability—Form and Content: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:
 - 1. Products and completed operations coverage:
 - a. Such insurance shall be maintained for three years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
 - 2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
 - 3. Broad form property damage coverage.
 - 4. Severability of interest.
 - 5. Underground, explosion, and collapse coverage.
 - 6. Personal injury coverage.
 - 7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.
 - 8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.
- D. Automobile liability: Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.
- E. Umbrella or excess liability: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and

automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.

- F. Contractor's pollution liability insurance: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.
- G. Additional insureds: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.
- H. Contractor's professional liability insurance: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.
- I. General provisions: The policies of insurance required by this Paragraph 6.03 shall:
 - 1. include at least the specific coverages provided in this Article.
 - 2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.
 - 3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.
 - 4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.
 - 5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.
- J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 Owner's Liability Insurance

- A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

- B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 Property Insurance

- A. Builder's Risk: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:
1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."
 2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.
 3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
 4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).
 5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
 6. extend to cover damage or loss to insured property while in transit.
 7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
 8. allow for the waiver of the insurer's subrogation rights, as set forth below.
 9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
 10. not include a co-insurance clause.

11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
 12. include performance/hot testing and start-up.
 13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.
- B. Notice of Cancellation or Change: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.
 - C. Deductibles: The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.
 - D. Partial Occupancy or Use by Owner: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
 - E. Additional Insurance: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.
 - F. Insurance of Other Property: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 Waiver of Rights

- A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:
 1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.
- D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.07 Receipt and Application of Property Insurance Proceeds

- A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.
- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 Supervision and Superintendence

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.02 Labor; Working Hours

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all

Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.03 Services, Materials, and Equipment

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.04 "Or Equals"

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.
 - 1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that:
 - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
 - 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
 - 3) it has a proven record of performance and availability of responsive service; and
 - 4) it is not objectionable to Owner.
 - b. Contractor certifies that, if approved and incorporated into the Work:
 - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.
- B. Contractor's Expense: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

- C. Engineer's Evaluation and Determination: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.
- D. Effect of Engineer's Determination: Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.
- E. Treatment as a Substitution Request: If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 Substitutes

- A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.
 - 1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.
 - 2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
 - 3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - a. shall certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design,
 - 2) be similar in substance to that specified, and
 - 3) be suited to the same use as that specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,
 - 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and
 - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
 - c. will identify:
 - 1) all variations of the proposed substitute item from that specified, and
 - 2) available engineering, sales, maintenance, repair, and replacement services.

- d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. Engineer's Evaluation and Determination: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. Special Guarantee: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. Reimbursement of Engineer's Cost: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- E. Contractor's Expense: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. Effect of Engineer's Determination: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 Concerning Subcontractors, Suppliers, and Others

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.
- B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.
- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.
- E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive,

reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.

- F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.
- H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.
- J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.
- K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.
- L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.
- N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.
- O. Nothing in the Contract Documents:
 - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor
 - 2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 Patent Fees and Royalties

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents,

consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.08 Permits

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

7.09 Taxes

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.10 Laws and Regulations

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 Record Documents

- A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.12 Safety and Protection

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
 - 1. all persons on the Site or who may be affected by the Work;
 - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 - 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.
- D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
- G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 Safety Representative

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

7.14 Hazard Communication Programs

- A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 Emergencies

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

7.16 Shop Drawings, Samples, and Other Submittals

- A. Shop Drawing and Sample Submittal Requirements:
 - 1. Before submitting a Shop Drawing or Sample, Contractor shall have:
 - a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
 - 2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.
 - 3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.
- B. Submittal Procedures for Shop Drawings and Samples: Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.
 - 1. Shop Drawings:
 - a. Contractor shall submit the number of copies required in the Specifications.
 - b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to

provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.

2. Samples:
 - a. Contractor shall submit the number of Samples required in the Specifications.
 - b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.
3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. Other Submittals: Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.
- D. Engineer's Review:
 1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
 2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.
 3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
 4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.
 5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.
 6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
 7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.
 8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.
- E. Resubmittal Procedures:
 1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 Contractor's General Warranty and Guarantee

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
 1. observations by Engineer;
 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 4. use or occupancy of the Work or any part thereof by Owner;
 5. any review and approval of a Shop Drawing or Sample submittal;
 6. the issuance of a notice of acceptability by Engineer;
 7. any inspection, test, or approval by others; or
 8. any correction of defective Work by Owner.
- D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 Indemnification

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of

Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
 - 1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 Delegation of Professional Design Services

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.
- B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 Other Work

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also

arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.
- D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

8.02 Coordination

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
 - 1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
 - 2. an itemization of the specific matters to be covered by such authority and responsibility; and
 - 3. the extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 Legal Relationships

- A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.
- C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.
- D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 Communications to Contractor

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 Replacement of Engineer

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

9.03 Furnish Data

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 Pay When Due

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 Lands and Easements; Reports, Tests, and Drawings

- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

- 9.06 Insurance
- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.
- 9.07 Change Orders
- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.
- 9.08 Inspections, Tests, and Approvals
- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.
- 9.09 Limitations on Owner's Responsibilities
- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- 9.10 Undisclosed Hazardous Environmental Condition
- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.
- 9.11 Evidence of Financial Arrangements
- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).
- 9.12 Safety Programs
- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

- 10.01 Owner's Representative
- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.
- 10.02 Visits to Site
- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise,

direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 Project Representative

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 Rejecting Defective Work

- A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 Shop Drawings, Change Orders and Payments

- A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.
- B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.
- C. Engineer's authority as to Change Orders is set forth in Article 11.
- D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 Determinations for Unit Price Work

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.07 Decisions on Requirements of Contract Documents and Acceptability of Work

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 Limitations on Engineer's Authority and Responsibilities

- A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.
- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 Compliance with Safety Program

- A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 Amending and Supplementing Contract Documents

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
 - 1. Change Orders:
 - a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.
 - b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.
 - 2. Work Change Directives: A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.
 - 3. Field Orders: Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 Owner-Authorized Changes in the Work

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be

supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 Unauthorized Changes in the Work

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 Change of Contract Price

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:
 - 1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or
 - 2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or
 - 3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).
- C. Contractor's Fee: When applicable, the Contractor's fee for overhead and profit shall be determined as follows:
 - 1. a mutually acceptable fixed fee; or
 - 2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;
 - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.01.C.2.a and 11.01.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner

shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;

- d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
- e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
- f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 Change of Contract Times

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.
- B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 Change Proposals

- A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.
 - 1. Procedures: Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.
 - 2. Engineer's Action: Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
 - 3. Binding Decision: Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- B. Resolution of Certain Change Proposals: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 Execution of Change Orders

- A. Owner and Contractor shall execute appropriate Change Orders covering:
 - 1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;
 - 2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
 - 3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and
 - 4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.
- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 Notification to Surety

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12 – CLAIMS

12.01 Claims

- A. Claims Process: The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:
 - 1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
 - 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and
 - 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.
- B. Submittal of Claim: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. Review and Resolution: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving

the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.

- D. Mediation:
1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.
 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.
 3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.
- E. Partial Approval: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. Denial of Claim: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.
- G. Final and Binding Results: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 Cost of the Work

- A. Purposes for Determination of Cost of the Work: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
 2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. Costs Included: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:
1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full

time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
 - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
 - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
 - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No

such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.
- i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. Costs Excluded: The term Cost of the Work shall not include any of the following items:

- 1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
- 2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
- 3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
- 4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
- 5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. Contractor's Fee: When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. Documentation: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

13.02 Allowances

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. Cash Allowances: Contractor agrees that:

- 1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
- 2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

- C. Contingency Allowance: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.
- E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:
 - 1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;
 - 2. there is no corresponding adjustment with respect to any other item of Work; and
 - 3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

14.01 Access to Work

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

14.02 Tests, Inspections, and Approvals

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.

- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
 - 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
 - 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
 - 3. by manufacturers of equipment furnished under the Contract Documents;
 - 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
 - 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.
- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 Defective Work

- A. Contractor's Obligation: It is Contractor's obligation to assure that the Work is not defective.
- B. Engineer's Authority: Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. Notice of Defects: Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. Correction, or Removal and Replacement: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. Preservation of Warranties: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. Costs and Damages: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 Acceptance of Defective Work

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 Uncovering Work

- A. Engineer has the authority to require special inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.
 - 1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
 - 2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 Owner May Stop the Work

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 Owner May Correct Defective Work

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.

- B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.
- C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 Progress Payments

- A. Basis for Progress Payments: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. Applications for Payments:
 - 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
 - 2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
 - 3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.
- C. Review of Applications:
 - 1. Engineer will, within ten (10) days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

- e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.
- D. Payment Becomes Due:
- 1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.
- E. Reductions in Payment by Owner:
- 1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
 - b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. the Work is defective, requiring correction or replacement;
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - h. the Contract Price has been reduced by Change Orders;
 - i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;
 - j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
 - k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
 - l. there are other items entitling Owner to a set off against the amount recommended.
 - 2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.
 - 3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 Contractor's Warranty of Title

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 Substantial Completion

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
- F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 Partial Use or Occupancy

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.
2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 Final Inspection

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 Final Payment

- A. Application for Payment:
 1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.
 2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
 - d. a list of all disputes that Contractor believes are unsettled; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
 3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral

satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. Engineer's Review of Application and Acceptance:

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. Completion of Work: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.

D. Payment Becomes Due: Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 Waiver of Claims

A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 Correction Period

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such other adjacent areas;
2. correct such defective Work;
3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the

defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).

- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 Owner May Suspend Work

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 Owner May Terminate for Cause

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:
 - 1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);
 - 2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
 - 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
 - 4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:
 - 1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and
 - 2. enforce the rights available to Owner under any applicable performance bond.
- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.
- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 Owner May Terminate For Convenience

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 Contractor May Stop Work or Terminate

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than ninety (90) consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within thirty (30) days after it is submitted, or (3) Owner fails for thirty (30) days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within thirty (30) days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change

Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 Methods and Procedures

- A. Disputes Subject to Final Resolution: The following disputed matters are subject to final resolution under the provisions of this Article:
 - 1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and
 - 2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.
- B. Final Resolution of Disputes: For any dispute subject to resolution under this Article, Owner or Contractor may:
 - 1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or
 - 2. agree with the other party to submit the dispute to another dispute resolution process; or
 - 3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18 – MISCELLANEOUS

18.01 Giving Notice

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
 - 1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or
 - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 Computation of Times

- A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 Cumulative Remedies

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 Limitation of Damages

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 No Waiver

- A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 Survival of Obligations

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 Controlling Law

- A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 Headings

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

END OF SECTION

SECTION 01 06 00

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

- A. The following requirements of Regulatory Agencies having jurisdiction within this project area are considered a part of these Contract Documents.
- B. The project construction, including the letting of contracts, shall conform to any applicable requirements of the State, territorial and local laws and/or ordinances provided that these requirements do not conflict with any Federal laws and this sub-chapter.
- C. South Carolina Sales Tax: All applicable South Carolina sales tax shall be paid by the Contractor.
- D. Use of chemicals: All chemicals used during the project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with manufacturer's instructions.
- E. Safety and Health Regulations: The Contractor shall comply with the Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596) and under Section 107 of the Contract Work Hours and Safety Standards Act (PL 91-54).

1.02 INSPECTION BY AGENCIES:

- A. The representatives of the South Carolina Department of Health and Environmental Control, South Carolina Department of Transportation, Chesterfield County, Environmental Protection Agency, and if required, the U.S. Army Corps of Engineers shall have access to the work wherever it is, in preparation or in progress, and the Contractor shall provide proper facilities for such access and inspection.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 23 00

BID ALTERNATES AND SUBSTITUTES

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.02 DEFINITIONS

- A. Bid Alternate: A scope of work proposed by the Bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept corresponding changes either in the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in the Contract Documents. The selection of the successful bidder will be based on the Base Bid amount which does not include Alternate Bid Items.
 - 1. The cost or credit for each alternate is the net addition or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum related to this Definition.
- B. Base Bid: The amount for which the Bidder proposes to perform Work, not including that work for which Alternative Bid items and Substitutes are also submitted.

1.03 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate or substitute into the Project.
 - 1. Include as part of each Alternate or Substitute, miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation whether or not indicated as part of the alternate.
- B. Notification: Following award of the Contract, Engineer shall notify each party involved, in writing, of the status of each alternate or Substitute equipment. Engineer shall indicate if alternates and substitutes have been accepted, rejected, or deferred for later consideration. Where applicable, Contractor shall include a complete description of negotiated modifications to alternates or Substitutes offered.
- C. Execute accepted alternates under the same conditions as other work of the Contract.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF ALTERNATIVES

- A. A complete Schedule of Bid Alternates is detailed within the Bid Form Section 00 41 00 and other Division 0 Sections.

END OF SECTION

SECTION 01 26 20
WEATHER DELAYS

ARTICLE 1 - GENERAL

1.01 Extension of Contract Time

If a Claim is made for an extension of time based upon weather delays in accordance with the General Conditions, an extension may be granted only for the number of Weather Delay Days in excess of the number of days listed for the applicable month on the Standard Baseline.

2.01 Standard Baseline for Adverse Weather

- A. The Standard Baseline is defined as the number of calendar days for each month during which construction activity exposed to weather conditions is expected to be prevented and suspended by cause of Adverse Weather. Suspension of construction activity for the number of days each month as listed in the Standard Baseline is included in the Work and is not eligible for extension of Contract Time.
- B. The Owner has established a Standard Baseline from the National Climatic Data Center (NCDC) from summary period of 1981 to 2010 and climate record period of 1887 to 2017 for the State of South Carolina.

3.01 Adverse Weather and Weather Delay Days

- A. Adverse Weather is defined as the occurrence of one or more of the following conditions within a twenty-four (24) hour day that prevents construction activity exposed to weather conditions or access to the site:
 - 1. Precipitation (rain, snow, or ice) in excess of one-tenth (0.10") liquid measure.
 - 2. Temperatures that do not rise above that required for the day's construction activity, if such temperature requirement is specified or accepted as standard industry practice.
 - 3. Sustained wind in excess of twenty-five (25) miles per hour.
 - 4. Dry Out (or Mud) Days under the following conditions:
 - a more precipitation days occur than listed in the Standard Baseline;
 - b there is a hindrance to site access or sitework and Contractor has taken all reasonable accommodations to avoid such hindrance; and,
 - c no more than one (1) Dry Out Day is allocated for each additional day of precipitation more than the Standard Baseline that total 1.0 inch or more, liquid measure, unless specifically recommended by the Designer.
- B. A Weather Delay Day may be counted if Adverse Weather prevents work on the project for fifty percent (50%) or more of the contractor's scheduled work day and critical path construction activities were included in the day's schedule, including a weekend day or holiday if Contractor has scheduled construction activities that day.
- C. Days of normal weather conditions which the contractor elects not to perform construction activities will be deducted from the eligible weather delays requested.

4.01 Documentation and Submittals

- A. An extension of the Contract Time for Adverse Weather must be requested in writing to the Designer at the end of each month and submitted with the pay application of applicable Adverse Weather occurrence along with all required support information. Such requests made after this limitation will not be considered.
- B. Submit daily jobsite work logs showing which and to what extent critical path construction activities have been affected by weather on a monthly basis.
- C. Submit actual weather data to support claim for time extension obtained from nearest NOAA weather station or other independently verified source approved by Designer at beginning of project.
- D. Organize Claim documentation to facilitate evaluation on a basis of calendar month periods and the Standard Baseline.
- E. Submit in accordance with the requirements of the Contract Documents.

END OF SECTION

Summary of Monthly Normals 1981-2010

Generated on 09/06/2023

Current Location: Elev: 520 ft. Lat: 34.7606° N Lon: -80.3728° W
 Station: **PAGELAND, SC US USC00386616**

Precipitation (in.)										
	Totals	Mean Number of Days				Precipitation Probabilities Probability that precipitation will be equal to or less than the indicated amount				
	Means	Daily Precipitation				Monthly Precipitation vs. Probability Levels				
Month	Mean	>= 0.01	>= 0.10	>= 0.50	>= 1.00	0.25	0.50	0.75		
01	4.01	9.4	6.9	2.9	1.2	2.93	3.68	4.74		
02	3.62	9.1	6.2	2.7	1.0	2.29	3.39	4.72		
03	4.07	8.7	6.6	3.2	1.0	2.48	3.77	5.52		
04	3.18	8.4	5.9	2.3	0.8	1.51	3.11	4.50		
05	2.80	8.0	5.8	1.9	0.6	1.32	2.55	3.83		
06	4.20	8.7	6.1	2.5	1.2	2.11	4.08	6.23		
07	4.98	9.6	7.4	3.3	1.7	2.31	4.29	7.10		
08	4.81	9.7	6.9	3.3	1.7	2.95	4.93	6.37		
09	3.80	6.8	4.7	2.4	1.3	1.85	3.63	4.94		
10	3.73	6.7	5.0	2.3	1.0	1.98	3.56	4.39		
11	3.52	7.4	5.2	2.4	0.9	1.59	3.01	4.63		
12	3.55	8.8	6.0	2.3	1.0	1.98	3.38	4.68		
Summary	46.27	101.3	72.7	31.5	13.4	25.30	43.38	61.65		

-7777: a non-zero value that would round to zero

Empty or blank cells indicate data is missing or insufficient occurrences to compute value

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preconstruction meeting.
- B. Progress meetings
- C. Construction progress schedule
- D. Submittals for review, information and project closeout
- E. Number of copies of submittals
- F. Submittal procedures

1.02 RELATED SECTIONS

- A. Section 00 70 00 - General Conditions: Dates for applications for payment
- B. Section 01 31 00- Construction Schedules
- C. Section 01 70 00 - Execution Requirements
- D. Section 01 78 00 - Closeout Submittals
- E. Sections throughout these specifications may include other submittals that may be required for construction

1.03 PROJECT COORDINATION

- A. Project Manager: Alliance Consulting Engineers, Inc. designee.
- B. Coordinate with the Project Manager on the site for allocation of mobilization areas; for field offices and sheds, for access, traffic and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Manager.
- D. Comply with Project Manager's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Make the following types of submittals to the Project Manager:
 - 1. Requests for interpretation.
 - 2. Requests for substitution.
 - 3. Shop drawings, operation and maintenance manuals, product data, and samples.
 - 4. Manufacturer's instructions and field reports.

5. Applications for payment and change order requests.
6. Progress schedules.
7. Coordination drawings.
8. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

- A. Engineer will schedule a meeting within thirty (30) days after the Owner has determined the low bidder and may be held prior to issuance of the Notice to Proceed when required by regulatory agencies having jurisdiction. In any event, the Meeting will be held prior to actual start of construction.
- B. For the individuals designated by the Contractor, his subcontractors and suppliers attending the Preconstruction Meeting, provide required authority to commit the entities they represent to solutions agreed upon in the meeting.
- C. Advise the Engineer at least twenty-hours (24) in advance of the meeting to add items to the agenda.
- D. Attendance Required:
 1. Owner.
 2. Engineer.
 3. Contractor.
 4. Subcontractors, as needed.
 5. Utility Providers
 6. Permit Agents
- E. Agenda:
 1. Execution of Owner-Contractor Contract Agreement.
 2. Distribution of Contract Documents.
 3. Arrangement of Contractor's forces and personnel and those of subcontractors, material suppliers and the Engineer.
 4. Channels and procedures for communication.
 5. Designation of personnel representing the parties to Contract, Contractor, Owner and Engineer.

6. Procedures and processing of field decisions, submittals and substitutions, applications for payments, proposal request, Change Orders and Contract closeout procedures.
 7. Scheduling.
 8. Scheduling activities of a Geotechnical Engineer
 9. Rules and regulations governing performance of the Work for security, quality control, housekeeping and related matters.
- F. Preconstruction Meeting minutes will be recorded and distributed within ten (10) days after meeting to participants, with three (3) copies to the Contractor and the required number of copies to the Owner, and those affected by decisions being made.

3.02 PROGRESS MEETINGS

- A. Engineer will make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings. Contractor must advise the Engineer within forty-eight (48) hours of advance notice of the meeting to add items to the agenda.
- B. The Contractor's relations with his subcontractors and material suppliers, and discussions with regards to these items are the Contractor's responsibility and normally not part of the project meeting agenda.
- C. For the individuals designated by the Contractor to attend and participate in the project meetings, provide required authority to commit the Contractor to solutions agreed upon in the project meetings.
- D. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Engineer, as appropriate to agenda topics for each meeting.
- E. Meeting Schedule:
 1. Project Meetings will be held monthly or as determined by the Engineer and Owner during construction.
 2. Coordinate as necessary to establish mutually acceptable schedule for meetings.
- F. Meeting Location: The Engineer will establish the meeting location, and where possible the meetings will be held at the project site or a location near the project site.
- G. Agenda:
 1. Review minutes of previous meetings.
 2. Review of Work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Maintenance of progress schedule.

7. Corrective measures to regain projected schedules
 8. Planned progress during succeeding work period.
 9. Maintenance of quality and work standards.
 10. Effect of proposed changes on progress schedule and coordination.
 11. Other business relating to Work.
- H. Project Meeting minutes will be recorded and distributed within ten (10) days after meeting to participants, with three (3) copies to the Contractor and the required number of copies to the Owner, and those affected by decisions made.
- I. Revisions to Meeting Minutes:
1. Unless published minutes are challenged in writing prior to the next regularly scheduled progress meeting, the minutes will be accepted as properly stating the activities and decisions of the meeting.
 2. Individuals challenging published minutes shall reproduce and distribute copies of the challenge for review by all parties affected.
 3. Challenge to minutes shall be settled as priority portion of "old business" at the next regularly scheduled meeting.

3.03 CONSTRUCTION PROGRESS SCHEDULE

- A. Comply with Section 01 31 00 - Construction Schedules
- B. Submit updated schedule with each Application for Payment.

3.04 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Engineer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.
- C. Samples
 1. Provide sample or samples identical to the precise article proposed to be provided. Identify as described under "Identification of submittals" below.

2. Number of samples required:
 - a. Unless otherwise specified, submit samples in the quantity which is required to be returned, plus one which will be retained by the Engineer.
 - b. By pre-arrangement in specific cases, a single sample may be submitted for review and, when approved, be installed in the work at a location agreed upon by the Engineer.
- D. Colors and Patterns
 1. Unless the precise color and pattern is specifically called out in the Contract Documents, and whenever a choice of color or pattern is available in the specified products, submit accurate color and pattern charts to the Engineer for selection and confirmation with the Owner.
- E. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below.

3.05 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 1. Design data.
 2. Certificates.
 3. Test reports.
 4. Inspection reports.
 5. Manufacturer's instructions and literature.
 6. Manufacturer's field reports.
 7. Other types indicated.
- B. Submit for Engineer's knowledge as contract administrator or for Owner

3.06 SUBMITTALS FOR PROJECT CLOSEOUT

- A. When the following are specified in individual sections, submit them at project closeout:
 1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties and Bonds.
 4. Keys and Keying Schedule.
 5. Spare parts and manuals.
 6. Evidence of payment and release of liens per the General Conditions.
 7. Section 00 65 19.13 - Contractor's Affidavit.

- 8. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

3.07 NUMBER OF COPIES OF SUBMITTALS

- A. Documents for Review:
 - 1. Shop Drawings
 - a. Scale and Measurement: Make shop drawings accurately to a scale of sufficiently large to show all pertinent aspects of the item and its method of connection to the Work.
 - b. Large Prints (11" X 17" or larger):
 - i. Submit shop drawings in the form of white copies.
 - ii. Blueprints will not be acceptable.
 - c. Manufacturer's Literature:
 - i. Where contents of submitted literature from manufacturers includes data not pertinent to the submittal, clearly show which portions of the contents are being submitted for review.
 - ii. Submit the number of copies which are required to be returned, plus three (3) copies which will be retained by the Engineer.
 - d. Do not begin fabrication of equipment or materials prior to Engineer's approval of shop drawings.
- B. Documents for Information: Submit three (3).
- C. Documents for Project Closeout: Make one (1) reproduction of submittal originally reviewed. Submit one (1) extra of submittals for information.
- D. Samples: Submit the number specified in individual specification sections; one (1) of which will be retained by Engineer.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.08 SUBMITTAL PROCEDURES

- A. Transmit each submittal with a Cover Letter that stipulates that the items submitted comply or do not comply with the full extent of the specifications. The Cover Letter must also include an explanation of why the items submitted are considered equal to the items specified. Failure to submit a Cover Letter will result in a rejection of the submittal.
- B. Timing of Submittals:
 - 1. Within fifteen (15) calendar days after the Contractor has received the Owner's notice to proceed, submit:

- a. Schedule for submittals including specification section, type of submittal and submittal date.
 - b. Construction schedule.
 - c. Schedule of partial payment requests.
 - 2. Make submittals of shop drawings, samples, substitution requests and other items in accordance with the provisions of this Section.
- C. Quality Assurance:
 - 1. Coordination of submittals:
 - a. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted.
 - b. Verify that each item and the submittal for it conform in all respects with the specified requirements.
 - c. By affixing the Contractor's signature to each submittal, certify that this coordination has been performed.
 - 2. The following products do not require further approval except for interface within the Work and where otherwise indicated.
 - a. Products specified by reference to standard specifications such as ASTM, AWWA, and similar standards.
 - b. Products specified by manufacturer's name and catalog model number.
 - 3. Or equal:
 - a. Where the phrase "or equal" occurs in the Contract Documents, do not assume that the materials, equipment or methods will be considered as equal unless the item has been specifically so approved for this Work by the Engineer.
 - b. The decision of the Engineer shall be final.
 - 4. The Engineer shall assume that no shop drawing or related submittal comprises a variation unless the Contractor advises the Engineer otherwise in writing.
- D. Sequentially number submittal in the Cover Letter. Revise submittals with original number and a sequential alphabetic suffix.
- E. Before submitting a shop drawing or any related material, Contractor shall:
 - 1. Review each such submission for conformance with the means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto, all of which are the sole responsibility of Contractor.
 - 2. Approve each such submission before submitting it.
 - 3. Stamp each such submission before submitting it.

- F. Shop drawings and related materials shall be returned with comments provided that each submission has been specified and is stamped by the Contractor.
- G. Shop drawings or material not specified or which have not been approved by the Contractor shall be returned without comment.
- H. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work and coordination of information is in accordance with the requirements of the Work and Contract Documents. The following stamp shall be used on all shop drawings: "This Shop Drawing has been reviewed by [Name of Contractor] and approved in accordance with the ways, means, methods, techniques, sequences and procedures associated with the project construction. [Name of Contractor] has approved these Shop Drawings in accordance with safety precautions and programs incidental thereto, and warrants that these Shop Drawings comply with the Contract Documents and includes no variations from the specifications."

Signature
Name and Title (Please Print)
Date

- I. Identification of Submittals
 - 1. Consecutively number all submittals.
 - a. When material is resubmitted for any reason, transmit under a new letter of transmittal and with a new transmittal number.
 - b. On resubmittals, cite the original submittal number for reference.
 - 2. Accompany each submittal with a letter of transmittal showing all information required for identification and checking.
 - 3. On at least the first page of each submittal, and elsewhere as required for positive identification, show the submittal number in which the item was included.
 - 4. Maintain an accurate submittal log for the duration of the work, showing current status of all submittals at all times. Make the submittal log available to the Engineer for his review upon request.
- J. Unrequired submittals will not be reviewed by the Engineer.
- K. Submittals required by the Contractor of his subcontractors, such as drawings, setting diagrams or similar information needed to coordinate the construction, shall remain between the Contractor and his subcontractors and these submittals will not be reviewed by the Engineer.
- L. Grouping of Submittals
 - 1. Unless otherwise specified, make submittals in groups containing all associated items to assure that information is available for checking each item when it is received.
 - a. Partial submittals may be rejected as not complying with the provisions of the Contract.
 - b. The Contractor may be held liable for delays so occasioned.

- M. Timing of Submittals
1. Make submittals far enough in advance of scheduled dates for installation to provide time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery.
- N. Resubmittal Schedule
1. For submittals marked "Furnish as Corrected" by the Engineer, resubmittal shall be within fifteen (15) days of the review date shown on the Engineer's shop drawing review stamp.
 2. For submittals marked "Revise and Resubmit", "Submit Specified Item", or "Rejected", resubmittal shall be within fifteen (15) days of the review date shown on the Engineer's shop drawing review stamp.
- O. Engineer's Review
1. Review by the Engineer does not relieve the Contractor from responsibility for errors which may exist in the submitted data.
 2. Revisions:
 - a. Make revisions required by the Engineer.
 - i. If the Contractor considers any required revision to be a change, he shall so notify the Engineer as provided for in the General Conditions.
 - ii. Make only those revisions directed or approved by the Engineer.
 - iii. Submittals which have been reviewed and returned to the Contractor marked "Revise and Resubmit" or "Rejected" and which are resubmitted and not in an approved state, will not be reviewed a third time unless payment for the third and any subsequent review is by the Contractor. The engineering costs for review shall be equal to the Engineer's charges to the Owner under the terms of the Engineering Agreement with the Owner.
- P. Deliver submittals to Engineer at business address.
- Q. Schedule submittals to expedite the Project, and coordinate submission of related items.
- R. For each submittal for review, allow twenty-five (25) working days excluding delivery time to and from the Contractor.
- S. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
- T. Provide space for Contractor and Engineer review stamps.
- U. When revised for resubmission, identify all changes made since previous submission.
- V. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

W. Submittals not requested will not be recognized or processed.

END OF SECTION

SECTION 01 31 00

CONSTRUCTION SCHEDULES

PART 1 GENERAL

1.01 DESCRIPTION

- A. Work included: Construction Schedules are to be prepared to provide assurance of project planning and the execution of the work so that the construction is completed within the construction period as stated in the Contract Documents, and to provide Alliance Consulting Engineers, Inc. a means to evaluate the progress of the work.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in Division 01 of these Specifications.
 - 2. General Conditions and the requirements associated with the progress schedule.
 - 3. Construction period: As related to the executed contract.
- C. Definitions: "Day", means calendar day.

1.02 QUALITY ASSURANCE

- A. The Contractor is to provide a scheduler that is thoroughly trained and experienced in preparing construction schedule data, and in preparing and issuing periodic schedule reports as stated below.
- B. Perform data preparation that includes analysis, charting and updating as required.
- C. Reliance upon the approved schedule:
 - 1. Once approved by Alliance Consulting Engineers, Inc., the construction schedule will be an integral part of the Contract and will establish interim completion dates for the various construction tasks specified in the Contract.
 - 2. The Contractor agrees and understands that the failure of the Owner to exercise this option either to order the Contractor to expedite an activity or to expedite the activity by other means shall not be considered a precedent for any other scheduled activities.

1.03 SUBMITTALS

- A. Comply with provisions of Section 01 30 00 Administrative Requirements.
- B. Once the preliminary schedule has been reviewed and approved by Alliance Consulting Engineers, Inc., within ten (10) calendar days, the Contractor must submit one (1) reproducible copy and four (4) prints of a preliminary construction schedule prepared in accordance with Part 3 of this Section.

- C. Once the Contractor receives final review and approval of the preliminary construction schedule, the Contractor must submit within ten (10) calendar days one (1) reproducible copy and four (4) prints of a construction schedule prepared in accordance with Part 3 of this Section.
- D. The Contractor must also provide on the first working day of each month, four (4) prints of the construction schedule that has been updated in accordance with Part 3 of this Section.

PART 2 PRODUCTS

2.01 CONSTRUCTION ANALYSIS

- A. The construction schedule must illustrate graphically by bar chart the order and interdependence of all construction activities required to complete the work, and the sequence in which the construction activities are to be completed. All construction activities must be planned by the Contractor and his project field superintendent in coordination with all subcontractors whose work is shown on the diagram and any other work being completed on the project site by other contractors that requires coordination.
 - 1. The graphical chart must be a two (2) line bar chart; with one (1) bar for planned activities, and one (1) bar for actual activity completion.
- B. Include, but do not necessarily limit indicated activities to:
 - 1. Project mobilization.
 - 2. Submittal and approval of shop drawings and sample data.
 - 3. Procurement of equipment and critical materials.
 - 4. Fabrication of special material and equipment, and its installation and testing.
 - 5. Each construction activity that is critical to the work being performed.
 - 6. All activities by Alliance Consulting Engineers, Inc. that affect progress, required dates for completion, or both, for all and each part of the Work.
 - 7. All activities by other contractors that have to be coordinated with the work being completed under this Contract.
 - 8. Final cleanup.
 - 9. Final inspecting and testing.

PART 3 EXECUTION

3.01 PRELIMINARY ANALYSIS

- A. Contents:
 - 1. Outline the activities of the Contractor for the period between receipt of Notice to Proceed and submittal of construction schedule.
 - 2. Outline the Contractor's approach to the remaining work to be completed.

3. Outline the costs of all activities scheduled before submittal and approval of the construction schedule.

3.02 CONSTRUCTION SCHEDULE

- A. Provide a construction schedule that incorporates all of the revisions from review of the preliminary analysis.

3.03 PERIODIC REPORTS

- A. Provide monthly updates of the approved construction schedule.
 1. Indicate "actual" progress for each activity on the bar chart.
 2. Provide written narrative summary of revisions causing delay in the construction, and an explanation of corrective actions being taken or proposed.

3.04 REVISIONS

- A. Provide a revised construction schedule periodically that includes delays, early completion, etc.
- B. Any revisions to the construction schedule must be approved by Alliance Consulting Engineers, Inc. before acceptance.

END OF SECTION

SECTION 01 32 00

PROJECT CONSTRUCTION SEQUENCE AND PROVISIONS

PART 1 GENERAL

1.01 CONSTRUCTION AREAS

- A. The Contractor shall limit his use of the construction areas for work and for storage to allow for:
 - 1. Work by other Contractors.
 - 2. Owner use.
 - 3. Public use.
- B. Coordinate use of work site under direction of Engineer.
- C. Assume full responsibility for the protection and safekeeping of materials and products under this Contract, stored on the site.
- D. Move any stored products, under Contractor's control, which interfere with operations of the OWNER or separate Contractor.
- E. Obtain and pay for the use of additional storage of work areas needed for operations.

1.02 SPECIFICATIONS

- A. Specifications

The Technical Specifications consist of three parts: General, Products and Execution. The General Section contains General Requirements which govern the work. Products and Execution modify and supplement these by detailed requirements of the work and shall always govern whenever there appears to be a conflict.

- B. Intent

All work called for in the Specifications applicable to this Contract, but not shown on the plans in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the plans or the Specifications, but involved in carrying out their intent or in the complete and proper execution of the work is required and shall be performed by the Contractor as though it were specifically delineated or described.

The apparent silence of the specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these specifications shall be made upon that basis. The inclusion of the General Requirements (or work specified elsewhere) in the General part of the specifications is only for the convenience of the Contractor, and shall not be interpreted as a complete list of related Specification Sections.

1.03 WORK IN PROGRESS

The Contractor shall furnish personnel and equipment which will be efficient, appropriate, and adequately sized to secure a satisfactory quality of work and a rate of progress which will insure the

completion of the work within the time stipulated in the Proposal. If at any time such personnel appears to the Engineer to be inefficient, inappropriate, or insufficient for securing the quality of work required for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character, or increase the personnel and equipment, and the Contractor shall conform to such order. Failure of the Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

1.04 UTILITY SYSTEMS AND FACILITIES

- A. The Contractor shall interrupt water, telephone, power, cable TV, sewer, gas or other related utility services and disturb the normal functioning of the system as little as possible. He shall notify the Engineer and the appropriate agency well in advance of any requirements for dewatering, isolating, or relocating a section of a utility, so that necessary arrangements may be made with the appropriate agency.
- B. The Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, storm drains and electric and telephone cables, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operations shall be repaired by him/her at his/her expense.
- C. The Contractor shall bear full responsibility for obtaining locations of all underground structures and utilities (including existing water services, drain lines, and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by the Contractor.
- D. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be a part of the work under the Contract and no separate payment will be made for this work.
- E. If, in the opinion of the Engineer, permanent relocation of a utility owned by the Owner is required, he may direct the Contractor in writing, to perform the work. Work so ordered will be paid for at the contract unit prices, if applicable, or as extra work. If relocation of a privately owned utility is required, the Owner will notify the utility to perform the work as expeditiously as possible. The Contractor shall fully cooperate with the Owner and utility and shall have no claim for delay due to such relocation. The Contractor shall notify all utility companies in writing at least 48 hours (excluding Saturdays, Sundays, and legal holidays) before excavating near their utilities.
- F. The Contractor shall be responsible to maintain water, telephone, power, cable TV, sewer, gas and other related utilities throughout construction at no additional cost to the Owner.
- G. The Contractor shall fully cooperate with all private and public utilities during the installation of new facilities, or relocation of existing facilities. The Contractor shall coordinate his work accordingly and shall have no claim except for time extension for delays associated with the proposed utility improvements.

1.05 TEST PITS

- A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor at the direction of the Engineer. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Engineer. No separate payment will be made.

1.06 CARE AND PROTECTION OF PROPERTY

- A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or he shall make good the damage in another manner acceptable to the Engineer.
- B. All sidewalks and driveways which are disturbed by the Contractor's operations shall be restored to their original or better condition by the use of similar or comparable materials.
- C. Along the location of this work all fences, walks, bushes, trees, shrubbery, and other physical features shall be protected and restored in a thoroughly workmanlike manner. Fences and other features removed by the Contractor shall be replaced in the location indicated by the Engineer as soon as conditions permit. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be regraded and seeded.
- D. Trees close to the work shall be boxed or otherwise protected against injury. The Contractor shall trim all branches that are liable to damage because of his operations, but in no case shall any tree be cut or removed without prior notification of the tree warden. All injuries to bark, trunk, limbs, and roots of trees shall be repaired by dressing, cutting, and painting according to approved methods, using only approved tools and materials.
- E. The protection, removal, and replacement of existing physical features along the line of work shall be a part of the work under the Contract, and all costs in connection therewith shall be included in the unit and/or lump sum prices established under other items in the Proposal.

1.07 CLEAN-UP

- A. During the course of the work, the Contractor shall keep the site of his operations in as clean and neat of a condition as is possible. He shall dispose of all residue resulting from the construction work and, at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, brick, lumber, equipment, temporary structures, and any other refuse remaining from the construction operations, and shall leave the entire site of the work in a neat and orderly condition.
- B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor and his/her subcontractors shall comply with all applicable Federal, State and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and elsewhere in the Specifications.
- C. The Contractor is advised that the disposal of excess excavated material in wetlands, stream corridors and plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor or any person employed by him, will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. The Contractor will be responsible to pay all fines, remove the fill, and restore the area impacted.

1.08 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. All newly constructed work shall be carefully protected from injury in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions injured shall be reconstructed by the Contractor at his own expense.
- B. All structures shall be protected in a manner approved by the Engineer. Should any of the structures become heaved, cracked, or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor, at his own expense, and to the satisfaction of the Engineer. If, in the final inspection of the work, any defects, faults, or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the guarantee period described in the Contract.
- C. Further, the Contractor shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the Owner.

1.09 PROJECT SEQUENCING

Construct work in stages to accommodate operation of existing facilities during construction period. Coordinate construction schedule and operations with the Owner and the Engineer. Owner reserves the right to place facilities, taken out of service by Contractor, back into service on emergency basis upon notification to Contractor.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. References and standards.
- B. Quality assurance submittals
- C. Control of installation.
- D. Inspection services.
- E. Cooperate with the Owner's selected testing agency and all others responsible for testing and inspecting the work.
- F. Provide such other testing and inspecting as are specified to be furnished by the Contractor in this Section and/or elsewhere in the Contract Documents.

1.02 RELATED REQUIREMENTS

- A. Section 00 70 00 – General Conditions
- B. Section 01 30 00 - Administrative Requirements
- C. Section 01 60 00 - Product Requirements
- D. Requirements for testing may be described in various Sections of these specifications.
- E. Where no testing requirements are described, but the Owner decides that testing is required, the Owner may require such testing to be performed under current pertinent standards for testing. Payment for such testing will be made as described in this Section.

1.03 ADDITIONAL WORK INCLUDED:

- A. Selection of testing laboratory: The contractor shall provide all necessary testing by a prequalified independent testing laboratory. This information shall be provided to the Engineer for approval during the shop drawing review process.
- B. Payment for initial testing: The selected contractor's contract shall provide all necessary services of the testing laboratory within the contract prices to the owner as further described in Article 2.1 of this Section.
- C. Tests at point of manufacture as specified in other Sections of these documents are to be made with all costs borne by the Contractor.

1.04 REFERENCE STANDARDS

- A. ASTM C 1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2009.

- B. ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2008.
- C. ASTM E 329 - Standard Specification for Agencies Engaged Construction Inspection and/or Testing; 2009.

1.05 SUBMITTALS

- A. Testing Agency Qualifications:
 - 1. Prior to start of Work, submit agency name, address, and telephone number, and names of full-time registered Engineer and responsible officer.
- B. Test Reports: After each test/inspection, promptly submit three (3) copies of report to Alliance Consulting Engineers, Inc. and to Owner.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number
 - c. Name of inspector
 - d. Date and time of sampling or inspection
 - e. Identification of product and specifications section
 - f. Location in the Project
 - g. Type of test/inspection
 - h. Date of test/inspection
 - i. Results of test/inspection
 - j. Conformance with Contract Documents
 - k. When requested by Alliance Consulting Engineers, Inc., provide interpretation of results.
 - 2. Test report submittals are for Alliance Consulting Engineers Inc.'s knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner information
- C. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Alliance Consulting Engineers, Inc., in quantities specified for Product Data.
 - 1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Alliance Consulting Engineers, Inc.

- D. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.06 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Alliance Consulting Engineers, Inc. before proceeding.
- F. Neither the contractual relationships, duties, nor responsibilities of the parties in Contract nor those of Alliance Consulting Engineers, Inc. shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.07 QUALITY ASSURANCE

- A. The testing laboratory will be qualified to the Owner's approval in accordance with ASTM E 329.
- B. Testing, when required, will be in accordance with all pertinent codes and regulations, and with selected standards of the American Society for Testing and Materials.

1.08 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01 60 00 Product Requirements.
- B. Promptly process and distribute required copies of test reports and related instructions to assure necessary retesting and replacement of materials with the least possible delay in progress of the work.

PART 2 PRODUCTS

2.01 PAYMENT FOR TESTING

- A. Testing Services:
 - 1. The Contractor will pay for all testing services required by the contract documents and manufacturer's recommendations except for concrete, aggregate and compaction testing.

2. When initial tests indicate non-compliance with the Contract Documents, any and all retesting and consulting required to provide compliance with the Contract Documents will be the responsibility of the contractor at no additional costs to the Owner.
3. Retesting: When initial tests indicate non-compliance with the Contract Documents, subsequent re-testing occasioned by the non-compliance shall be performed by the same testing agency.

2.02 CODE COMPLIANCE TESTING

- A. Inspections and tests required by codes or ordinances, or by a plan approval authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

2.03 CONTRACTOR'S CONVENIENCE TESTING

- A. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step-in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Alliance Consulting Engineers, Inc. before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 CONTRACTOR TESTING COORDINATION:

- A. Cooperation with Testing Laboratory:
 1. Representatives of the testing laboratory shall have access to the work at all times and at all locations where the work is in progress. Provide facilities for such access to enable the laboratory to perform its functions properly.

- B. Taking Specimens:
 - 1. All specimens and samples for testing, and deliveries to laboratory, unless otherwise provided in the Contract Documents, shall be taken by the testing personnel. All sampling equipment and personnel will be provided by the testing laboratory. All deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

3.03 SCHEDULES FOR TESTING

- A. Establishing schedule:
 - 1. By advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings.
 - 2. Provide all required time within the construction schedule.
- B. Revising schedule: When changes of construction schedule are necessary during construction, coordinate all such changes with the testing laboratory as required.
- C. Adherence to schedule: When the testing laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the work, all extra charges for testing attributable to the delay may be back-charged to the Contractor and shall not be borne by the Owner.

3.04 TESTING AND INSPECTION

- A. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Alliance Consulting Engineers, Inc. and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Alliance Consulting Engineers, Inc. and Contractor of observed irregularities or non-conformance of Work or products.
 - 5. Perform additional tests and inspections required by Alliance Consulting Engineers, Inc.
 - 6. Submit reports of all tests/inspections specified.
- B. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.

4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:

1. Provide incidental labor and facilities:

a. To provide access to Work to be tested/inspected

b. To facilitate tests/inspections

2. Notify Alliance Consulting Engineers, Inc. and laboratory twenty-four (24) hours prior to expected time for operations requiring testing/inspection services.

3. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

4. Arrange with the Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Alliance Consulting Engineers, Inc.

E. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

F. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Alliance Consulting Engineers, Inc. Payment for re testing will be charged to the Contractor by deducting testing charges from the Contract Price.

3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Alliance Consulting Engineers, Inc., it is not practical to remove and replace the Work, Alliance Consulting Engineers, Inc. will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 41 26

PERMITS AND RIGHTS-OF-WAY

PART 1 GENERAL

1.01 DESCRIPTION

- A. Work included: This section outlines the requirements of the Contractor for the payment for any fees and the acquisition of any required licenses, building permits, rights-of-ways, easements, etc., that may be required for the construction of the project.
- B. Work not included: The Owner will obtain and provide to the Contractor, copies of the following, if required:
 - 1. South Carolina Department of Health and Environmental Control, Permit to Construct,
 - 2. South Carolina Department of Transportation Encroachment Permit, and
 - 3. Chesterfield County Contractors Local Business License.
- C. Related work: Documents affecting work of this section include, but are not necessarily limited to, General Conditions and Sections in Division 01 of these specifications.

1.02 SUBMITTALS

- A. Submit to the Engineer and post at the site, satisfactory evidence that all required licenses, building permits, etc., have been obtained prior to start of construction.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 BUSINESS LICENSE

- A. Verify licenses that are required to perform the work within the project area, and obtain at no additional cost to the Owner.

3.02 RIGHTS-OF-WAY, UTILITY LINES

- A. The Contractor shall confine his activities to the project limits as illustrated in the Contract Documents.
- B. The Owner will provide no right-of-way over other property.

3.03 LAND

- A. The necessary land for construction of the proposed improvements will be provided by the Owner.

END OF SECTION

SECTION 01 42 19

REFERENCE STANDARDS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Throughout these Contract Documents, references are made to specifications and standards that have been issued by nationally recognized professional and/or trade organizations. These referenced standards are generally identified by abbreviating the name of the organization following with the specification/standard number, and unless specifically indicated otherwise, all references to standards refer to the latest edition available at the time of the bidding.

1.02 ABBREVIATIONS

- A. Wherever the following abbreviations are used in these Contract Documents, these abbreviations are to be considered as the same as the respective expressions represented below:

1.	AASHO	American Association of State Highway Officials
2.	ACI	American Concrete Institute
3.	AISC	American Institute of Steel Construction
4.	ALS	American Lumber Standards
5.	ANSI	American National Standards Institute, Inc.
6.	ASTM	American Society for Testing and Materials
7.	AWWA	American Water Works Association
8.	AWPA	American Wood Preservers Association
9.	AWS	American Welding Society
10.	FSS	Federal Specifications and Standards, General Services Administration
11.	SPIB	Southern Pine Inspection Bureau
12.	SSPC	Steel Structures Painting Council

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 45 29

TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes testing which the Owner may require, beyond that testing required of the manufacturer, to determine if materials provided for the Project meet the requirements of these Specifications.
- B. This work also includes all testing required by the Owner to verify work performed by the Contractor is in accordance with the requirements of these Specifications, i.e., concrete strength and slump testing, soil compaction, etc.
- C. This work does not include materials testing required in various sections of these Specifications to be performed by the manufacturer, e.g., testing of pipe.

1.02 SECTION INCLUDES

- A. Selection of Testing Laboratory.
- B. Laboratory Duties.
- C. Payment for Testing Services.
- D. Contractor Responsibilities.
- E. Schedules for Testing.
- F. Transporting Samples.

1.03 SELECTION OF TESTING LABORATORY

The testing laboratory or laboratories will be selected by the Contractor, subject to the approval of the Owner.

1.04 LABORATORY DUTIES

- A. Cooperate with the Owner, Engineer and Contractor.
- B. Provide qualified personnel promptly on notice.
- C. Perform specified inspections, sampling and testing of materials.
 - 1. Comply with specified standards, ASTM, other recognized authorities, and as specified.
 - 2. Ascertain compliance with requirements of the Contract Documents.
- D. Promptly notify the Engineer and Contractor of irregularity or deficiency of work which are observed during performance of services.
- E. Promptly submit three copies (two copies to the Engineer and one copy to the Contractor) of report of inspections and tests in addition to those additional copies required by the Contractor with the following information included:

1. Date issued
 2. Project title and number
 3. Testing laboratory name and address
 4. Name and signature of inspector
 5. Date of inspection or sampling
 6. Record of temperature and weather
 7. Date of test
 8. Identification of product and Specification section
 9. Location of Project
 10. Type of inspection or test
 11. Results of test
 12. Observations regarding compliance with the Contract Documents
- F. Perform additional services as required.
- G. The laboratory is not authorized to release, revoke, alter or enlarge on requirements of the Contract Documents, or approve or accept any portion of the Work.

1.05 PAYMENT FOR TESTING SERVICES

- A. The cost of testing services required by the Contract shall be paid for by the Contractor and shall be included in the cost of the work to which it pertains. This excludes concrete, soil and asphalt testing, which will be paid for by the Owner.
- B. The cost of additional testing services not specifically required in the Specifications, but requested by the Owner or Engineer, shall be paid for by the Owner.
- C. The cost of material testing described in various sections of these Specifications or as required in referenced standards to be provided by a material manufacturer, shall be included in the price bid for that item and shall not be paid for by the Owner.
- D. The cost of retesting any item that fails to meet the requirements of these Specifications shall be paid for by the Contractor.

1.06 CONTRACTOR RESPONSIBILITIES

- A. Contractor will be furnished contact information for the selected laboratory. Contractor will be required to schedule ALL testing.
- B. Cooperate with laboratory personnel, provide access to Work and/or manufacturer's requirements.
- C. Provide to the laboratory, representative samples, in required quantities, of materials to be tested.
- D. Furnish copies of mill test reports.

- E. Furnish required labor and facilities to:
 - 1. Provide access to Work to be tested;
 - 2. Obtain and handle samples at the site (if certified to do so);
 - 3. Facilitate inspections and tests;
 - 4. Build or furnish a holding box for concrete cylinders or other samples as required by the laboratory.
- F. Notify the laboratory sufficiently in advance of operation to allow for the assignment of personnel and schedules of tests.
- G. Laboratory Tests: Where such inspection and testing are to be conducted by an independent laboratory agency, the sample(s) shall be selected by such laboratory or agency, or the Engineer, and shipped to the laboratory by the Contractor at Contractor's expense.
- H. Copies of all correspondence between the Contractor and testing agencies shall be provided to the Engineer.
- I. If the Contractor disagrees with the approved Engineer's testing agency's methods or results during an onsite test, the Contractor may have another testing agency conduct an independent evaluation at the Contractor's expense. After an independent evaluation is performed, the Contractor will submit their results to the Engineer for review.

1.07 SCHEDULES FOR TESTING

- A. Establishing Schedule
 - 1. The Contractor shall, by advance discussion with the testing laboratory, determine the time required for the laboratory to perform its tests and to issue each of its findings, and make all arrangements for the testing laboratory to be on site to provide the required testing.
 - 2. Provide all required time within the construction schedule.
- B. When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the testing laboratory as required.
- C. When the testing laboratory is ready to test according to the determined schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra costs for testing attributable to the delay will be back-charged to the Contractor and shall not be borne by the Owner.

1.08 TRANSPORTING SAMPLES

The Contractor shall be responsible for transporting all samples, except those taken by testing laboratory personnel, to the testing laboratory.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations and procedures.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.
- G. Protect products scheduled for use in the work by means including, but not necessarily limited to, those described in this Section.

1.02 RELATED REQUIREMENTS

- A. Section 00 21 13 - Instructions to Bidders
- B. Section 01 40 00 - Quality Requirements
- C. Documents affecting work of this Section include, but are not necessarily limited to, Standard General Conditions of the Construction Contract and Sections in Division 01 of these specifications.
- D. Additional procedures also may be prescribed in other Sections of these specifications.

1.03 SUBMITTALS

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. Submit within fifteen (15) days after date of Agreement.
 - 2. For products specified only by reference standards, list applicable reference standards.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
- E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.04 QUALITY ASSURANCE

- A. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

1.05 MANUFACTURER'S RECOMMENDATIONS

- A. Except as otherwise approved by the Engineer, determine and comply with manufacturer's recommendations on product handling, storage and protection.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
- B. Unforeseen historic items encountered remain the property of the Owner; notify the Owner promptly upon discovery; protect, remove, handle, and store as directed by the Owner.
- C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.
- D. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.

2.03 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- B. Alliance Consulting Engineers, Inc. will consider requests for substitutions only within fifteen (15) days after date of Agreement.
- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Document
- D. A request for substitution constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Will provide the same warranty for the substitution as for the specified product.
 - 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 5. Will reimburse the Owner and Alliance Consulting Engineers, Inc. for review or redesign services associated with re-approval by authorities.
- E. Substitution Submittal Procedure:
 - 1. Submit three (3) copies of request for substitution for consideration. Limit each request to one proposed substitution.
 - 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
 - 3. Alliance Consulting Engineers, Inc. will notify Contractor in writing of decision to accept or reject request.

3.02 PACKAGING

- A. Deliver products to the job site in their manufacturer's original container, with labels intact and legible.
 - 1. Maintain packaged materials with seals unbroken and labels intact until time of use.
 - 2. Promptly remove damaged material and unsuitable items from the job site and promptly replace with material meeting the specified requirements, at no additional cost to the Owner.
- B. The Engineer may reject as non-complying such material and products that do not bear identification satisfactory to the Engineer as to manufacturer, grade, quality and other pertinent information.

3.03 TRANSPORTATION AND HANDLING

- A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- B. Transport and handle products in accordance with manufacturer's instructions.
- C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
- F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- H. Prevent contact with material that may cause corrosion, discoloration, or staining.
- I. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- J. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
- K. Partial payments under the Contract will not relieve the Contractor from responsibility.
 - 1. When materials and work at the site that have been partially paid for are not adequately protected by the Contractor, such materials will be protected by the Owner at the expense of the Contractor and no further partial payment thereon will be made.

- L. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the Owner.

3.05 REPAIRS AND REPLACEMENTS

- A. In the event of damage, promptly make replacements and repairs to the approval of the Engineer and at no additional cost to the Owner.
- B. Additional time required to secure replacements and to make repairs will not be considered by the Engineer to justify an extension in the contract time of completion.

END OF SECTION

SECTION 01 70 00
EXECUTION REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of the Owner's personnel.
- I. Project Record Documents.
- J. Contract Closeout procedures, except payment procedures.

1.02 RELATED REQUIREMENTS

- A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in Division 01 of these Specifications.
- B. Other requirements for technical services are stated in other sections of these Specifications.
- C. Section 00 65 19.13 - Contractor's Affidavit.
- D. Section 01 30 00 - Administrative Requirements
- E. Section 01 40 00 - Quality Requirements
- F. Section 01 78 00 - Closeout Submittals

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, with elevations and locations of the work in conformance with Contract Documents.

3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
1. Structural integrity of any element of Project.
 2. Integrity of weather exposed or moisture resistant element.
 3. Efficiency, maintenance, or safety of any operational element.
 4. Visual qualities of sight exposed elements.
 5. Work of the Owner or separate Contractor.

1.04 QUALIFICATIONS

- A. For survey work, employ a land surveyor registered in South Carolina. Submit an evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

1.05 PROJECT CONDITIONS

- A. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- C. Dust Control: Execute work by methods to minimize raising dust from construction operations.
- D. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
1. Minimize amount of bare soil exposed at one time.
 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
 3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
 4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
- G. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.06 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After the Owner's occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of the Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work.
- B. Start of work means acceptance of existing conditions.
- C. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- D. Examine and verify specific conditions described in individual specification sections.

- E. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- F. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- G. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Alliance Consulting Engineers, Inc. four (4) days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two (2) days after meeting to participants, with two (2) copies to Alliance Consulting Engineers, Inc., Owners, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Alliance Consulting Engineers, Inc. of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Alliance Consulting Engineers, Inc. the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Alliance Consulting Engineers, Inc.
- F. Utilize recognized engineering survey practices.

- G. Establish a minimum of two (2) permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- H. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
- I. Periodically verify layouts by same means.
- J. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as shown.
 - 2. Report discrepancies to Alliance Consulting Engineers, Inc. before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings or described in the Technical Specifications.
 - 2. Relocate items indicated on drawings or described in the Technical Specifications.

- C. Services (Including but not limited to Fire Protection, Electrical and Telecommunications): Remove, relocate and extend existing systems to accommodate new construction.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 - 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. Provide temporary connections as required to maintain existing systems in service.
 - 4. Verify that abandoned services serve only abandoned facilities.
- D. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch as specified for patching new work.
- E. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
 - 1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Alliance Consulting Engineers, Inc.
- F. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- G. Clean existing systems and equipment.
- H. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- I. Do not begin new construction in alterations areas before demolition is complete.
- J. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-conforming work.
- C. Execute cutting and patching including excavation and fill to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- I. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.
 - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

- J. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
- K. Make neat transitions. Patch work to match adjacent work in texture and appearance. Where new work abuts or aligns with existing, perform a smooth and even transition.
- L. Patch or replace surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. Repair substrate prior to patching finish. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.08 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

3.10 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

3.12 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Use cleaning materials that are nonhazardous.
- C. Clean site; sweep paved areas, rake clean landscaped surfaces.
- D. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 PROJECT RECORD DOCUMENTS

- A. Work includes:
 - 1. Throughout progress of the Work, maintain an accurate record of changes in the Contract Documents, as described in Article 3.1 below.
 - 2. Upon completion of the Work, deliver the recorded changes to the Engineer.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, and Sections in Division 01 of these specifications.
 - 2. Other requirements affecting Project Record Documents may appear in pertinent other Sections of these specifications.
- C. Quality assurance:
 - 1. Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved by the Engineer.
 - 2. Accuracy of records shall be such that future search for items shown on the Project Record Documents may rely reasonably on the information provided under this Section of the Work.
- D. Submittals:
 - 1. The Engineer's approval of the current status of Project Record Documents may be a prerequisite to the Engineer's approval of requests for progress payment and request for final payment under the Contract.
 - 2. Prior to submitting each request for progress payment, secure the Engineer's approval of the current status of the Project Record Documents.

3. Prior to submitting request for final payment, submit the final Project Record Documents to the Engineer and secure his approval.
- E. Product handling:
1. Maintain Record Documents completely protected from deterioration and from loss and damage until completion of the Work and transfer to the Engineer.
 2. In the event of loss of recorded data, use means necessary to again secure the data to the Engineer's approval.
 - a. Such means shall include, if necessary, in the opinion of the Engineer, removal and replacement of concealing materials.
 - b. In such case, provide replacements to the standards originally required by the Contract Documents.
- F. Job Set Documents:
1. Promptly following receipt of the Owner's Notice to Proceed, secure from the Engineer, at no charge to the Contractor, one complete set of all Documents comprising the Contract.
- G. Maintenance of Job Set:
1. Immediately upon receipt of the job set described in above paragraph titled "JOB SET DOCUMENTS", identify each of the Documents with the title, "RECORD DOCUMENTS - JOB SET".
 2. Preservation:
 - a. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set to the approval of the Engineer.
 - b. Do not use the job set for any purpose except entry of new data and for review by the Engineer.
 - c. Maintain the job set at the site of Work as that site is designated by the Engineer.
 3. Making entries on Job Set Drawings:
 - a. Use erasable colored pencil, preferably red (not ink or indelible pencil) to delineate changes.
 - b. Show by station number location of all fittings, manholes, valves, wye locations, etc.
 - c. Reference all fittings and valves to two aboveground items reasonably safe from being relocated and indicate such references on the drawings.
 - d. Show location of electrical conduit, pull boxes, etc.

4. Submittal:
 - a. Submit "marked-up" set of drawings to the Engineer.
 - i. Make any necessary additions as required by the Engineer.

3.15 CLOSEOUT PROCEDURES

- A. Work included shall be providing compliance with the requirements of the General Conditions of these Specifications for administrative procedures in closing out the project work.
- B. Make submittals that are required by governing or other authorities.
 1. Provide copies to Alliance Consulting Engineers, Inc.
 2. When the Engineer finds the Contractor's work acceptable, the Contractor shall be given such notice and should proceed with closeout submittals.
 3. Closeout submittals shall contain at least the following:
 - a. Project record documents.
 - b. Equipment operation and maintenance manuals and copies of start-up reports.
 - c. Warranties and bonds.
 - d. Spare parts and manuals.
 - e. Evidence of payment and release to liens per General Conditions.
 - f. Section 00 65 19.13 - Contractor's Affidavit.
- C. Notify Alliance Consulting Engineers, Inc. when work is considered ready for Substantial Completion.
 1. The Contractor shall notify the Engineer that, in his opinion, the project is substantially complete. A written statement listing items complete shall be submitted.
 2. Upon receipt of the Contractor's notice, the Engineer shall make an observation to determine if substantial completion is provided.
 3. If, in the Engineer's opinion, the project is not substantially complete, a written notice to the Contractor shall follow outlining reasons and deficiencies in work that comprised the Engineer's decision. The Engineer's decision shall be final.
- D. Request and obtain permit acceptance on all open construction permits.
- E. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Alliance Consulting Engineers, Inc.'s review.

- F. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owners-occupied areas.
- G. Accompany Engineer & Owner on preliminary final observation.
 - 1. The Engineer will make a final observation for the Contractor after all items noted in the substantial completion observation have been corrected. The Contractor shall notify the Engineer in writing when a final observation is needed. Incomplete and/or defective work shall be given to the Contractor by written notice.
- H. Notify Alliance Consulting Engineers, Inc. when work is considered finally complete.
- I. Complete items of work determined by Alliance Consulting Engineers, Inc.'s final observation.
- J. Re-observation:
 - 1. Re-observation required due to failure by the Contractor to make previously noted corrections will be performed by the Engineer.
 - 2. Cost for such observations will be due to and payable by the Contractor at a rate equal to charges to the Owner for similar work.
 - 3. Re-observations will continue until the work is acceptable to the Engineer.
- K. Final Payment:
 - 1. Final payment to the Contractor will be made upon completion of the previous items and others required by these specifications. A final statement shall be forwarded to the Engineer. The statement shall address:
 - a. Previous change orders.
 - b. Unit prices.
 - c. Deductions for un-corrected work.
 - d. Deductions for liquidated damages.
 - e. Deductions for re-testing work.
 - f. Deductions for re-observation.
 - g. Deductions for shop drawing review.
 - h. Adjusted contract sum.
 - i. Previous payments.
 - j. Amount due.
 - 2. When required, the Engineer will prepare a contract change order for adjustments not previously made.

END OF SECTION

SECTION 01 71 23
FIELD ENGINEERING

PART 1 GENERAL

1.01 DESCRIPTION

- A. Work included: Provide such field engineering services as are required for proper completion of the Work.

1.02 Related work:

- A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions and Sections in Division 01 of these Specifications.

1.03 QUALITY ASSURANCE

- A. Provide competent labor, supervision, inspection services, testing services, materials and equipment for a complete and quality rehabilitation and coating project.
- B. Exercise proper precautions to verify the information described in the Technical Specifications and Contract Documents prior to laying out or performing any part of the Work.
 - 1. The Contractor will be held responsible for any errors therein that otherwise might have been avoided.
 - 2. Promptly inform the Engineer of any errors or discrepancies discovered in the Technical Specifications in order that proper corrections may be made.

1.04 PROCEDURES

- A. Verify lead content of existing coating system before starting work on the site.
- B. Secure all required permits and make all required and necessary notifications before starting work on the site.
- C. Perform preparation, coating and repair task during progress of the Work consistent with the spirit of the Technical Specifications.
- D. Do not deviate from or change items of the Work without specific approval from the Engineer.
- E. Promptly advise the Engineer when a change becomes necessary because of other changes in the Work.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 74 19

WASTE MANAGEMENT

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. The Owner requires that this Project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Other illegal dumping or burying.
- E. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 No products are required under this Section.

- A. See Section 01 60 00 - Product Requirements for substitution submission procedures.
- B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 60 00 Product Requirements:
 - 1. Relative amount of waste produced, compared to specified product.
 - 2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
 - 3. Proposed disposal method for waste product.
 - 4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 30 00 Administrative Requirements for additional requirements for project meetings, reports, submittal procedures and project documentation.
- B. See Section 01 60 00 Product Requirements for waste prevention requirements related to delivery, storage and handling.
- C. See Section 01 70 00 Execution Requirements for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse and return methods to be used by all parties at the appropriate stages of the project.
- B. Meetings: Discuss trash/waste management goals and issues at project meetings.
 - 1. Pre-bid meeting.
 - 2. Pre-construction meeting.
 - 3. Regular job-site meetings.
- C. Reuse of Materials On-Site: Set aside, sort and protect separated products in preparation for reuse.
- D. Salvage: Set aside, sort and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 01 78 00

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and Bonds.

1.02 RELATED REQUIREMENTS

- A. Section 00 70 00 – General Conditions
- B. Section 01 30 00 - Administrative Requirements
- C. Section 01 70 00 - Execution Requirements
- D. Individual Product Sections: Specific requirements for operation and maintenance data.
- E. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Contractor to keep Record Documents on site at all times for review by Engineer or Owner. Submit documents to Alliance Consulting Engineers, Inc. with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Alliance Consulting Engineers, Inc. will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by the Owners, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents fifteen (15) days prior to final inspection. This copy will be reviewed and returned after final inspection, with Alliance Consulting Engineers, Inc. comments. Revise content of all document sets as required prior to final submission.
 - 4. Submit two sets of revised final documents in final form within ten (10) days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with the Owners permission, submit documents within ten (10) days after acceptance.

2. Make other submittals within ten (10) days after Date of Substantial Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten (10) days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 1. Drawings.
 2. Addenda.
 3. Change Orders and other modifications to the Contract.
- B. Ensure entries are complete and accurate, enabling future reference by the Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Record Drawings: Legibly mark each item to record actual construction including:
 1. Field changes of dimension and detail.
 2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE MANUALS

- A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- B. Prepare data in the form of an instructional manual.

3.04 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work. Except for items put into use with The Owners permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.

END OF SECTION

SECTION 02 30 00

SUBSURFACE EVALUATION

PART 1 GENERAL

1.01 DESCRIPTION

- A. Subsurface Evaluation Report:
 - 1. Report of the Geotechnical Subsurface Exploration for REV 1 Lynches River Industrial Park Roadway and Stormwater Pageland, South Carolina. Prepared for the Project by S&ME, Inc. dated March 12, 2021 (ECS, LLP. Project No. 206150)
 - a. A copy of the report is included in this Section 02 30 00.
- B. Use of data:
 - 1. These reports were obtained only for the Engineer's use in design and is not a part of the Contract Documents.
 - 2. The report is available for bidders' information but is not a warranty of subsurface conditions.
 - 3. It is the responsibility of the Bidders to visit the site and acquaint themselves with the existing conditions.
 - 4. Prior to bidding, bidders may make their own Subsurface Investigations to satisfy themselves as to site and subsurface soil conditions, but these investigations must be performed under the time schedules and arrangements that have been approved in advance by the Engineer.

1.02 QUALITY ASSURANCE

- A. Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports in accordance with the schedule of special inspections, as specified in Section 01 40 00.
- B. All work that is performed under this contract that does not meet technical or design requirements must be adjusted and no deviation from the Contract Documents can be made without specific and written approval from the Engineer.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION



Report of Geotechnical Exploration – REV 1
Lynches River Industrial Park Roadways and Stormwater
Pageland, South Carolina
S&ME Project No. 206150

PREPARED FOR:

Alliance Consulting Engineers, Inc.
PO Box 8147
Columbia, South Carolina 29202

PREPARED BY:

S&ME, Inc.
134 Suber Road
Columbia, South Carolina 29210

March 12, 2021



March 12, 2021

Alliance Consulting Engineers, Inc.
PO Box 8147
Columbia, South Carolina 29202

Attention: Mr. Steven Whaley, P.E.

Reference: **Report of Geotechnical Exploration – REV 1**
Lynches River Industrial Park Roadways and Stormwater
Pageland, Chesterfield County, South Carolina
S&ME Project No. 206150

Dear Mr. Whaley:

As requested, S&ME, Inc. (S&ME) has completed field and laboratory testing for the Lynches River Industrial Park Roadways and Stormwater project site, in Pageland, Chesterfield County, South Carolina. Our work was performed in general accordance with our proposal No. 13-2000477, dated October 27, 2020.

This report provides information on the exploration and testing procedures used, our boring records, our laboratory data and our conclusions and recommendations regarding site conditions, site preparation, excavation considerations, suitability of on-site soils for use as structural fill, fill placement and compaction, subgrade CBR value, and flexible asphalt pavement thickness for the proposed industrial park roadway.

S&ME appreciates this opportunity to work with you as your geotechnical engineering consultant on this project. Please contact us at (803) 561-9024 if you have any questions or need any additional information regarding this report.

Sincerely,

S&ME, Inc.


John P. Lewis, P.E.
Project Engineer





Robert C. Bruorton, P.E.
Senior Engineer





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Appendices

Appendix I – Figures

Appendix II – Field Data

Appendix III – Laboratory Data



1.0 Project Information

Initial information regarding the project was received in email and phone correspondence between Mr. Steven Whaley, P.E. of Alliance Consulting Engineers, Inc. (ACE), Mr. Matt Cooke, P.G., P.E. of S&ME on October 23rd, 2020. Included in the correspondence was the *Conceptual Site Plan ±2,500-LF of Proposed Roadway and Stormwater Master Plan for Lynches River Industrial Park, Town of Pageland, Chesterfield County, South Carolina*, dated October 22, 2020 and prepared by ACE. The site is located within the southern quadrant of the intersection of Dove Sutton Road and US Highway 601, in Pageland, South Carolina, as shown on the *Site Location Plan*, attached as Figure 1 in Appendix I. The site is identified as Chesterfield County TMS Nos. 019-000-000-101 and 019-000-000-038.

From our review of the provided information, it is further understood that the planned development at the site will consist of a 1,365 linear foot asphalt-paved entrance drive, a proposed 1,185 linear foot asphalt paved secondary road, and six stormwater ponds to be located on Lots 1, 3, 4, 6, 7, 8. Existing and proposed grade information has not been provided at this time. However, we understand the proposed stormwater ponds are assumed to be between 5 and 7 feet deep.

Anticipated traffic loading conditions were provided to Mr. Cooke by Mr. Whaley, via email correspondence on February 19 and March 2, 2021. Traffic loading conditions for modeling purposes were determined to be as follows:

- 1,315 passenger vehicles per day for a 5-day week, and
- 225 tractor-trailers per day for a 5-day week.

2.0 Exploration Procedures

The subsurface exploration of this project included a total of twelve (12) Standard Penetration Test (SPT) soil test borings and bulk sampling. The approximate boring locations are shown on the *Boring Location Plan*, attached as Figure 2 in Appendix I.

2.1 Reconnaissance of Project Area

On January 6, 2021, a representative from S&ME visited the site to observe current site conditions and lay out proposed boring locations. Soil test boring locations were laid out using our sub-meter GPS equipment. The boring locations indicated on the attached *Boring Location Plan* must be considered as approximate. No formal survey of boring locations or elevations was conducted by S&ME.

2.2 Field Testing and Sampling

The following sections detail our field and sampling activities at the site. A summary of our exploration procedures is included in Appendix II.



2.2.1 *Soil Test (SPT) Borings*

Twelve (12) soil test borings with SPT sampling and testing were performed on January 16, 2021. The SPT borings were performed by Southern Drill, Inc., under subcontract to S&ME, using a CME 550 ATV-mounted drill rig. The borings were advanced using 2¼-inch inside diameter hollow-stem augers to termination depths of roughly 5 to 10 feet below the existing ground surface.

Split-spoon samples and Standard Penetration Test Resistance N-values were obtained at selected intervals in general accordance with ASTM D1586. Representative samples of the soils obtained by the split-spoon sampler were collected and placed in suitably identified, sealed glass jars and transported to our laboratory.

2.2.2 *Ground Water Measurements*

Measurement of ground water was attempted in the borings shortly after drilling was completed. After a period of roughly 24 hours, ground water measurements were repeated in attempt to obtain a stabilized ground water reading within the borings.

2.2.3 *Bulk Samples*

Two (2) composite bulk sample (BS-1 and BS-2) were obtained at the site as follows:

Table 2-1 – Bulk Sample Summary

Bulk Sample No.	Representative Boring	Purpose
BS-1	B-2	Pavement Bearing Materials
BS-2	B-5	Pavement Bearing Materials

The representative bulk samples of near-surface soils were obtained by randomly taking shovel loads from the auger cuttings or spoil brought to the surface, until a sample of 75 to 100 pounds was obtained. The samples were placed in plastic bags and marked with appropriate descriptive information.

2.2.4 *Borehole Closure*

Following collection of relevant geotechnical data, boreholes were filled by slowly pouring auger cuttings into the open hole such that minimal “bridging” of the material occurred in the hole. Backfilling of the upper two feet of each hole was tamped as heavily as possible with a shovel handle or other hand-held equipment, and the backfill crowned to direct rainfall away on the surface.

2.3 **Laboratory Testing**

Recovered split spoon and bulk samples and field logs were transported to our laboratory. Soils were subsequently classified by a geotechnical professional in general accordance with the visual-manual method described in ASTM D2488.



The following laboratory soil testing was conducted on the bulk sample BS-1, representative of the pavement bearing soils during this exploration:

Table 2-2 – Laboratory Soil Testing Summary

Laboratory Test	Specification	Quantity
Atterberg Limits	ASTM D4318	1
Percent-finer #200 Sieve	ASTM D422	1
Natural Moisture Content	ASTM D2216	1
Standard Proctor	ASTM D698	1
California Bearing Ratio (CBR)	ASTM D1883	1

A summary of our laboratory testing procedures and the laboratory test results are included in Appendix III.

3.0 Site Conditions

S&ME's assessment of the geotechnical conditions began with a reconnaissance of the topography and physical features of the site. We also consulted various available topographic and geologic maps for relevant information.

3.1 Surface Conditions

As previously mentioned, the site is located within the southern quadrant of the intersection of Dove Sutton Road and US Highway 601 in Pageland, South Carolina. The site currently consists of undeveloped wooded areas, open grass covered fields and an agricultural field planted. Unpaved dirt trails and several creeks were observed throughout the site. The site is bounded by Dove Sutton Road and existing industrial facilities to the north, agricultural fields, and wooded areas to the south, SC-207 to the west, and Highway 601 N to the east.

The site appeared to slope down from east to west during our site reconnaissance. From our review of available topographic information, this was confirmed as existing grades appear to range from about elevation 559 to 477 feet.

3.2 Subsurface Conditions

Recovered field samples and field boring logs were reviewed by a member of our geotechnical staff. Soil test boring records are attached.

3.2.1 Site Geology

The site is located in the Carolina Slate Belt section of the Piedmont Physiographic Province of South Carolina. The Carolina Slate Belt extends from Georgia to North Carolina and parts of Virginia. Over geologic time, the volcanic and sedimentary rocks, which the belt originally consisted of, were subjected to metamorphism, heat and pressure. The metamorphic process gave rise to the primary rock types evident today, referred to as



metavolcanics. These metavolcanics include dacitic, rhyolitic, and andesitic flows along with tuffs and breccias. The metasediments found include argillite and slate, which the belt is named.

The topography and relief of the area has developed from differential weathering of the metamorphic rock. Ridges and hills have been developed on the more easily weathered and erodible rock. Because of the continued chemical and physical weathering, the rocks in the area are now generally covered with a mantle of soil that has weathered in place from the parent bedrock. These soils have variable thicknesses and are referred to as residuum or residual soils. The residuum is typically finer grained and has a higher clay content near the surface because of the advanced weathering. Similarly, the soils typically become coarser grained with increasing depth because of decreased weathering. As the degree of weathering decreases, the residual soils generally retain the overall appearance, texture, gradation and foliations of the parent rock.

The term *partially weathered rock (PWR)* is applied to very dense micaceous sands or silty sands of the Carolina Piedmont, which register SPT N-values in excess of 100 blows per foot. PWR generally varies widely within even small areas owing to minute differences in the chemical properties of the parent bedrock, which results in widely varying rates of weathering. Isolated lenses or seams of PWR often are present within Piedmont Residuum well above the overall PWR level within a given area. PWR is considered excellent bearing material for foundations and is relatively incompressible except in highly stressed deep foundations.

3.2.2 *USDA Soil Survey Information*

From a qualitative standpoint, the USDA Natural Resources Conservation Service's Soil Surveys can often provide helpful information. The surveys map the near surface soils (i.e., depths \leq 6 ft.) and provide general descriptions. The data is not intended to replace geotechnical evaluations and testing but it can help identify trends. Soil maps are often a useful indication of the geologic environment governing soil behavior as well as the seasonal depth to ground water and depth to rock.

The USDA-NCSS web-based SoilWeb and USDA Natural Resource Conservation Service soils map of Chesterfield County, South Carolina, issued in 1995 were reviewed. Nine series were indicated within the project area:

- Badin silt loam, 2 to 6 percent slopes (BaB) – moderately deep soil on broad, gently sloping ridges and side slopes of the Piedmont.
- Badin silt loam, 6 to 10 percent slopes (BaC) – moderately deep soil on narrow, strongly sloping ridgetops and side slopes of the Piedmont.
- Badin silt loam, 10 to 15 percent slopes (BaD) – moderately deep soil on narrow, moderately steep ridges and side slopes of the Piedmont.
- Badin silt clay loam, 2 to 6 percent slopes, eroded (BdB2) – moderately deep soil on gently sloping ridges and side slopes of the Piedmont.
- Badin silt clay loam, 6 to 10 percent slopes, eroded (BdC2) – moderately deep soil on narrow, strongly sloping ridges and side slopes of the Piedmont.
- Chewacla clay loam, 0 to 2 percent slopes (Ch) – very deep soil on narrow, nearly level flood plains along major and minor streams of the Piedmont and Coastal Plain.
- Goldston channery silt loam, 6 to 10 percent slopes (GtC) – shallow soil on strongly sloping side slopes and ridgetops of the Piedmont.



- Goldston channery silt loam, 10 to 15 percent slopes (GtD) – shallow soil on moderately steep side slopes and narrow ridges of the Piedmont.
- Riverview silt loam, frequently flooded (Rv) – very deep soil on nearly level natural levees and narrow, long flood plains along major and minor streams of the Piedmont and Coastal Plain.

The soil information is provided in the table below:

Table 3-1 – USDA Soil Series Survey

Soil Series	Soil Type	Depth to Seasonal High GW Table	Depth to Bedrock	Permeability	Shrink / Swell Potential	Soil Reaction
BaB	ML, CL-ML, CL, CH	> 6 ft.	20-40 in.	moderate	low to moderate	very strongly to slightly acidic
BaC						
BaD						
BdB2	ML, CL, CH	0.5-1.5 ft. (apparent Nov-Apr)	> 60 in.	low		
BdC2						
Ch	GM, SM, ML	> 6 ft.	10-20 in.	moderately rapid	low	
GtC						
GtD	ML, CL-ML, CL, SM, SC-SM	3.0-5.0 (apparent Dec-Mar)	> 60 in.	moderate to moderately rapid	low	very strongly to slightly acidic
Rv						

The USDA information provided for this site points to a few items that could influence geotechnical recommendations for the planned structure and foundations.

- Soil series labeled GtC and GtD are noted to have shallow depth to bedrock.
- Soil series labeled BaB, BaC, BaD, BdB2 and BdC2 are noted to have relatively shallow depth to bedrock.
- Soil series labeled BaB, BaC, BaD, BdB2 and BdC2 are noted to have high plasticity clays (CH) present, with the shrink/swell potential being low to moderate.
- Soil series labeled Ch and Rv are noted to have shallow seasonal high ground water tables.
- Soil series across the site are noted to be very strongly to slightly acidic.

The USDA Soil Survey is shown on the *USDA Soil Survey Map*, attached as Figure 3, in Appendix I.



3.2.3 *Interpreted Subsurface Profile*

The generalized subsurface conditions at the site are described below. The discussed subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring records included in Appendix II should be reviewed for specific information at each boring location. The depth and thickness of the subsurface strata indicated on the boring records was estimated based on the auger cuttings and the samples recovered. The transition between materials may be more gradual than indicated on the boring records. Information on actual subsurface conditions exists only at the specific boring locations and is relevant to the time the exploration was performed. Variations may occur and should be expected at locations remote from the boring. The stratification lines were used for our analytical purposes and, unless specifically stated otherwise, should not be used as the basis for design or construction cost estimates. Soil test boring records are attached in Appendix II.

Surface Materials

Surface materials in the form of topsoil, roughly 4 to 6 inches in thickness, were encountered in Boring B-1 and B-7 at the existing ground surface. Surface materials may be thicker in areas not explored at this time.

"Plow Zone" Soils

Borings B-3 through B-6 and B-8 through B-12, within the agricultural fields, encountered "Plow Zone" soils up to 12 inches in thickness. "Plow Zone" soils are typically encountered in areas used for agricultural purposes and influenced by cycles of discing and growing of crops. "Plow Zone" soils are typically dark brown or gray and contain varying amounts of organics.

The "Plow Zone" soils encountered on-site typically consisted of low plasticity fines with some fine to medium sands and few roots (ML). Recovered samples were generally brown in color and were dry to the touch.

Piedmont Residuum

Beneath the surface materials and "plow zone" soils, or from the existing ground surface, the borings encountered Piedmont residual soils to termination depths of 5 to 10 feet below the existing ground surface. The residuum generally consisted of low to high plasticity silty and clayey fines with varying amounts of fine to medium sands (ML, CL, and CH).

Recovered samples of the residual soils were generally tan, orange, gray, red, and brown in color and were dry to moist to the touch. SPT N-values ranged from 4 to 70 blows per foot (bpf), indicating soft to very hard consistencies in the silty and clayey soils.

Partially Weathered Rock (PWR)

Several borings encountered partially weathered rock (PWR) beneath the Piedmont residuum. PWR is defined as a very dense or very hard material exhibiting SPT N-values in excess of 100 blows per foot (bpf). PWR was encountered as summarized in the table below:



Table 3-2 – Summary of Encountered PWR

Boring No.	Approximate PWR Depth	Approximate PWR Elevation
B-2	8½ ft.	~502.5 ft.
B-7	3½ ft.	~516.5 ft.
B-12	3½ ft.	~527.5 ft.

Recovered samples of PWR consisted of low plasticity silty fines with trace to some fine to medium sands (ML), similar to the overlying Piedmont residual soils. Split spoon samples were typically dry to moist to the touch and were tan in color. Some samples contained relict rock structure.

Ground Water

Ground water was measured at the time of drilling and repeated after a roughly 24-hour period. Ground water was encountered in Boring B-2, only, at time of drilling at a depth of roughly 7 feet below the existing ground surface. Ground water was encountered after a roughly 24-hour period in Borings B-2 and B-3 at depths ranging from roughly 2½ to 4 feet below existing ground surface.

Borehole cave-in was also measured in our borings, at depths ranging from roughly 1 to 4½ feet below the existing ground surface. In moist or dry soils, cave-in depths typically represent soils which fell into the boreholes as the drilling tools were removed.

Although planned grades across the site were not available at the time of this report, it appears that ground water may impact construction within the vicinity of Borings B-2 and B-3, depending on the final grades. Additionally, it is possible that perched water conditions may be encountered during excavation and grading activities across the site. Perched ground water is surface water that infiltrates through the upper, less dense or more permeable soils (such as the “plow zone” soils) but becomes perched or trapped at the interface with the underlying, more dense or less permeable soils (such as the silts and clays encountered across the site).

We note that ground-water levels are influenced by precipitation, long term climatic variations, and nearby construction. Measurements of ground water made at different times than our exploration may indicate ground-water levels substantially different than indicated on the boring records in Appendix II.

3.3 Laboratory Physical Tests

3.3.1 Compaction Behavior

The bulk sample was compacted in standard molds using ASTM D698 Method A. A summary of the results is provided in the table below, with laboratory results presented in Appendix III:



Table 3-3 – Bulk Sample Moisture-Density Relationship Summary

Sample No.	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	USCS Soil Type
BS-1	102.7	16.5	CL

As previously discussed, bulk sample BS-1 was obtained from near surface soils in a pavement area. The pavement bearing materials had a maximum dry density of 102.7 pcf at an optimum moisture content of 16.5 percent. The optimum moisture content obtained in the test was roughly 9.3 percent below the in-situ moisture content of the soils and roughly 7.5 percent less than the plastic limit.

3.3.2 *Bearing Ratio Testing*

One (1) laboratory California Bearing Ratio test was performed for soaked specimens of BS-1, compacted to roughly 91 and 97 percent of the standard Proctor maximum dry density. Moisture contents were at the optimum moisture content value during molding. Specimens were confined under a surcharge weight of 10 pounds during soak. Plots of CBR vs. penetration are included in Appendix III.

4.0 Conclusions and Recommendations

The following paragraphs include our conclusions and recommendations regarding site preparation, excavation considerations, dewatering considerations, suitability of on-site soils for use as structural fill, fill placement and compaction, subgrade CBR value, and flexible asphalt pavement thickness for the proposed industrial park roadway.

The soil profile encountered at this site appears suitable for the proposed development. Conditions at this site do not appear to pose issues for site preparation or grading that differ substantially from the surrounding region.

Although planned finished grades across the site were not available at the time of this report, there are portions of the site where high plasticity clays (CH) may be encountered during grading activities, depending on finished grades. High plasticity clays may have a potential for swell volume changes with increased moisture content. Volume changes in the subgrade can cause structural distress in pavements. If these soils are to be left in-place or placed as structural fill, the owner must understand that there are risks involved; however, we believe that with proper observation and a reasonable effort to remediate poor soils during construction, these risks can be minimized.

We recommend that the geotechnical engineer or his qualified representative be present during construction to observe the subgrade and to provide recommendations for remediation, as required. Remediation will typically involve the removal of the unsuitable material and replacement with suitable material such as compacted soil or crushed stone. Chemical stabilization may be an option if larger areas are cost prohibitive for undercut/replacement.



Low to medium plasticity silty and clayey soils (ML and CL) in cut portions of the site appear marginally suitable for re-use as structural fill. The term marginally refers to the fact that these soils may be moisture sensitive to some degree and can be difficult to work if allowed to become wet. These difficulties can include softening of exposed subgrade soils, excessive rutting or deflection under construction traffic, and the difficulty associated with adequately drying and compacting wet soil. Moisture-related earthwork difficulties can be reduced by performing the earthwork during the typically drier months of the year (May through October). High plasticity silty and clayey soils in cut portions of the site may be used as structural fill, provided they are placed at the base of deep fill areas and not within 5 feet of planned finished grade.

Mass excavation using conventional grading equipment, including trackhoes and pan scrapers, appears feasible, across the majority of the site. As previously mentioned, PWR was encountered in Borings B-2, along the roadway alignment and Borings B-7 and B-12 within pond areas. If PWR is encountered during excavation processes, special procedures including ripping and/or blasting will be necessary during site grading.

From our field observations, including shallow ground water measurements, it appears that ground water may impact construction within the proposed northern portion of alignment. Typical shallow dewatering techniques should suffice in controlling ground water where encountered.

4.1 Site Preparation

Site preparation will need to include removal of unsuitable surface materials within the proposed pavement footprints. This should include surface vegetation, organic laden topsoil, plow zone soils, stumps, root bulbs, surface debris and any unstable/unsuitable surface or subsurface soils.

Removal of stumps and roots will result in disturbance of the upper soils. In filled areas, the upper soils will need to be stabilized prior to placing fill. Stabilization, if required, may consist of removing and replacing unstable material or, where unstable soils are thin, wetting/drying and compacting in-place.

4.1.1 Clearing, Grubbing and Stripping

The site is comprised of mostly agricultural fields and wooded areas. Topsoil thickness encountered in our borings in the wooded portions of the site measured between 4 and 6 inches. While "Plow Zone" materials containing few roots extended to depths of up to roughly 12 inches within agricultural field portions of the site. The organic soil stripping process may expose deeper organic soils in portions of the site than suggested by the boring data. These soils often have a similar color to topsoil but contain only minor amounts of organics. The organic content of the topsoil materials encountered at the existing ground surface was not tested, therefore, the depth of initial stripping is not known at this time, and could vary, depending on the actual organic content of the soils and the project specifications. If these soils are to remain in-place or are to be re-used as structural fill, the organic content should be tested, in general accordance with ASTM D2974.

4.1.2 Dewatering Considerations

As previously mentioned, Borings B-2 and B-3 encountered ground water at depths of roughly 4 and 2½ feet below the existing round surface at our delayed measurements. Additionally, USDA soil series Ch and Rv are noted to have shallow seasonal high ground water tables. Depending on the planned grades along the



alignment, ground water may be encountered during grading activities and result in an unstable subgrade for fill placement.

A temporary system that has performed adequately on previous projects with similar conditions consists of temporary excavations (ditches) and sump pumps. Pumping from the sumps should be maintained until fill placement is a minimum of three feet above the water level. Other means of improving drainage at the site may be accomplished with ditches located at select areas.

Continue dewatering during fill placement to maintain groundwater at its lowered elevation. If discontinued prematurely, the ground water level will rise, saturating the fill soils and preventing effective compaction. When the excavation has been filled more than three feet above the natural groundwater level, dewatering may be discontinued.

If planned finished grades are near the observed ground water depth, temporary ditches may need to be converted to permanent French drains.

If ground water or infiltrating surface water is not properly controlled during construction, the subgrade soils which will support pavements may be damaged. Furthermore, construction equipment mobility may be impaired.

4.1.3 Surface Preparation/Proofrolling

In most areas, surface preparation can likely be limited to proofrolling of the surface. After removal of topsoil, root mat, plow zone soils and unsuitable soils/materials and cutting to grade, but prior to fill placement, the exposed ground surface should be observed by the geotechnical engineer or a representative of the geotechnical engineer to confirm that poor soils have been removed and that the exposed subgrade is suitable for support of pavements.

To aid in evaluation of the exposed soils, the area should be proofrolled using a loaded dump truck or similarly loaded piece of equipment. Areas that rut, pump, or move excessively under movement of the equipment should be stabilized prior to placement of fill soil or base course. If left in place, soft or wet soils will exhibit substantially lower bearing for pavements. Stabilization, if required, may consist of removing and replacing unstable material or, where unstable soils are thin, wetting/drying and compacting in-place. If large unstable areas are encountered that are cost prohibitive to undercut and replace, drying and stabilizing by chemical means could be an option.

Care should be taken during construction so that the subgrade soils are not disturbed more than necessary. If heavily reworked or disturbed, stabilization may be required for what could otherwise be considered an acceptable subgrade.

4.1.4 Wet Weather Grading

Based on our experience, low to high plasticity silty and clayey soils (ML, CL and CH), similar to those encountered across the site, can be difficult to work if allowed to become wet and may also require extended drying times. Reasonable measures by the grading contractor to grade the surface to drain and seal the surface with a smooth drum roller prior to rainfall will likely be effective to limit risk of periodic rain significantly affecting grading.



Our experience indicates that allowing heavy equipment to run on the existing ground surface will result in heavy rutting. Running heavy equipment on previously placed fill during rain events or where water is ponded will result in degradation of the fill. If these conditions are evident or persist and routinely cause issues, then during construction, gravity-drained surface ditches should be installed around the site to promote surface runoff. Ditches should have at least 6 inches of relief per 100 feet of length to facilitate flow.

4.1.5 High Plasticity Soils

High plasticity clays (CH) were sporadically encountered across the site. High plasticity soils identified in USDA soil series BaB, BaC, BaD, BdB2 and BdC2 likely reflect the clay accumulation zone (B horizon) of the soils in the upper few feet of the soil profile. Where encountered, high plasticity soils may exhibit shrink-swell characteristics when exposed to moisture variations.

High plasticity clays may occur close to finished grade, depending on planned grades along the alignment. Therefore, we recommend that the high plasticity soils be undercut a minimum of 3 feet below the final subgrade elevation and replaced with the low plasticity fine grained soils encountered across the site. Where soils at the base of the undercut are unstable under proofrolling, additional undercutting may be necessary and should be determined in the field by an experienced soils technician working under the direction of the geotechnical engineer while monitoring construction activity.

If the moisture content increases to the point that these soils become unstable during construction, over-excavation and replacement with suitable structural fill material may be required. Alternately, lime stabilization techniques could be utilized in order to lower the moisture content (short-term) and plasticity (long-term) of the referenced soils. These techniques should extend to a depth of at least three feet below structural subgrades in pavement areas. It should be noted that the success of lime stabilization techniques is highly dependent upon the means and methods utilized by the constructor. Laboratory mix design testing on representative samples should be performed prior to use of this stabilization method.

4.2 Excavation Considerations

Although planned grades along the alignment were not available at the time of this report, based on review of the soil test boring data, it appears that soft to very stiff silty and clayey residual soils will most likely be encountered during general excavation. However, due to the depths at which PWR was encountered, as provided in Table 3-2 above, it appears that difficult excavation may be encountered in some portions of the site.

4.2.1 General Excavation

Piedmont residuum consisting of soft to very stiff cohesive soils can be typically excavated using pans, scrapers, backhoes and front end loaders in mass grading. The degree of difficulty that mobile equipment will encounter rises dramatically in materials exceeding about 70 to 80 blows per foot. These conditions were generally not encountered in our soil borings other than the areas previously detailed where PWR was encountered.



4.2.2 *Difficult Excavation – PWR*

Based on the subsurface conditions encountered, as detailed in Table 3-2 above, PWR may be encountered, depending on planned finished grade. It is important to note that PWR elevations shown in the borings reflect the widely spaced boring locations. No generalization of the trend between boring locations is made. Such generalization would entail substantial risk since the composition and density of the soil and rock may vary between testing locations. We emphasize that there may be substantial areas on the site where PWR or rock may occur above the level indicated by the testing.

PWR can normally be excavated by hard to very hard ripping. We recommend ripping be performed with a single-tooth hydraulically articulated ripper mounted to the frame of a D-9 or larger dozer. Our experience indicates that as the consistency of partially weathered rock increases ("N" values greater than 50/4" to 50/2" as represented on the Boring Records in Appendix II) the probability that blasting will be required increases for both mass and local excavation. Based on the subsurface conditions encountered by the borings, it is our professional opinion that the majority of soils can be excavated by appropriately sized heavy construction equipment. Occasional blasting or hoe ram use to excavate local areas of more resistant material may be expected in both mass and confined excavations. The speed and ease of excavation will depend on the type of grading equipment, operator skill and the geologic structure of the material itself, such as the direction of bedding, planes of weakness, and spacing of discontinuities.

It has been our experience in this geological area that materials having SPT N-values of less than 50 blows/3 inches (i.e. 50/3" as represented on the Boring Records in Appendix II) can generally be excavated using pans and scrapers by first loosening with a single-tooth ripper attached to a suitable sized dozer, such as a Caterpillar D-8 or D-9.

4.2.3 *Ripping versus Blasting*

On earthwork projects requiring ripping, a controversy sometimes develops as to whether the materials can be removed by ripping or whether blasting is required. It should be noted that ripping is dependent on the equipment and techniques used as well as the operator's skill and experience. The success of the ripping operation is dependent on finding the proper combinations for the conditions encountered. Excavation of the weathered rock is typically much more difficult in confined excavations. Jackhammering or blasting is anticipated to be required for materials having SPT N-values in excess of 50 blows/2 inches (i.e. 50/2"), or at or near the level that auger refusal is encountered.

4.2.4 *Confined Areas*

Excavation of hard to very hard residual soils in confined areas will likely require pneumatic hammers or spades. Light blasting may be necessary to efficiently remove more resistant partially weathered rock or bedrock that could be present in confined excavations. We emphasize that the character of the soil and rock strata may vary widely between testing locations, and no trend between testing locations is implied.



4.2.5 *Classified Excavations*

For classified excavations, we suggest that massive rock excavation be defined as any material that cannot be excavated with a single tooth, hydraulically articulated ripper drawn by a crawler tractor (Caterpillar D-9 or equivalent), occupying an original volume of at least one cubic yard.

For confined excavations, we suggest that any material occupying an original volume of at least one-half of a cubic yard or more which cannot be excavated with a Caterpillar 325 or equivalent using a 24-inch wide bucket equipped with rock teeth.

4.3 **Use of On-site Soils as Structural Fill**

The on-site soils that may be proposed for use as fill at the site (i.e. within cut portions of the site) consist of soils with USCS soil classification of low to high plasticity silts and clays (ML, CL, and CH). Before beginning to place fill, sample and test each proposed fill material to determine maximum dry density, optimum moisture content, natural moisture content, gradation and plasticity of the soil.

4.3.1 *Fine Grained Proposed Fill Soils*

Fine grained, low to medium plasticity soils (ML and CL), similar to those encountered across the site, are typically suitable to marginally suitable for use as structural fill. Suitability of these soils for use depends a great deal on the moisture content of the material at time of placement.

Marginal suitability refers to the fact that fine grained soils are moisture sensitive to some degree and can be difficult to work if allowed to become wet. These difficulties can include softening of exposed subgrade soils, excessive rutting or deflection under construction traffic, and the difficulty associated with adequately drying and compacting wet soil. Moisture-related earthwork difficulties can be reduced by performing the earthwork during the typically drier months of the year (May through October).

4.3.2 *High Plasticity Proposed Fill Soils*

Design issues associated with use of high plasticity, fine grained soils (CH) as fill include potential shrink/swell of bearing soils and low pavement subgrade strength. These design issues can be mitigated by restricting use of high plasticity soil materials as fill to depths of 5 feet or more below final grade in structural fill areas below pavements. At these depths, soils do not appreciably change soil moisture content, and therefore do not undergo appreciable change in volume. Additionally, high stresses associated with wheel loads have distributed sufficiently that high plasticity soil strengths are sufficient at these depths. These soils may also be used in non-structural fill or landscaped areas.

Construction issues associated with the use of on-site high plasticity soils as fill include drying prior to compaction and sensitivity to deterioration upon exposure to water. The construction issues can be mitigated by making provisions to moisture condition soils prior to compaction and repair of subgrades that deteriorated during construction. To improve the workability and behavioral characteristics of these soils, stabilization by chemical means may be necessary.



4.3.3 Use of Rock Fill

Shot rock or partially weathered rock (PWR) excavated in large chunks can be used in deep fill areas, provided you place them well apart to allow compaction of soil between them. Avoid placing heaped large pieces within 2 feet of subgrades in paved areas.

Shot rock used as mass fill often contains so many fines that considerable settling will occur if the fill is not compacted. Rock fill is usually spread in 18-inch to 48-inch lifts, depending on maximum fragment size. Lift thickness must typically be greater than the maximum size. Typically, each lift should be topped by a layer of fine gravel or soil to choke off the voids in the rock fill and limit risk of dropouts forming on the surface.

Heavy compaction forces are needed to relocate large stones to increase the density and stability of the rock mass. Densification of the rock mass typically requires use of very large, high capacity smooth drum vibratory compactors. Since compactors are subject to great stresses, the vibratory drum should be constructed of thick, high-grade steel.

Procedures used to lay and spread each lift prior to compaction are very important in achieving a satisfactory fill. Dozer spreading of the layers is recommended in advance of compaction, because the dozer blade can do some reorienting of the rocks and the tracks perform some compaction. This provides a more or less even surface for the compactor.

Compaction of each lift must be monitored to judge whether the rock fragments tend to break down under the compactive effort. If there is a crushing effect on the surface material, the number of passes may have to be reduced. Or, if the machine is equipped with more than one amplitude, lower amplitude can be used to reduce surface material distortion.

4.4 Fill Placement and Compaction

As previously mentioned, two bulk samples of planned pavement bearing soils that may be used as structural fill were obtained however, only one (BS-1 from the vicinity of Boring B-2) was tested for percent fines and plasticity. The following table summarizes these test results, while detailed test results are provided in Appendix III.

Table 4-1 – Assumed Planned Structural Fill Laboratory Testing Results

Boring No.	Bulk Sample No.	Depth (ft.)	USCS Soil Type	Percent Finer #200 (%)	Atterberg Limits		
					LL	PL	PI
B-2	BS-1	1-5	CL	78.7	36	24	12

These soils appear to generally be similar to the recovered samples of clayey Piedmont residuum encountered across the site. Therefore, the planned structural fill material from these general vicinities, or within areas with similar USCS soil classifications, appear suitable for reuse as structural fill.

In general, structural soil fill material should have less than 5 percent organic matter, a standard Proctor maximum dry density of 90 pcf or greater and a plasticity index (PI) of 30 percent or less. Materials with a PI greater than 30



percent, similar to the high plasticity clays (CH) encountered on-site, are susceptible to volume changes with changes in moisture content. Volume changes in the subgrade can cause structural distress in pavements. If these materials are used as fill the owner must understand and accept the risks associated with using these materials. If these soils are used, we recommend that they be placed in the lower portions of the compacted fill as previously indicated in this report. We recommend that off-site borrow meet the organic content, PI and density requirements of this section. Testing will be required before fill placement begins to determine the optimum moisture-density condition for the fill materials. Material to be used as soil fill should be tested and approved by the geotechnical engineer before being placed.

4.4.1 Density and Moisture Requirements

Place new fill in maximum 8-inch loose lifts and compact to at least 98 percent of maximum dry density (ASTM D698 Standard Proctor). Fill moisture content should be maintained within +/- 3 percent of the optimum moisture content. Contractor should be prepared to wet or dry soils as necessary to achieve compaction. Fill should be placed level at least 5 feet beyond the pavement footprint before sloping. In addition to meeting the compaction requirement, fill material must be stable under movement of the construction equipment and must not exhibit rutting or pumping after compacting.

4.4.2 Fill Placement at or Near Ground Water Elevation

Due to the shallow delayed ground water readings at Borings B-2 and B-3 along the planned alignment, ranging from roughly 2½ to 4 feet below the existing ground surface, special care should be taken during fill placement activities. Where fill will be placed at or near ground water elevations, the static setting of the roller should be used. The use of the static setting will minimize the capillary action created from an increased pore-water pressure of the underlying saturated soils, which is most commonly created with the use of a vibratory setting of the roller. This will ultimately minimize the saturation of the fill soils and the degradation of previously placed fills.

4.4.3 Compaction of Cohesive Soils

The compaction characteristics of silty and clayey soils (ML, CL, and CH) with plastic properties encountered at this site will be highly dependent on the soil moisture content at the time of construction. Sheeps-foot compactors will likely be preferable because the pads better penetrate the soil and they tend to break down the natural cohesive bonds between the particles.

The water content of these soils is usually very difficult to modify in the field. Above or below the optimum moisture content, the soils become progressively more difficult to manipulate and compact. Soils excavated above the water table are usually close enough to optimum moisture content to place and compact efficiently with little moisture conditioning required. Soils that are initially too wet or are allowed to become wet due to rainfall are more difficult to use. Drying wet silty/clayey soils usually requires favorable weather conditions and often requires repeated disking and rolling with sheeps-foot rollers to lower the moisture content.

Slope the fill surface to drain and prevent ponding water. If rain is expected while filling is temporarily halted, roll the surface with rubber tire or steel drum equipment to improve surface run-off.



4.4.4 Monitoring and Testing

Fill placement should be witnessed by an experienced soils technician working under the guidance of the geotechnical engineer. We recommend observation by a qualified soils technician with testing at random intervals to confirm compaction is being achieved. Part-time testing may suffice for pavement areas and utility trench fills.

4.5 Pavement Support and Construction

Pavement sections at the site are assumed to consist of flexible asphalt pavement. The proposed pavement areas are understood to consist of the new, two-lane, asphalt-paved roadways.

4.5.1 Subgrade Support Value

As previously discussed, one (1) two-point soaked laboratory California Bearing Ratio (CBR) test was performed on a representative bulk sample (BS-1) obtained from Boring B-2, within the planned pavement areas along the alignment. The tested bulk sample was classified as a CL with 78.7 percent fines, a liquid limit of 36 percent and a plasticity index of 12 percent.

The sample was compacted (remolded) to approximately 91 and 97 percent of the standard Proctor maximum dry density, approximately at the optimum moisture. Based on the laboratory test results and considering our experience with similar soils under similar loading conditions, a CBR value of roughly 5 percent, corresponding to a resilient modulus (MR) of 7,160 psi, is recommended for use in design of the pavement sections using a subgrade compacted to 98 percent of the standard Proctor maximum dry density. This is assuming that pavement subgrades are prepared in accordance with previous sections of this report. This also assumes that fill material placed within the proposed pavement areas is placed and compacted according to the recommendations given in this report. Imported fill, if required, should be tested to determine that it exhibits a CBR equivalent to or exceeds the value assumed in pavement recommendations.

We recommend that special care be given to providing adequate drainage away from pavement areas to reduce infiltration of surface water to the base course and subgrade materials in these areas. Water should be detoured away from the pavement areas and adequate slopes provided to maintain drainage off site. Pavement areas should be proofrolled prior to placing structural fill and/or aggregate base course. Proofrolling procedures are outlined in other sections of this report.

4.5.2 Traffic Volumes

As previously discussed, anticipated traffic loading conditions were provided to Mr. Cooke by Mr. Whaley via email correspondence on February 19 and March 2, 2021. It is understood that 1,315 passenger vehicles per day and 225 tractor-trailer trucks per day are anticipated for the site after full build-out of the industrial park. From the provided information, the assumed traffic volumes and calculated Equivalent Single Axle Load (ESAL) are summarized below:



Industrial Park Roadways – Medium Duty Section (with truck traffic):

- Anticipated 655 passenger vehicles per day over a five-day week, with 0.006 ESAL per vehicle.
- Anticipated 45 tractor-trailer trucks per day over a five-day week, with 2.37 ESAL per vehicle.
- A design life of 20 years with 576,560 Equivalent Single Axle Loads (ESAL) over the design life.

Industrial Park Roadways – Heavy Duty Section (with truck traffic):

- Anticipated 655 passenger vehicles per day over a five-day week, with 0.006 ESAL per vehicle.
- Anticipated 225 tractor-trailer trucks per day over a five-day week, with 2.37 ESAL per vehicle.
- A design life of 20 years with 2,800,850 Equivalent Single Axle Loads (ESAL) over the design life.

4.5.3 *Flexible Asphalt Pavements*

Pavement thickness computations were performed using the SCDOT *Pavement Design Guidelines – 2008* for analysis of the unreinforced flexible pavement section. Based on the subsurface conditions and assuming our grading recommendations will be implemented as specified, the following presents our recommendations regarding typical pavement sections and materials. Using the above described assumed traffic loadings, we recommend the minimum pavement sections indicated in the table below.

Table 4-2 – Recommended Flexible Pavement Section Thickness

Pavement Designation	Cement Modified SubBase	Graded Aggregate Base Course	Asphalt Intermediate Course	Asphalt Surface Course
Medium Duty	---	12 inches	2 inches	2 inches
	8 inches	6 inches	2 inches	2 inches
Heavy Duty	---	14 inches	3¾ inches	2 inches
	8 inches	8 inches	3½ inches	2 inches

It is our opinion that the flexible pavement should consist of a wearing course of hot mix asphaltic (HMA) concrete, an intermediate course of HMA concrete and a base course of graded aggregate Macadam Base Course material. Base course material is necessary for structural support.

Materials and workmanship should meet the minimum requirements of the SCDOT *Standard Specifications for Highway Construction*, 2007 Edition and supplemental specifications. The applicable sections include the following:

Table 4-3 – SCDOT Bituminous Pavements Specifications

Section	2007 SCDOT Standard Specification Section
Subgrade	Section 208, page 130
Cement Modified Sub-Base	Section 301, page 140



Graded Aggregate Base Course	Section 305, page 159
Hot Mixed Asphalt Pavement	Section 401, page 188
Hot Mix Asphalt Surface Course	Section 403, page 220
Supplemental Specifications	
HMA Material Properties, dated July 1, 2006	
HMA Courses, dated Jul 2, 2006	

Sufficient testing should be performed during flexible pavement installation to confirm that the required thickness, density, and quality requirements of the pavement specifications are followed. This is very important for the long-term performance of the pavement and can be performed by S&ME as part of our construction materials testing services.

4.5.4 *Base Course Materials*

As provided, the subbase materials recommended for the pavements could consist of either graded aggregate base course or cement modified subbase materials. Therefore, we provide the following recommendations for both materials.

Graded Aggregate Base Course

Base course materials assumed in computation of pavement sections above consists of materials meeting the hardness, durability and gradation requirements of graded aggregate base course (GABC) defined in current SCDOT *Standard Specifications* (2007 ed.) section 305. The crushed stone graded aggregate base course (GABC) used in pavement section construction should meet the requirements of Section 305 of the SCDOT Standard Specifications (2007 ed.) and should consist of “Macadam Base Course” as defined by Section 305.02 of the SCDOT specification.

Fill placed in pavement areas should be compacted as recommended in preceding sections. Prior to pavement installation, exposed pavement subgrades should be methodically proofrolled at final subgrade elevation under the observation of the S&ME geotechnical engineer, and any identified unstable areas should be repaired as directed.

As stated in the SCDOT Section 305, new base course should be compacted to at least 100 percent of the modified Proctor maximum dry density (ASTM D1557) and should not exhibit pumping or rutting under equipment traffic. Heavy compaction equipment is likely to be required in order to achieve the required base course compaction, and the moisture content of the material will likely need to be maintained very near the optimum moisture content in order to facilitate proper compaction. Base course of greater than 8 inches total thickness must be constructed in two lifts of approximately equal thickness. S&ME should be contacted to perform field density and thickness testing of the base course prior to paving.

Soil-Cement Base Course



Base course materials assumed in computation of pavement sections above consists of materials meeting the requirements of cement modified subbase defined in current SCDOT Standard Specifications (2007 ed.) Section 301. Laboratory soil cement mix design testing must be performed to determine the required cement application rate.

The quality of a soil-cement subbase course depends greatly on the mixing and compacting procedures. Most failures in soil-cement applications have been due to improper mixing where unstabilized soil lumps are found surrounded by an over-cemented soil matrix. It is difficult to achieve as adequate a mixing in the field as in the laboratory. However, by following accepted procedures, an experienced contractor can closely match the homogeneity of the laboratory mix.

Sandy soils can generally break apart easily and are readily mixed with the cement using disc plows or other simple equipment. More clayey soils resist manipulation by simple equipment and generally require mechanical mixers that cut or pulverize the lumps at relatively high speed. Based on soil types observed at the site, we expect the former type will be more appropriate here.

We estimated an average cement requirement based on visual-manual manipulation of the recovered soils and classification tests of representative samples in the laboratory. For a typical sandy soil with few to some fines content, we estimate soils will require 4 to 6 percent cement based on dry soil weight. However, the percentage cement required should be based on trial mixes prepared in the laboratory prior to construction.

Water added to the mixture should be carefully gauged to adjust moisture content slightly below or equal to the optimum moisture content during compaction. Too much water will result in loss of compressive strength of the soil-cement mixture due to washing out of the cement. Too much water also inhibits the breakdown of the more clayey materials and prevents adequate mixing of the soil-cement. Too little water will prevent adequate hydration.

We recommend soil-cement construction be accomplished in the following manner:

1. Grade and compact the soil to the required subgrade elevation.
2. Place the soil to be used in the soil-cement mix in wind-rows, providing sufficient material for a compacted thickness of about 6 inches per lift.
3. Place the required volume of cement on top of the wind-rows. No cement should be applied unless the temperature is at least 40 degrees F and rising.
4. Mix the soil and cement and distribute evenly over the area to be paved, including a 2-foot wide extension around the perimeter of the paved area. Mixing should extend the full depth of the lift.
5. Test the moisture content of the mix. Add the water needed to bring the moisture up to optimum moisture content. One or two percent more water should be added to allow for evaporation. Water shall be thoroughly mixed with the soil.
6. Compact the mixture to at least 98 percent of the Standard Proctor compaction maximum density. The soil-cement mix can be compacted with the same equipment used to compact the soil alone.
7. Soil-cement compaction should begin no later than thirty minutes following moistening. A minimum of one field density test should be performed for every 5,000 sq. ft. of application per lift to confirm that the recommended density is achieved.



8. Repeat the above procedure for additional lifts if necessary. Additional soil-cement lifts should be constructed immediately following compaction of preceding lift(s) so that shear planes do not form between the layers.
9. After compaction, the completed surface may require trimming or fine grading to the required slopes. Contractor should only work as large an area that can be completed during daylight hours.

It is important that effective curing of the soil-cement mix occur to obtain the design strength. At least seven days moist curing is necessary to allow the soil-cement to gain the required strength and rigidity. A bituminous prime coat should be sprayed on immediately to retain the existing moisture. Waterproof membranes, wet cloths, or wet straw can also be used for this purpose. Where necessary for temporary roadways to cross the curing area, designated areas should be covered with at least 8 inches of soil to protect the completed base.

Soil-cement subbase construction should be witnessed by the geotechnical engineer. Frequent measurements of the thickness of the soil-cement base should be made to verify the contractor's procedures produce an adequate coverage. In addition, we recommend that unconfined compressive strength tests be performed on a minimum of 1 cored sample of the stabilized mix per 5,000 square feet of application after the 7-day curing cycle is complete. Samples should have a minimum compressive strength of 600 psi.

4.5.5 *General*

Pavement performance is very dependent on subgrade condition. Drainage will have a major impact on subgrade condition. Drainage should be designed to result in subsurface water levels being at least 2 feet below the top of the pavement subgrade. Design should not result in water standing on the pavement surface or behind curbing. Landscaped areas behind curbing should be at or above the elevation of the curbing. Design should result in positive drainage being available from the stone base material.

The performance of the pavement will be influenced by a number of factors including the actual condition of subgrade soils at the time of pavement installation, installed thicknesses and compaction, and drainage. The subgrade soils should be re-evaluated by proofrolling immediately prior to placement of base course stone and unstable areas repaired. This recommendation is very important to the long-term performance of the pavements. Areas adjacent to pavements (embankments, landscaped island, ditching, etc.) which can drain water (rainwater or sprinklers) should be designed so that water does not seep below the pavements. This may require the use of French drains or swales. Sufficient tests and inspections should be performed during pavement installation to confirm that the required thickness, density, and quality requirements of the specifications are followed.

Experience indicates that a thin surface overlay of asphalt pavement may be required in about 10 years due to normal wear and weathering of the surface. Such wear is typically visible in several forms of pavement distress, such as aggregate exposure and polishing, aggregate stripping, asphalt bleeding and various types of cracking. There are means to methodically estimate the remaining pavement life based on a systematic statistical evaluation of pavement distress density and mode of failure. We recommend the pavement be evaluated in about 7 years to assess the pavement condition and remaining life.



5.0 Qualifications of Report

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty either express or implied, is made.

We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

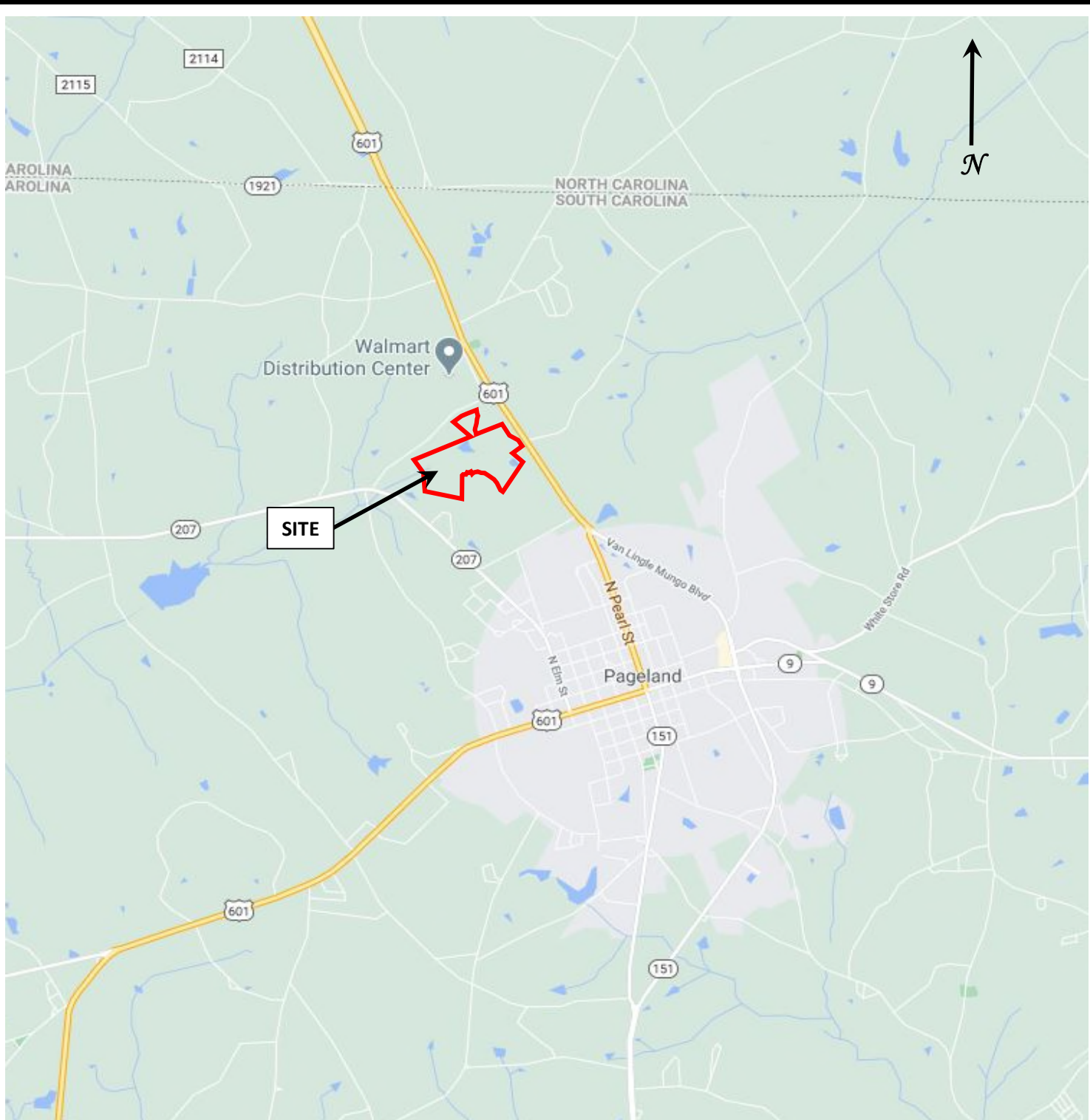
Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, and bacteria). If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

S&ME should be retained to review the final plans and specifications to confirm that earthwork, foundation, and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME's review of final plans and specifications followed by our observation and monitoring of earthwork and foundation construction activities.

Appendices

Appendix I – Figures



SOURCE: Google Maps



SITE LOCATION PLAN

JOB NAME: Lynches River Ind. Park Roadway and Stormwater
LOCATION: Dove Sutton Rd & US Highway 601
CITY, STATE: Pageland, South Carolina
JOB NO.: 206150

FIGURE NO.

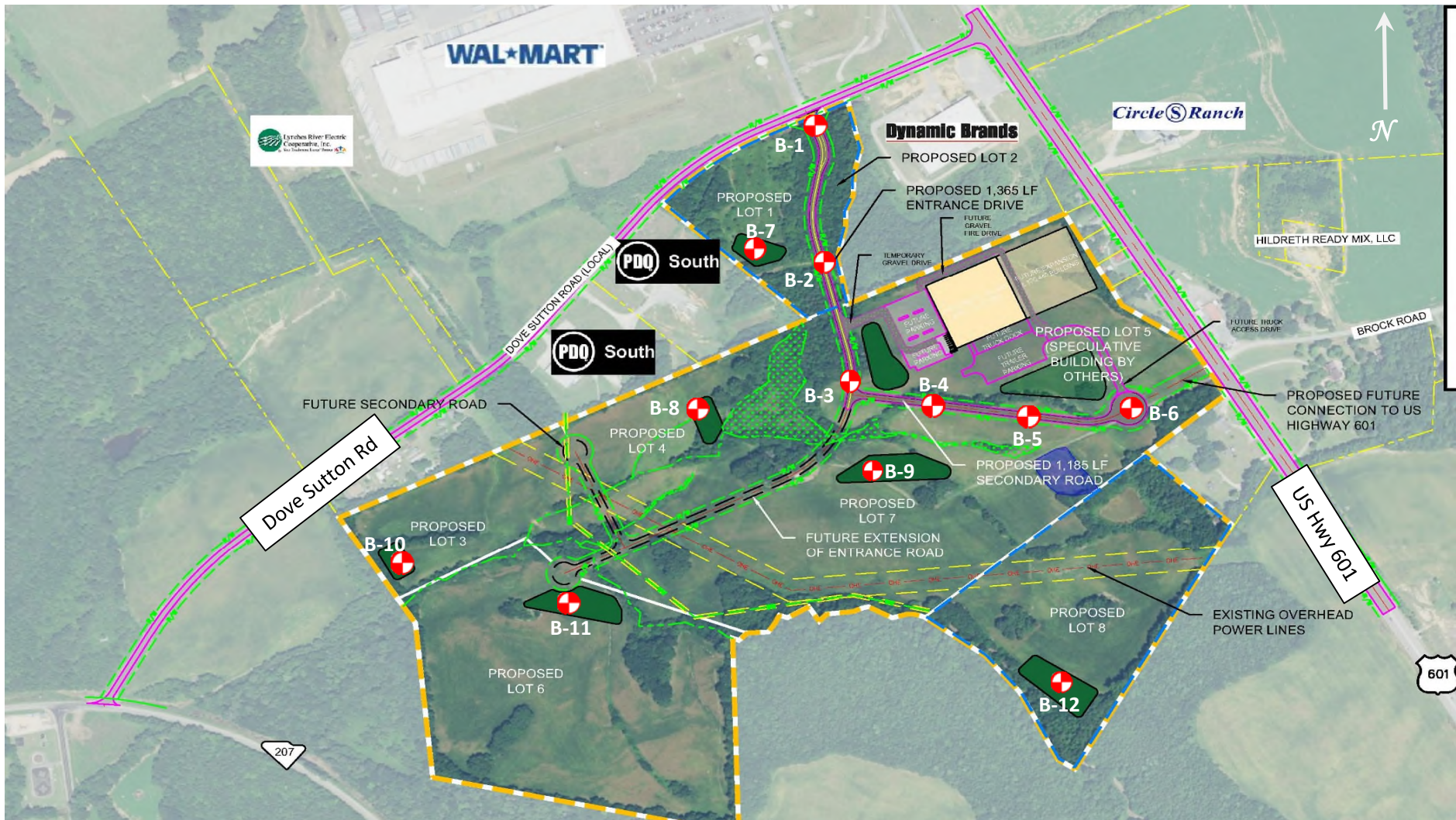
1

SCALE: NTS

CHECKED BY: RCB

DATE: 3/1/2021

DRAWN BY: JPL



SOURCE: Google Earth



 Boring Location

BORING LOCATION PLAN		FIGURE NO.
JOB NAME: Lynch's River Ind. Park Roadway and Stormwater LOCATION: Dove Sutton Rd & US Highway 601 CITY, STATE: Pageland, South Carolina JOB NO.: 206150		2
SCALE: NTS	CHECKED BY: RCB	
DATE: 3/1/2021	DRAWN BY: JPL	



SOURCE: USDA Soil Survey of Chesterfield County, South Carolina



USDA SOIL SURVEY MAP			
JOB NAME: Lynchess River Ind. Park Roadway and Stormwater		FIGURE NO. 3	
LOCATION: Dove Sutton Rd & US Highway 601			
CITY, STATE: Pageland, South Carolina			
JOB NO.: 206150			
SCALE: NTS	CHECKED BY: RCB		
DATE: 3/1/2021	DRAWN BY: JPL		

Appendix II – Field Data

LEGEND TO SOIL CLASSIFICATION AND SYMBOLS




SOIL TYPES

(Shown in Graphic Log)

	Fill
	Asphalt
	Concrete
	Topsoil
	Gravel
	Sand
	Silt
	Clay
	Organic
	Silty Sand
	Clayey Sand
	Sandy Silt
	Clayey Silt
	Sandy Clay
	Silty Clay
	Partially Weathered Rock
	Cored Rock

WATER LEVELS

(Shown in Water Level Column)

-  = Water Level At Termination of Boring
-  = Water Level Taken After 24 Hours
-  = Loss of Drilling Water
- HC = Hole Cave

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY

Very Soft
Soft
Firm
Stiff
Very Stiff
Hard
Very Hard

STD. PENETRATION RESISTANCE BLOWS/FOOT

0 to 2
3 to 4
5 to 8
9 to 15
16 to 30
31 to 50
Over 50

RELATIVE DENSITY OF COHESIONLESS SOILS

RELATIVE DENSITY

Very Loose
Loose
Medium Dense
Dense
Very Dense

STD. PENETRATION RESISTANCE BLOWS/FOOT

0 to 4
5 to 10
11 to 30
31 to 50
Over 50

SAMPLER TYPES

(Shown in Samples Column)

-  Shelby Tube
-  Split Spoon
-  Rock Core
-  No Recovery

TERMS

Standard Penetration Resistance - The Number of Blows of 140 lb. Hammer Falling 30 in. Required to Drive 1.4 in. I.D. Split Spoon Sampler 1 Foot. As Specified in ASTM D-1586.

REC - Total Length of Rock Recovered in the Core Barrel Divided by the Total Length of the Core Run Times 100%.

RQD - Total Length of Sound Rock Segments Recovered that are Longer Than or Equal to 4" (mechanical breaks excluded) Divided by the Total Length of the Core Run Times 100%.



DATE DRILLED: 1/16/21	ELEVATION: 528.0 ft	NOTES: Northing/Easting correlated from Latitude/Longitude estimated from Google Earth. Elevations estimated from Google Earth. No formal survey performed by S&ME.
DRILL RIG: CME 550	BORING DEPTH: 10.0 ft	
DRILLER: H. Wessinger	WATER LEVEL: Not Encountered	
HAMMER TYPE: Automatic	LOGGED BY: AKS	
SAMPLING METHOD: Split spoon		NORTHING: 1078650 EASTING: 2177432
DRILLING METHOD: 2 1/4" H.S.A.		

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
0 - 4	SURFACE MATERIAL - TOPSOIL - 4 inches.													
4 - 5		PIEDMONT RESIDUUM - FAT CLAY (CH) - mostly high plasticity fines, few fine to medium sands, moist, red, soft.			SS-1	▲	2	2	2					4
5 - 6		LEAN CLAY WITH SAND (CL) - mostly medium plasticity fines, little fine to medium sands, moist, red, stiff.	HC	523.0	SS-2	▲	3	5	7					12
6 - 8.5		--- @ 6 feet - very stiff.			SS-3	▲	6	8	8					16
8.5 - 10		--- @ 8.5 feet - trace fine rock fragments.			SS-4	▲	9	12	16					28
10		Boring terminated at 10 ft		518.0										

S&ME BORING LOG 206150 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 2/26/21

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3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



PROJECT: Lynches River Industrial Park Roadway and Stormwater Pageland, South Carolina S&ME Project No. 206150						BORING LOG B- 2									
DATE DRILLED: 1/16/21		ELEVATION: 511.0 ft		NOTES: Northing/Easting correlated from Latitude/Longitude estimated from Google Earth. Elevations estimated from Google Earth. No formal survey performed by S&ME.											
DRILL RIG: CME 550		BORING DEPTH: 10.0 ft													
DRILLER: H. Wessinger		WATER LEVEL: 7' ATD, 4' 24 hr													
HAMMER TYPE: Automatic		LOGGED BY: AKS													
SAMPLING METHOD: Split spoon						NORTHING: 1078044		EASTING: 2177458							
DRILLING METHOD: 2 1/4" H.S.A.															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80		
		PIEDMONT RESIDUUM - LEAN CLAY WITH SAND (CL) - mostly medium plasticity fines, little fine to medium sands, dry to moist, red, firm.													
		--- @ 3.5 feet - moist, brown.													
5		--- @ 6 feet - orange, stiff.													
		PARTIALLY WEATHERED ROCK (PWR) - SANDY SILT (ML) - mostly low plasticity fines, some fine to medium sands, dry to moist, tan, very hard, relict rock structure.													
10		Boring terminated at 10 ft													

S&ME BORING LOG 206150 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 2/26/21

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PROJECT: Lynches River Industrial Park Roadway and Stormwater Pageland, South Carolina S&ME Project No. 206150				BORING LOG B-3									
DATE DRILLED: 1/16/21		ELEVATION: 509.0 ft		NOTES: Northing/Easting correlated from Latitude/Longitude estimated from Google Earth. Elevations estimated from Google Earth. No formal survey performed by S&ME.									
DRILL RIG: CME 550		BORING DEPTH: 10.0 ft											
DRILLER: H. Wessinger		WATER LEVEL: NE ATD, 2.8' 24 hr											
HAMMER TYPE: Automatic		LOGGED BY: AKS											
SAMPLING METHOD: Split spoon				NORTHING: 1077513		EASTING: 2177578							
DRILLING METHOD: 2 1/4" H.S.A.													
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA				STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS	N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10			20
		PLOW ZONE - SANDY SILT (ML) - mostly low plasticity fines, some fine to medium sands, few roots, dry, dark brown.											
		PIEDMONT RESIDUUM - FAT CLAY (CH) - mostly high plasticity fines, moist, tan, stiff.			SS-1		3	4	4				8
			<u>HC</u>										
		LEAN CLAY WITH SAND (CL) - mostly low plasticity fines, little fine to medium sands, dry to moist, orange, very stiff.		504.0	SS-2		5	6	10				16
5													
		--- @ 6 feet - relict rock structure.			SS-3		8	12	14				26
		--- @ 8.5 feet - trace fine rock fragments, moist, orange mottled with light gray, very hard.			SS-4		13	21	30				51
10				499.0									
		Boring terminated at 10 ft											

S&ME BORING LOG 206150 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 2/26/21

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PROJECT: Lynches River Industrial Park Roadway and Stormwater Pageland, South Carolina S&ME Project No. 206150						BORING LOG B- 4								
DATE DRILLED: 1/16/21		ELEVATION: 515.0 ft		NOTES: Northing/Easting correlated from Latitude/Longitude estimated from Google Earth. Elevations estimated from Google Earth. No formal survey performed by S&ME.										
DRILL RIG: CME 550		BORING DEPTH: 10.0 ft												
DRILLER: H. Wessinger		WATER LEVEL: Not Encountered												
HAMMER TYPE: Automatic		LOGGED BY: AKS												
SAMPLING METHOD: Split spoon						NORTHING: 1077402		EASTING: 2177919						
DRILLING METHOD: 2¼" H.S.A.														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080	
		PLOW ZONE - SANDY SILT (ML) - mostly low plasticity fines, some fine to medium sands, few roots, dry, dark brown.												
		PIEDMONT RESIDUUM - LEAN CLAY WITH SAND (CL) - mostly medium plasticity fines, little fine to medium sands, little fine rock fragments, moist, red, stiff.			SS-1		2	4	6					10
		LEAN CLAY (CL) - mostly medium plasticity fines, few fine to medium sands, dry to moist, tan, stiff.	HC	510.0	SS-2		3	5	9					14
5		--- @ 6 feet - very stiff, relict rock structure.			SS-3		5	7	12					19
		--- @ 8.5 feet - hard.			SS-4		4	9	34					43
10		Boring terminated at 10 ft		505.0										

S&ME BORING LOG 206150 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 2/26/21

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PROJECT: Lynches River Industrial Park Roadway and Stormwater Pageland, South Carolina S&ME Project No. 206150					BORING LOG B-5									
DATE DRILLED: 1/16/21		ELEVATION: 528.0 ft			NOTES: Northing/Easting correlated from Latitude/Longitude estimated from Google Earth. Elevations estimated from Google Earth. No formal survey performed by S&ME.									
DRILL RIG: CME 550		BORING DEPTH: 10.0 ft												
DRILLER: H. Wessinger		WATER LEVEL: Not Encountered												
HAMMER TYPE: Automatic		LOGGED BY: AKS												
SAMPLING METHOD: Split spoon					NORTHING: 1077344		EASTING: 2178339							
DRILLING METHOD: 2 1/4" H.S.A.														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80	
		PLOW ZONE - SANDY SILT (ML) - mostly low plasticity fines, some fine to medium sands, few roots, dry, dark brown.												
		PIEDMONT RESIDUUM - LEAN CLAY (CH) - mostly medium plasticity fines, few fine to medium sands, moist, red, stiff.												
		--- @ 3.5 feet - very stiff.												
5			HC	523.0	SS-1		3	4	6					10
					SS-2		4	7	11					18
					SS-3		6	10	15					25
		--- @ 8.5 feet - orange, hard, relict rock structure.			SS-4		9	13	29					42
10		Boring terminated at 10 ft		518.0										

S&ME BORING LOG 206150 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 2/26/21

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DATE DRILLED: 1/16/21	ELEVATION: 540.0 ft	NOTES: Northing/Easting correlated from Latitude/Longitude estimated from Google Earth. Elevations estimated from Google Earth. No formal survey performed by S&ME.
DRILL RIG: CME 550	BORING DEPTH: 10.0 ft	
DRILLER: H. Wessinger	WATER LEVEL: Not Encountered	
HAMMER TYPE: Automatic	LOGGED BY: AKS	
SAMPLING METHOD: Split spoon		NORTHING: 1077394 EASTING: 2178754
DRILLING METHOD: 2 1/4" H.S.A.		

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft)				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	/ REMARKS					
											10	20	30	6080	
0 - 1		PLOW ZONE - SANDY SILT (ML) - mostly low plasticity fines, some fine to medium sands, few roots, dry, dark brown.													
1 - 5	DIAGONAL STRIPES	PIEDMONT RESIDUUM - FAT CLAY (CH) - mostly high plasticity fines, few fine to medium sands, moist, orange, firm.	HC												
5 - 10	VERTICAL STRIPES	SILT WITH SAND (ML) - mostly low to medium plasticity fines, little fine to medium sands, moist, orange, very stiff, relict rock structure. --- @ 8.5 feet - medium plasticity fines.		535.0											
					SS-1	2	3	5			●				8
					SS-2	5	7	9			●				16
					SS-3	8	8	12			●				20
					SS-4	5	10	13			●				23
10		Boring terminated at 10 ft		530.0											

S&ME BORING LOG 206150 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 2/26/21

PROJECT: Lynches River Industrial Park Roadway and Stormwater Pageland, South Carolina S&ME Project No. 206150				BORING LOG B- 7											
DATE DRILLED: 1/16/21		ELEVATION: 520.0 ft		NOTES: Northing/Easting correlated from Latitude/Longitude estimated from Google Earth. Elevations estimated from Google Earth. No formal survey performed by S&ME.											
DRILL RIG: CME 550		BORING DEPTH: 5.0 ft													
DRILLER: H. Wessinger		WATER LEVEL: Not Encountered													
HAMMER TYPE: Automatic		LOGGED BY: AKS													
SAMPLING METHOD: Split spoon				NORTHING: 1078115		EASTING: 2177178									
DRILLING METHOD: 2 1/4" H.S.A.															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA				STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080		
		SURFACE MATERIAL - TOPSOIL - 6 inches.													
		PIEDMONT RESIDUUM - LEAN CLAY WITH SAND (CL) - mostly medium plasticity fines, trace fine to medium sands, moist, red mottled with yellow, very stiff.	HC		SS-1		4	10	16						26
		PARTIALLY WEATHERED ROCK (PWR) - SILT (ML) - mostly low plasticity fines, trace fine to medium sands, dry to moist, tan, very hard.			SS-2		21	50/5"							50/5"
5		Boring terminated at 5 ft		515.0											

S&ME BORING LOG 206150 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 2/26/21

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PROJECT: Lynches River Industrial Park Roadway and Stormwater Pageland, South Carolina S&ME Project No. 206150						BORING LOG B- 8									
DATE DRILLED: 1/16/21		ELEVATION: 504.0 ft		NOTES: Northing/Easting correlated from Latitude/Longitude estimated from Google Earth. Elevations estimated from Google Earth. No formal survey performed by S&ME.											
DRILL RIG: CME 550		BORING DEPTH: 5.0 ft													
DRILLER: H. Wessinger		WATER LEVEL: Not Encountered													
HAMMER TYPE: Automatic		LOGGED BY: AKS													
SAMPLING METHOD: Split spoon						NORTHING: 1077394		EASTING: 2176928							
DRILLING METHOD: 2 1/4" H.S.A.															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080		
		PLOW ZONE - SANDY SILT (ML) - mostly low plasticity fines, some fine to medium sands, few roots, dry, dark brown.													
		PIEDMONT RESIDUUM - LEAN CLAY WITH SAND (CL) - mostly medium plasticity fines, little fine to medium sands, trace mica, moist, orange, stiff. --- @ 3.5 feet - firm.	HC		SS-1		4	5	5						10
					SS-2		3	3	5						8
5		Boring terminated at 5 ft		499.0											

S&ME BORING LOG 206150 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 2/26/21

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PROJECT: Lynches River Industrial Park Roadway and Stormwater Pageland, South Carolina S&ME Project No. 206150				BORING LOG B- 9											
DATE DRILLED: 1/16/21		ELEVATION: 516.0 ft		NOTES: Northing/Easting correlated from Latitude/Longitude estimated from Google Earth. Elevations estimated from Google Earth. No formal survey performed by S&ME.											
DRILL RIG: CME 550		BORING DEPTH: 5.0 ft													
DRILLER: H. Wessinger		WATER LEVEL: Not Encountered													
HAMMER TYPE: Automatic		LOGGED BY: AKS													
SAMPLING METHOD: Split spoon				NORTHING: 1077104		EASTING: 2177645									
DRILLING METHOD: 2 1/4" H.S.A.															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA				STANDARD PENETRATION TEST DATA (blows/ft) /REMARKS				N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60	80	
		PLOW ZONE - SANDY SILT (ML) - mostly low plasticity fines, some fine to medium sands, few roots, dry, dark brown.													
		PIEDMONT RESIDUUM - LEAN CLAY (CL) - mostly low to medium plasticity fines, few fine to medium sands, moist, tan, very stiff.	HC		SS-1		5	7	14						21
		SILT (ML) - mostly low plasticity fines, dry to moist, tan, very hard, relict rock structure.			SS-2		12	29	41						70
5		Boring terminated at 5 ft		511.0											

S&ME BORING LOG 206150 BORING LOGS.GPJ SME COLUMBIA GINT DATA TEMPLATE.GDT 2/26/21

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PROJECT: Lynches River Industrial Park Roadway and Stormwater Pageland, South Carolina S&ME Project No. 206150						BORING LOG B-10									
DATE DRILLED: 1/16/21		ELEVATION: 478.0 ft		NOTES: Northing/Easting correlated from Latitude/Longitude estimated from Google Earth. Elevations estimated from Google Earth. No formal survey performed by S&ME.											
DRILL RIG: CME 550		BORING DEPTH: 5.0 ft													
DRILLER: H. Wessinger		WATER LEVEL: Not Encountered													
HAMMER TYPE: Automatic		LOGGED BY: AKS													
SAMPLING METHOD: Split spoon						NORTHING: 1076710		EASTING: 2175703							
DRILLING METHOD: 2 1/4" H.S.A.															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080		
		PLOW ZONE - SANDY SILT (ML) - mostly low plasticity fines, some fine to medium sands, few roots, dry, dark brown.													
		PIEDMONT RESIDUUM - LEAN CLAY WITH SAND (CL) - mostly medium plasticity fines, little fine to medium sands, moist, orange, stiff. --- @ 3.5 feet - hard, trace fine rock fragments.	HC		SS-1		2	3	5						8
5		Boring terminated at 5 ft		473.0	SS-2		5	10	29						39

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PROJECT: Lynches River Industrial Park Roadway and Stormwater Pageland, South Carolina S&ME Project No. 206150						BORING LOG B-11									
DATE DRILLED: 1/16/21		ELEVATION: 487.0 ft		NOTES: Northing/Easting correlated from Latitude/Longitude estimated from Google Earth. Elevations estimated from Google Earth. No formal survey performed by S&ME.											
DRILL RIG: CME 550		BORING DEPTH: 5.0 ft													
DRILLER: H. Wessinger		WATER LEVEL: Not Encountered													
HAMMER TYPE: Automatic		LOGGED BY: AKS													
SAMPLING METHOD: Split spoon						NORTHING: 1076531		EASTING: 2176403							
DRILLING METHOD: 2¼" H.S.A.															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	6080		
		PLOW ZONE - SANDY SILT (ML) - mostly low plasticity fines, some fine to medium sands, few roots, dry, dark brown.													
		PIEDMONT RESIDUUM - LEAN CLAY WITH SAND (CL) - mostly medium plasticity fines, little fine to medium sands, trace mica, moist, orange, firm.	HC		SS-1		2	3	3						6
		LEAN CLAY (CL) - mostly low to medium plasticity fines, few fine to medium sands, moist, orange, hard, relict rock structure.			SS-2		9	14	29						43
5		Boring terminated at 5 ft		482.0											

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PROJECT: Lynches River Industrial Park Roadway and Stormwater Pageland, South Carolina S&ME Project No. 206150						BORING LOG B-12									
DATE DRILLED: 1/16/21		ELEVATION: 531.0 ft		NOTES: Northing/Easting correlated from Latitude/Longitude estimated from Google Earth. Elevations estimated from Google Earth. No formal survey performed by S&ME.											
DRILL RIG: CME 550		BORING DEPTH: 5.0 ft													
DRILLER: H. Wessinger		WATER LEVEL: Not Encountered													
HAMMER TYPE: Automatic		LOGGED BY: AKS													
SAMPLING METHOD: Split spoon						NORTHING: 1076191		EASTING: 2178438							
DRILLING METHOD: 2 1/4" H.S.A.															
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-MSL)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			STANDARD PENETRATION TEST DATA (blows/ft) / REMARKS				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	10	20	30	60/80		
		PLOW ZONE - SANDY SILT (ML) - mostly low plasticity fines, some fine to medium sands, few roots, dry, dark brown.													
		PIEDMONT RESIDUUM - LEAN CLAY (CL) - mostly medium to high plasticity fines, few fine to medium sands, moist, red, stiff.	HC		SS-1		3	4	6						10
		PARTIALLY WEATHERED ROCK (PWR) - SILT (ML) - mostly low plasticity fines, trace fine to medium sands, dry to moist, tan, very hard.			SS-2		14	29	50/4"						50/4"
5		Boring terminated at 5 ft		526.0											

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Summary of Field Procedures

◆ Boring and Sampling

Soil Test Boring with Hollow-Stem Auger

Soil sampling and penetration testing were performed in general accordance with ASTM D1586, *Standard Test Method for Penetration Test and Split Barrel Sampling of Soils*. Borings were made by mechanically twisting a continuous steel hollow stem auger into the soil. At regular intervals, soil samples were obtained with a standard 1.4-inch I. D., 2-inch O. D., split barrel sampler. The sampler was first seated six inches to penetrate any loose cuttings, then driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler through the two final six inch increments was recorded as the penetration resistance (SPT N) value. The N-value, when properly interpreted by qualified professional staff, is an index of the soil strength and foundation support capability.

Bulk Samples

At selected locations and depths, representative bulk samples of the soils were obtained by randomly taking shovel loads from the cuttings or spoil brought to the surface, until a sample of 30 to 50 pounds was obtained. The sample was placed in a cloth or plastic sack marked with appropriate descriptive information. Samples were protected from freezing at all times.

Borehole Closure

Following collection of relevant geotechnical data, boreholes were filled by slowly pouring auger cuttings or bentonite chips into the open hole such that minimal “bridging” of the material occurred in the hole. Backfilling of the upper two feet of each hole was tamped as heavily as possible with a shovel handle or other hand held equipment, and the backfill crowned to direct rainfall away on the surface. Where boreholes exceeded five feet in depth, a plastic hole plug was firmly tamped into place within the backfill at a depth of about two feet.

Preservation and Transporting of Soil Samples with Control of Field Moisture

Procedures for preserving soil samples obtained in the field and transportation of samples to the laboratory generally followed those given in ASTM D4220, *Standard Practice for Preserving and Transporting Soil Samples* for Group B samples as defined in Section 4. Group B samples are those samples not suspected of being contaminated and for which only water content and classification, proctor, relative density, or profile logging will be performed. Group B samples also include bulk samples that are intended to be remolded in the laboratory for compaction, swell pressure, percent swell, consolidation, permeability, CBR, or shear testing. Representative samples of the cuttings or split spoon samples, or representative bulk samples, were placed in suitably identified, sealed glass jars or plastic containers and transported to the laboratory. Sample identification numbers on the containers corresponded to sample numbers recorded on field boring records or test pit records. Thin-walled tube samples were sealed at the ends with paraffin and capped with plastic end caps.

◆ Field Tests of Earth Materials

The subsurface conditions encountered during drilling were reported on a field test boring record by the chief driller. The record contains information about the drilling method, samples attempted and sample recovery, indications of materials in the borings such as coarse gravel, cobbles, etc., and indications of materials encountered between sample intervals. Representative soil samples were placed in glass jars and transported to the laboratory along with the field boring records. Recovered samples not expended in laboratory tests are commonly retained in our laboratory for 60 days following completion of drilling. Field boring records are retained at our office.

Measurement of Static Water Levels

Water level readings were made in the open boreholes immediately after completing drilling and withdrawal of the tools. Where feasible, measurements were repeated after an elapsed period of 24 hours to gauge the stabilized water level. Procedures for measurement of liquid levels in open boreholes are described in ASTM D4750, *Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)*. A weighted measuring tape was slowly lowered into each borehole until the liquid surface was penetrated by the weighted end. The reading on the tape was recorded at a reference point on the surface and compared to the reading at the demarcation of the wetted and unwetted portions of the tape. The difference between the two readings was recorded as the depth of the liquid surface below the reference point. Measurements made by this method were then repeated until approximately consistent values were obtained.

Appendix III – Laboratory Data

MOISTURE - DENSITY REPORT

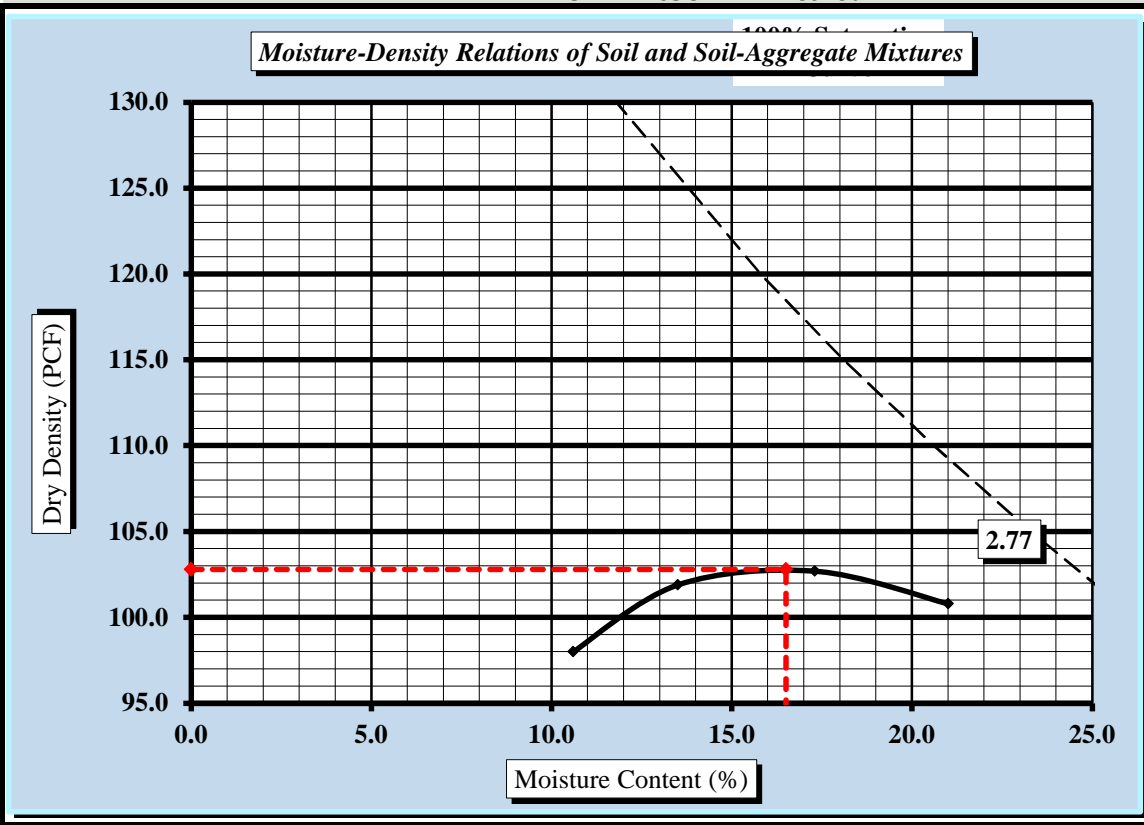


Quality Assurance

S&ME, Inc. - Charleston: 620 Wando Park Boulevard, Mt. Pleasant, SC 29464			
S&ME Project #:	206150	Report Date:	2-3-21
Project Name:	Lynches River Industrial Park Roadways	Test Date(s):	1-29-21
Client Name:	Aliance Consulting Engineers, Inc.		
Client Address:	PO Box 8147, Columbia, SC 29202		
Boring #:	B-2	Sample #:	BS-1
Location:	Offset:	Sample Date:	1/16/2021
Sample Description:	Reddish brown, clay (CL)		

Maximum Dry Density 102.7 PCF. Optimum Moisture Content 16.5%


ASTM D 698 - - Method A



Soil Properties
Natural Moisture Content Specific Gravity of Soil
Liquid Limit Plastic Limit Plastic Index
% Passing
3/4" #4 #10 #20 #40 #60 #100 #200
Oversize Fraction
Bulk Gravity % Moisture % Oversize MDD Opt. MC

Moisture-Density Curve Displayed: Fine Fraction Corrected for Oversize Fraction (ASTM D 4718)
 Sieve Size used to separate the Oversize Fraction: #4 Sieve 3/8 inch Sieve 3/4 inch Sieve
 Mechanical Rammer Manual Rammer Moist Preparation Dry Preparation

References / Comments / Deviations:

Jeff Smith  Lab Manager 2/3/2021
 Technical Responsibility Signature Position Date
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MATERIAL FINER THAN THE #200 SIEVE



ASTM D1140

S&ME, Inc. - Charleston: 620 Wando Park Boulevard, Mt. Pleasant, SC 29464

Project #:	206150	Report Date:	2-3-21
Project Name:	Lynches River Industrial Park Roadways	Test Date(s):	1-25-21
Client Name:	Aliliance Consulting Engineers, Inc.		
Client Address:	PO Box 8147, Columbia, SC 29202		
Sample by:	Southern Drill, Inc.	Sample Dates:	1-16-21
Sampling Method:	Drill Rig :		

Boring No.	B-2	Sample No.	BS-1	Sample Depth:	0 to 5.0 FT
Sample Description Reddish brown, clay (CL)					
<input type="checkbox"/>	Auxiliary	#200 Wash	Method A	<input type="checkbox"/>	Method B <input type="checkbox"/>
	Tare #:	86	Soaked	<input checked="" type="checkbox"/>	Soak Time 24 hrs.
	Tare Wt. (T)	60.97	Original Dry Mass of Sample (B)		240.84
	Wet Wt + T	363.89	After 200 Wash + Tare Wt. (C _T)		112.18
	Dry Wt + T	301.81	Dry Mass Retained on #200 Sieve (C)		51.21
	Moisture Content (MC)	25.8%	% Passing #200 Sieve (A)		78.7%

Boring No.		Sample No.		Sample Depth:	
Sample Description					
<input type="checkbox"/>	Auxiliary	#200 Wash	Method A	<input checked="" type="checkbox"/>	Method B <input type="checkbox"/>
	Tare #:		Soaked	<input type="checkbox"/>	Soak Time 24 hrs.
	Tare Wt. (T)		Original Dry Mass of Sample (B)		
	Wet Wt (W) + T		After 200 Wash + Tare Wt. (C _T)		
	Dry Wt (D) + T		Dry Mass Retained on #200 Sieve (C)		
	Moisture Content (MC)		% Passing #200 Sieve (A)		

Boring No.	B-043	Sample No.		Sample Depth:	
Sample Description					
<input type="checkbox"/>	Auxiliary	#200 Wash	Method A	<input type="checkbox"/>	Method B <input type="checkbox"/>
	Tare #:		Soaked	<input type="checkbox"/>	Soak Time 24 hrs.
	Tare Wt. (T)		Original Dry Mass of Sample (B)		
	Wet Wt (W) + T		After 200 Wash + Tare Wt. (C _T)		
	Dry Wt (D) + T		Dry Mass Retained on #200 Sieve (C)		
	Moisture Content (MC)		% Passing #200 Sieve (A)		

Balance ID. 06976 Calibration Date: 1/7/21 #200 Sieve 10712 Calibration Date: 12/7/20

Notes / Deviations / References:

Kim Gonzalez
Technician Name

Signature

Nicet II
Certification Type/No.

2/3/2021
Date

Jeff Smith
Technical Responsibility

Signature

Lab Manager
Position

2/3/2021
Date

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LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



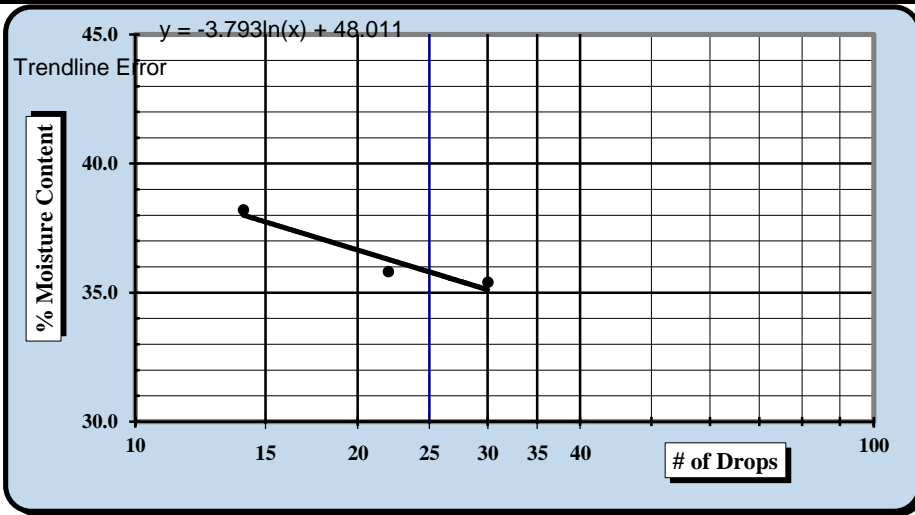
ASTM D 4318 AASHTO T 89 AASHTO T 90

S&ME, Inc. - Charleston: 620 Wando Park Boulevard, Mt. Pleasant, SC 29464

Project #:	206150	Report Date:	2-8-21
Project Name:	Lynches River Industrial Park Roadways	Test Date(s)	2-7-21
Client Name:	Alliance Consulting Engineers, Inc.		
Client Address:	PO Box 8147, Columbia, SC 29202		
Boring #:	B-2	Sample #:	BS-1
		Sample Date:	1-16-21
Location:	boring	Depth	0-5 ft

Sample Description: Reddish brown, Clay (CL)					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	6976	1/7/2020	Grooving tool	10659	7/31/2020
LL Apparatus	6238	7/31/2020	Grooving tool		
Oven	13796	8/3/2020	Grooving tool		

Pan #	Tare #:	Liquid Limit						Plastic Limit		
		1	2	3	4	5	6	7	8	9
A	Tare Weight	19.35	21.79	20.16				20.81	21.07	
B	Wet Soil Weight + A	37.99	41.79	44.77				28.70	26.56	
C	Dry Soil Weight + A	33.12	36.52	37.97				27.16	25.53	
D	Water Weight (B-C)	4.87	5.27	6.80				1.54	1.03	
E	Dry Soil Weight (C-A)	13.77	14.73	17.81				6.35	4.46	
F	% Moisture (D/E)*100	35.4%	35.8%	38.2%				24.3%	23.1%	
N	# OF DROPS	30	22	14						
LL	LL = F * FACTOR									
Ave.	Average							23.7%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	36
Plastic Limit	24
Plastic Index	12
Group Symbol	CL
Multipoint Method	<input checked="" type="checkbox"/>
One-point Method	<input type="checkbox"/>

Wet Preparation Dry Preparation Air Dried 10%

Notes / Deviations / References:

Kim Gonzalez
 Technician Name

2/8/2021
 Date

Jeff Smith
 Technical Responsibility

2/8/2021
 Date

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CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL



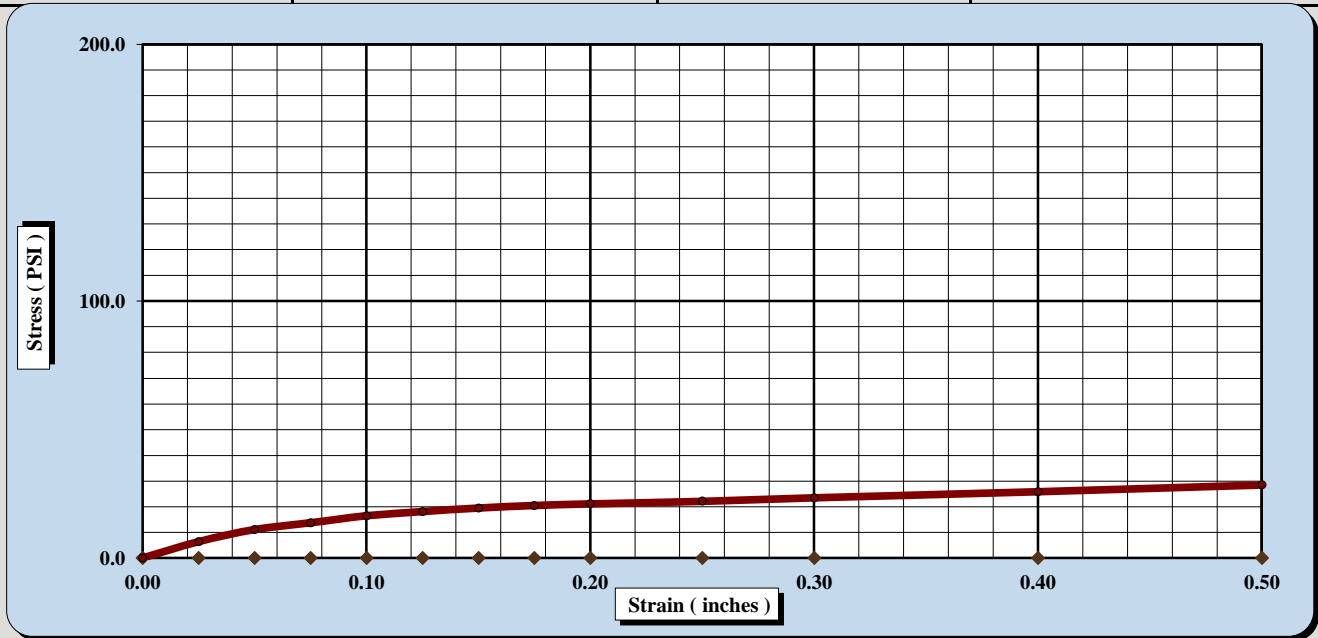
ASTM D 1883

S&ME, Inc. - Charleston: 620 Wando Park Boulevard, Mt. Pleasant, SC 29464

Project #:	206150	Report Date:	2-7-21
Project Name:	Lynches River Industrial Park Roadways	Test Date(s)	2-3-21
Client Name:	Alliance Consulting Engineers, Inc.		
Client Address:	PO Box 8147, Columbia, SC 29202	25 Blows	
Boring #:	B-2	Sample #:	BS-1
		Sample Date:	1-16-21
Location:	Offset: 25 Blows	Elevation: 0-5 ft	
Sample Description: Reddish brown. clay (CL)			

ASTM D 698 Method A Maximum Dry Density: 102.7 PCF Optimum Moisture Content: 16.5%
 Compaction Test performed on grading complying with CBR spec. % Retained on the 3/4" sieve: 0.0%

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in.	1.6	CBR at 0.2 in.	1.4



CBR Sample Preparation:

The replacement method was used and compacted in a 6" CBR mold in accordance with ASTM D1883, Section 6.1.1

Before Soaking		After Soaking	
Compactive Effort (Blows per Layer)	25	Final Dry Density (PCF)	92.0
Initial Dry Density (PCF)	93.1	Moisture Content (top 1" after soaking)	25.7%
Moisture Content of the Compacted Specimen	16.8%	Percent Swell	0.7%
Percent Compaction	90.7%		

Soak Time: 96 hrs.	Surcharge Weight 10.0	Surcharge Wt. per sq. Ft. 51.0	
Liquid Limit 36	Plastic Index 12	Apparent Relative Density 2.750	

Notes/Deviations/References:

Jeff Smith
Technical Responsibility

Signature

Lab Manager
Position

2/7/2021
Date

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CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL



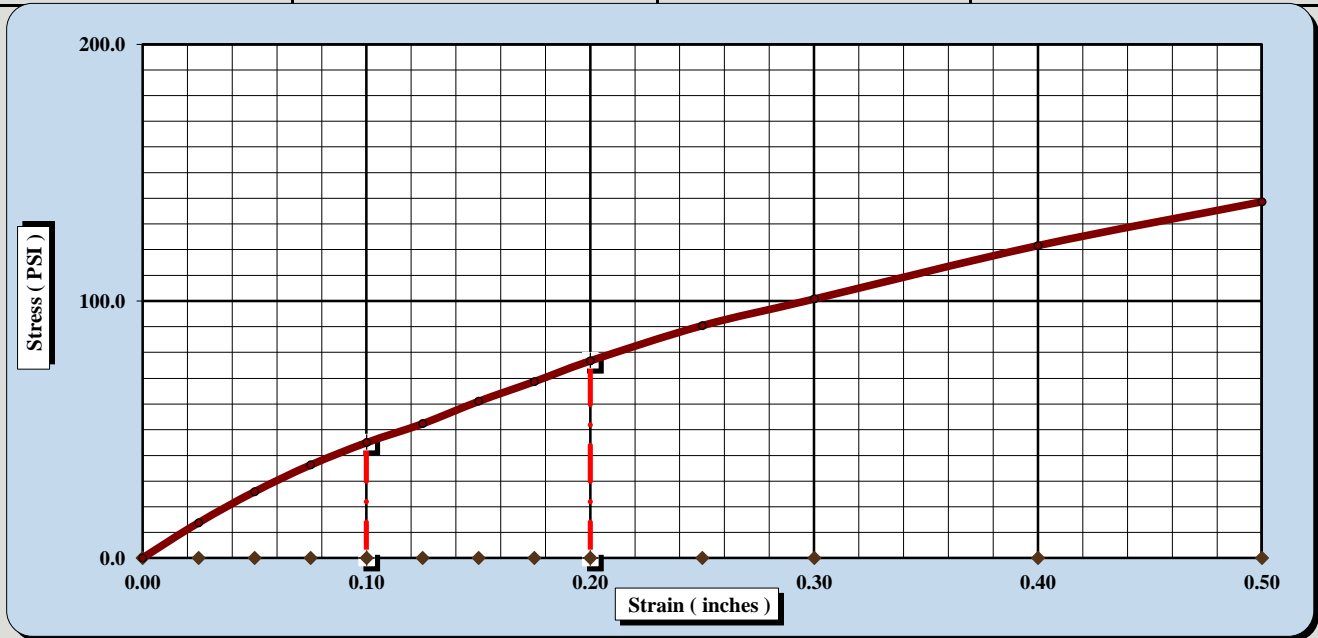
ASTM D 1883

S&ME, Inc. - Florence: 2327 Prosperity Way, Suite 9, Florence, SC 29501

Project #:	206150	Report Date:	2-7-21
Project Name:	Lynches River Industrial Park Roadways	Test Date(s)	2-3-21
Client Name:	Alliance Consulting Engineers, Inc.	56 BLOWS	
Client Address:	PO Box 8147, Columbia, SC 29202		
Boring #:	B-2	Sample #:	BS-1
		Sample Date:	1-16-21
Location:		Offset:	Elevation: 0-5 ft
Sample Description: Reddish brown, clay (CL)			

ASTM D 698 Method A Maximum Dry Density: 102.7 PCF Optimum Moisture Content: 16.5%
 Compaction Test performed on grading complying with CBR spec. % Retained on the 3/4" sieve: 1.0%

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in.	4.5	CBR at 0.1 in.	4.5
		CBR at 0.2 in.	5.1



CBR Sample Preparation:

The entire gradation was used and compacted in a 6" CBR mold in accordance with

Before Soaking		After Soaking	
Compactive Effort (Blows per Layer)	56	Final Dry Density (PCF)	
Initial Dry Density (PCF)	100.1		101.2
Moisture Content of the Compacted Specimen	16.8%	Moisture Content (top 1" after soaking)	22.3%
Percent Compaction	97.4%	Percent Swell	0.7%

Soak Time: 96 hrs.	Surcharge Weight 10.0	Surcharge Wt. per sq. Ft. 51.2	
Liquid Limit 36	Plastic Index 12	Apparent Relative Density 2.750	

Notes/Deviations/References:

Jeff D. Smith

Technical Responsibility

Signature

Lab Manager

Position

2/7/2021

Date

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Summary of Laboratory Procedures

Recovered disturbed and undisturbed samples and the drillers' field logs were transported to the laboratory where they were examined by the geotechnical engineer. Selected samples representative of certain groups of soils were subjected to simple classification tests by hand or other simple means.

◆ Laboratory Tests of Soil

Examination of Split Spoon Soil Samples

Soil and rock samples and field boring records were reviewed in the laboratory by the geotechnical engineer. Soils were classified in general accordance with the visual-manual method described in ASTM D 2488, *Standard Practice for Description and Identification of Soils (Visual-Manual Method)*. The geotechnical engineer also prepared the final boring records enclosed with this report.

Moisture Content Testing of Soil Samples by Oven Drying

Moisture content was determined in general conformance with the methods outlined in ASTM D2216, "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil or Rock by Mass." This method is limited in scope to Group B, C, or D samples of earth materials which do not contain appreciable amounts of organic material, soluble solids such as salt or reactive solids such as cement. This method is also limited to samples which do not contain contamination.

A representative portion of the soil was divided from the sample using one of the methods described in Section 9 of ASTM D2216. The split portion was then placed in a drying oven and heated to approximately 110 degrees C overnight or until a constant mass was achieved after repetitive weighing. The moisture content of the soil was then computed as the mass of water removed from the sample by drying, divided by the mass of the sample dry, times 100 percent. No attempt was made to exclude any particular particle size from the portion split from the sample.

Liquid and Plastic Limits Testing

Atterberg limits of the soils was determined generally following the methods described by ASTM D4318, *Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils*. Albert Atterberg originally defined "limits of consistency" of fine grained soils in terms of their relative ease of deformation at various moisture contents. In current engineering usage, the liquid limit of a soil is defined as the moisture content, in percent, marking the upper limit of viscous flow and the boundary with a semi-liquid state. The plastic limit defines the lower limit of plastic behavior, above which a soil behaves plastically below which it retains its shape upon drying. The plasticity index (PI) is the range of water content over which a soil behaves plastically. Numerically, the PI is the difference between liquid limit and plastic limit values.

Representative portions of fine grained Group A, B, C, or D samples were prepared using the wet method described in Section 10.1 of ASTM D4318. The liquid limit of each sample was determined using the multipoint method (Method A) described in Section 11. The liquid limit is by definition the moisture content where 25 drops of a hand operated liquid limit device are required to close a standard width groove cut in a

soil sample placed in the device. After each test, the moisture content of the sample was adjusted and the sample replaced in the device. The test was repeated to provide a minimum of three widely spaced combinations of N versus moisture content. When plotted on semilog paper, the liquid limit moisture content was determined by straight line interpolation between the data points at N equals 25 blows.

The plastic limit was determined using the procedure described in Section 17 of ASTM D4318. A selected portion of the soil used in the liquid limit test was kneaded and rolled by hand until it could no longer be rolled to a 3.2 mm thread on a glass plate. This procedure was repeated until at least 6 grams of material was accumulated, at which point the moisture content was determined using the methods described in ASTM D2216.

Percent Fines Determination of Samples

A selected specimen of soils was washed over a No. 200 sieve after being thoroughly mixed and dried. This test was conducted in general accordance with ASTM D1140, *Standard Test Method for Amount of Material Finer Than the No. 200 Sieve*. Method A, using water to wash the sample through the sieve without soaking the sample for a prescribed period of time, was used and the percentage by weight of material washing through the sieve was deemed the "percent fines" or percent clay and silt fraction.

Compaction Tests of Soils Using Standard Effort

Soil placed as engineering fill is compacted to a dense state to obtain satisfactory engineering properties. Laboratory compaction tests provide the basis for determining the percent compaction and water content needed to achieve the required engineering properties, and for controlling construction to assure the required compaction and water contents are achieved. Test procedures generally followed those described by ASTM D698, *Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 lbf/ft³)*.

The relationship between water content and the dry unit weight is determined for soils compacted in either 4 or 6 inch diameter molds with a 5.5 lbf rammer dropped from a height of 12 inches, producing a compactive effort of 12,400 lbf/ft³. ASTM D 698 provides three alternative procedures depending on material gradation:

Method A (Shall be used if 20 percent or less by weight is retained on No. 4 sieve)

- ◆ All material passes No. 4 sieve size
- ◆ 4 inch diameter mold
- ◆ Soil in 3 layers with 25 blows per layer

Method B (Shall be used if 20 percent by weight is retained on the No. 4 sieve and 20 percent or less by weight is retained on the 3/8-inch sieve)

- ◆ All material passes 3/8 inch sieve
- ◆ 4 inch diameter mold
- ◆ Soil in 3 layers with 25 blows per layer

Method C (Shall be used if more than 20 percent by weight is retained on the 3/8-inch sieve and less than 30 percent is retained on the 3/4-inch sieve)

- ◆ All material passes $\frac{3}{4}$ inch sieve
- ◆ 6-inch diameter mold
- ◆ Soil in 3 layers with 56 blows per layer

Soil was compacted in the mold in three layers of approximately equal thickness, each compacted with either 25 or 56 blows of the rammer. After compaction of the sample in the mold, the resulting dry density and moisture content was determined and the procedure repeated. Separate soils were used for each sample point, adjusting the moisture content of the soil as described in Section 10.2 (Moist Preparation Method). The procedure was repeated for a sufficient number of water content values to allow the dry density vs. water content values to be plotted and the maximum dry density and optimum moisture content to be determined from the resulting curvilinear relationship.

Laboratory California Bearing Ratio Tests of Compacted Samples

This method is used to evaluate the potential strength of subgrade, subbase, and base course material, including recycled materials, for use in road and airfield pavements. Laboratory CBR tests were run in general accordance with the procedures laid out in ASTM D1883, *Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils*. Specimens were prepared in standard molds using three different levels of compactive effort within plus or minus 0.5 percent of the optimum moisture content value. While embedded in the compaction mold, each sample was inundated for a minimum period of 96 hours to achieve saturation. During inundation the specimen was surcharged by a weight approximating the anticipated weight of the pavement and base course layers. After removing the sample from the soaking bath, the soil was then sheared by jacking a piston having a cross sectional area of 3 square inches into the end surface of the specimen. The piston was jacked 0.5 inches into the specimen at a constant rate of 0.05 inches per minute.

The CBR is defined as the load required to penetrate a material to a predetermined depth, compared to the load required to penetrate a standard sample of crushed stone to the same depth. The CBR value was usually based on the load ratio for a penetration of 0.10 inches, after correcting the load-deflection curves for surface irregularities or upward concavity. However, where the calculated CBR for a penetration of 0.20 inches was greater than the result obtained for a penetration of 0.01 inches, the test was repeated by reversing the specimen and shearing the opposite end surface. Where the second test indicated a greater CBR at 0.20 inches penetration, the CBR for 0.20 inches penetration was used.

**SECTION 02 41 00
DEMOLITION**

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 01 70 00 - Execution Requirements.
- B. Section 31 10 00 – Site Preparation.
- C. Section 31 23 23.13 – Backfill and Compaction.
- D. Section 31 25 00 – Erosion and Sedimentation Controls.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 3. Provide, erect, and maintain temporary barriers and security devices.
 - 4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 5. Do not close or obstruct roadways or sidewalks without permit.
 - 6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until built elements to be salvaged or relocated have been removed.

- C. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.

3.02 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

3.03 MEASUREMENT AND PAYMENT

- A. Payment will be made for work under this Section per the Contractor's bid for the related items listed in Specification Section 00 41 00 Bid Form.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.
- B. Form Accessories.
- C. Expansion and Contraction Joints with Accessories.
- D. Water Stops

1.02 RELATED SECTIONS

- A. Section 03 30 00 - Cast-In-Place Concrete.

1.03 REFERENCES

- A. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary; American Concrete Institute International; 2011.
- C. ACI 347R - Guide to Formwork for Concrete; American Concrete Institute International; 2004.
- D. ACI 350R – Environmental engineering Concrete Structures; American Concrete institute International; 2004.
- E. ASME A17.1 - Safety Code for Elevators and Escalators; The American Society of Mechanical Engineers; 2010.
- F. PS 1 - Construction and Industrial Plywood; National Institute of Standards and Technology (Department of Commerce); 2012.
- G. AHA A135.4 (1995) Basic Hardboard
- H. ASTM A 1011/A 1011M (2003a) Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
- I. ASTM A 109/A 109M (2003) Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled
- J. ASTM A 167 (1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- K. ASTM A 480/A 480M (2003b) General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip
- L. ASTM C 919 (2002) Use of Sealants in Acoustical Applications
- M. ASTM C 920 (2008) Elastomeric Joint Sealants
- N. ASTM D 1751 (1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

CONCRETE FORMING AND ACCESSORIES

- O. ASTM D 1752 (1984; R 1996e1) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
- P. ASTM D 2628 (1991; R 1998) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
- Q. ASTM D 2835 (1989; R 1998) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements
- R. ASTM D 4 (1986; R 1998) Bitumen Content
- S. ASTM D 412 (1998a; R 2002e1) Vulcanized Rubber and Thermoplastic Elastomers – Tension
- T. ASTM D 471 (1998e1) Rubber Property - Effect of Liquids
- U. ASTM D 5249 (1995; R 2000) Backer Material for Use with Cold-and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
- V. ASTM D 5329 (1996) Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements
- W. COE CRD-C 513 (1974) Specifications for Rubber Waterstops
- X. COE CRD-C 572 (1974) Specifications for Polyvinylchloride Waterstops

1.04 DESIGN REQUIREMENTS

Formwork shall be designed in accordance with methodology of ACI 347 for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface, which meets the requirements of the class of finish specified in Section 03 30 00 CAST-IN-PLACE CONCRETE. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

1.05 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements
- B. Formwork - Drawings showing details of formwork, including dimensions of panel joints, supports, studding and shoring, and sequence of form and shoring removal. Manufacturer's recommendation on method and rate of application of form release agents.
- C. Samples of form ties and method of sealing form tie hole from transmission of water in hydraulic structures.
- D. Construction and Control Joints: Layout and location for each type.
- E. Manufacturer's literature, including safety data sheets, for preformed fillers and the lubricants used in their installation; field-molded sealants and primers (when required by sealant manufacturer); preformed compression seals and preformed control joints.
- F. Water Stops - Details of splices, method of securing and supporting water stop in forms to maintain proper orientation and location during concrete placement.
- G. Samples of all proposed waterstops this includes both PVC and hydrophilic waterstops.

1.06 QUALITY ASSURANCE

Design formwork under direct supervision of a Professional Structural Engineer experienced in design of concrete formwork and licensed in the State of South Carolina.

1.07 DELIVERY, STORAGE AND HANDLING

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

PART 2 PRODUCTS

2.01 WOOD FORM MATERIALS

- A. Form Materials: At the discretion of the Contractor.
- B. Softwood Plywood: PS 1, C Grade, Group 2.
- C. Softwood Plywood: PS 1, B-B High Density Concrete Form Overlay, Class I.
- D. Plywood: Douglas Fir species; solid one side grade; sound undamaged sheets with clean, true edges.
- E. Lumber: Straight, dressed on all sides, uniform width and thickness, free from knots, offsets, holes, dents, and other surface defects; with grade stamp clearly visible.

2.02 PREFABRICATED FORMS

- A. Manufacturers:
 - 1. Alabama Metal Industries Corporation; www.amico-online.com.
 - 2. Molded Fiber Glass Concrete Forms Co.
 - 3. Reward Wall Systems.
 - 4. SureVoid Products, Inc.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- C. Preformed Plastic Forms: Thermoplastic polystyrene form liner, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- D. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.
- E. Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, of sizes indicated.

2.03 FORMWORK ACCESSORIES

- A. Form Ties: Removable type, galvanized metal, fixed length, cone type, with waterproofing washer, 7/8 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.
- B. Water Stop Ties: For water-holding structures, basements, pipe galleries, and accessible spaces below finish grade, furnish 6-inch high polyvinylchloride waterstops. Polyvinylchloride waterstops for expansion joints shall be centerbulb type equal to No. 7C by W.R. Grace and Company, No. 9380LB by Sonneborn-Contech, RCB-6316 by BoMetals, Inc. or equal. Polyvinylchloride waterstops for construction joints shall be No. 3 by W.R. Grace and Company, No. 4316 by Sonneborn-Contech, FR-6316 by BoMetals, Inc., or equal, and as specified herein. Polyvinylchloride waterstops have the following properties:

Tensile Strength (ASTM D412)	2000 psi min.
Ultimate Elongation (ASTM D412)	350 Percent min.
Low Temperature Brittleness (ASTM D746)	(-)35 Degrees F.

Orient water stop perpendicular to tie and symmetrical about center of tie. Design ties to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.

- C. Form Release Agent: Material: Release agent shall not bond with, stain, or adversely affect concrete surfaces, and shall not impair subsequent treatment of concrete surfaces when applied to forms. A ready-to-use water based material formulated to reduce or eliminate surface imperfections, containing no mineral oil or organic solvents. Environmentally safe, meeting local, state, and federal regulation and can be used in potable water facilities.
- D. Corners: Filleted, rigid plastic type; 1 x 1 inch size; maximum possible lengths.
- E. Dovetail Anchor Slot: Stainless steel, 22 gage thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- F. Flashing Reglets: Stainless steel, 22 gage thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- G. Nails, Spikes, Lag Bolts, Through Bolts, and Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

2.04 CONTRACTION JOINT STRIPS

Contraction joint strips shall be, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

2.05 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be pre-formed material conforming to ASTM D 1751 or ASTM D 1752. Unless otherwise indicated, filler material shall be 10 mm 3/8 inch thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249.

2.06 SEALANT

- A. Preformed Polychloroprene Elastomeric Type ASTM D 2628.

- B. Two Component Polyurethane, Field-Molded Type ASTM C 920, Type M, Grade P or NS, Class 25, Use T for horizontal joints. Type M, Grade NS, Class 25, Use NT for vertical joints. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant and non-absorptive material type such as extruded butyl or polychloroprene rubber.

2.07 PVC WATERSTOPS FOR EXPANSION JOINTS

- A. Provide flexible PVC (polyvinyl chloride) waterstop as manufactured by Greenstreak, profile style number 732, FR-6316 by BoMetals or approved equal. This profile has a length of 6 inches, a thickness of 3/8 inch a bulb diameter of 7/8 inch, and rib dimension of 5/8 inch.
- B. The PVC waterstop shall be extruded from an elastomeric plastic material of which the basic resin is prime virgin polyvinyl chloride. The PVC compound shall not contain any scrapped or reclaimed material or pigment whatsoever.
- C. Performance Requirements as follows:

Property	Test Method	Required Limits
Water absorption	ASTM D 570	0.15% max
Tear Resistance	ASTM D 624	200 lb/in (35 kN/m) min.
Ultimate Elongation	ASTM D 638	350% min.
Tensile Strength	ASTM D 638	2000 psi (13.78 Mpa) min.
Low Temperature Brittleness	ASTM D 746	No Failure @ -35° F (-37° C)
Stiffness in Flexure	ASTM D 747	600 psi (4.13 Mpa) min.
Specific Gravity	ASTM D 792	1.45 max.
Hardness, Shore A	ASTM D 2240	79 +3
Tensile Strength after accelerated extraction	CRD-C 572	1850 psi (11.03 Mpa) min.
Elongation after accelerated extraction	CRD-C 572	300% min.
Effect of Alkalies after 7 days: Weight Change Hardness Change	CRD-C 572	between -0.10% / +0.25% +/- 5 points

2.08 HYDROPHILIC WATERSTOP FOR NON-MOVING CONTRACTION AND CONSTRUCTION JOINTS

- A. Provide hydrophilic rubber waterstop as supplied by Greenstreak, HYDROTITE profile style number CJ-1020-2K or approved equal. This profile has a width of 0.79 inches and a height of 0.39 inches.
- B. The waterstop shall be a combination of chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties.
- C. The waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete.
- D. Performance Requirements as follows:

Chloroprene Rubber

Property	Test Method	Required Limits
Tensile Strength	ASTM D 412	1300 PSI min.
Ultimate Elongation	ASTM D 412	400% min.
Hardness (Shore A)	ASTM D 2240	50 +/- 5
Tear Resistance	ASTM D 624	100 lb/inch min.

Modified Chloroprene (Hydrophilic) Rubber

Property	Test Method	Required Limits
Tensile Strength	ASTM D 412	350 PSI min.
Ultimate Elongation	ASTM D 412	600% min.
Hardness (Shore A)	ASTM D 2240	52 +/- 5
Tear Resistance	ASTM D 624	50 lb/inch
Expansion Ratio	Volumetric Change - Distilled Water at 70° F	3 to 1 min.

2.09 WATERSTOP ACCESSORIES

A. PVC Waterstops

1. Provide factory made waterstop fabrications for all changes of direction, intersections, and transitions leaving only straight butt joint splices for the field.
2. Provide hog rings or grommets spaced at 12 inches on center along length of waterstop.
3. Provide Teflon-coated thermostatically controlled waterstop splicing irons for field butt splices.

B. Hydrophilic Waterstops

1. Provide Greenstreak 7300 two-component epoxy gel or engineer approved equal to secure HYDROTITE to rough, wet (or dry) concrete.
2. Provide LEAKMASTER single-component hydrophilic sealant or engineer approved equal to secure HYDROTITE to rough, dry concrete.
3. Provide cyanacrylate adhesive (super glue) for all splices.

PART 3 EXECUTION

3.01 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval before framing openings in structural members that are not indicated on drawings.
- F. Provide fillet strips on external corners of beams, joists, columns, and walls. Fillet strips shall be placed in the forms.
- G. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
- H. Coordinate this section with other sections of work that require attachment of components to formwork.

- I. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from the Engineer before proceeding.

3.02 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.03 INSERTS, EMBEDDED PARTS AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
- B. Locate and set in place items that will be cast directly into concrete.
- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- D. Position recessed anchor slots for brick veneer masonry anchors to spacing and intervals.
- E. Install accessories in accordance with manufacturer's instructions so they are straight, level and plumb. Ensure items are not disturbed during concrete placement.
- F. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.
- G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.04 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
 1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
 2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.05 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301.
- B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.
- C. Camber slabs and beams 1/4 inch per 10 feet.

- D. Camber slabs and beams in accordance with ACI 301.

3.06 FIELD AND QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 45 29.
- B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.
- C. Do not reuse wood formwork more than three (3) times for concrete surfaces to be exposed to view. Do not patch formwork.

3.07 FORM REMOVAL

Forms shall be removed preventing injury to the concrete and ensuring the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least twenty-four (24) hours has elapsed since concrete placement. Supporting forms and shores shall not be removed from beams, floors and walls until the structural units are strong enough to carry their own weight and any other construction or natural loads. Supporting forms or shores shall not be removed before the concrete strength has reached seventy (70) percent of design strength, as determined by field cured cylinders or other approved methods. Job-cured test specimens shall demonstrate this strength, and by a structural analysis considering the proposed loads in relation to these test strengths and the strength of forming and shoring system. The job-cured test specimens for form removal purposes shall be provided in numbers as directed and shall be in addition to those required for concrete quality control. The specimens shall be removed from molds at the age of twenty-four (24) hours and shall receive, insofar as possible, the same curing and protection as the structures they represent.

3.08 CONTRACTION JOINTS

Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Joints shall be approximately 1/8 inch wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than 1 inch.

3.09 JOINT STRIPS

Strips shall be of the required dimensions and as long as practicable. After the first floating, the concrete shall be grooved with a tool at the joint locations. The strips shall be inserted in the groove and depressed until the top edge of the vertical surface is flush with the surface of the slab. The slab shall be floated and finished as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, the top portion of the strip shall be sawed out after the curing period to form a recess for sealer. The removable section of PVC or HIPS strips shall be discarded and the insert left in place. True alignment of the strips shall be maintained during insertion.

3.10 SAWED JOINTS

Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed.

3.11 EXPANSION JOINTS

Preformed expansion joint filler shall be used in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. The filler shall extend the full slab depth, unless otherwise indicated. The edges of the joint shall be neatly finished with an edging tool of 1/8 inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. The wood strip shall be removed after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. The groove shall be thoroughly cleaned of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust, which shall be blown out of the groove with oil-free compressed air.

3.12 JOINT SEALANT

Sawed contraction joints and expansion joints in slabs shall be filled with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material, which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant.

3.13 JOINTS WITH FIELD-MOLDED SEALANT

Joints shall not be sealed when the sealant material, ambient air, or concrete temperature is less than 4 degrees C, 40 degrees F. When the sealants are meant to reduce the sound transmission characteristics of interior walls, ceilings, and floors the guidance provided in ASTM C 919 shall be followed. Joints requiring a bond breaker shall be coated with curing compound or with bituminous paint. Bond breaker and back-up material shall be installed where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's Recommendations.

3.14 WATERSTOP INSTALLATION

A. PVC Waterstop

1. Field butt splices shall be heat fused welded using a Teflon covered thermostatically controlled waterstop splicing iron at approximately 380 degrees F. Follow approved manufacturer recommendations.
2. Lapping of waterstop, use of adhesives, or solvents shall not be allowed.
3. Center waterstop in joint and secure waterstop in correct position using hog rings or grommets spaced at 12" on centers along the length of the waterstop and wire tie to adjacent reinforcing steel.

B. Hydrophilic Waterstop

1. Cut coil ends square (or at proper angle for mitered corners) with shears or sharp blade to fit splices together without overlaps.
2. Splices shall be sealed using cyanoacrylate adhesive (super glue) and LEAKMASTER.
3. Seal watertight any exposed cells of HYDROTITE using LEAKMASTER.
4. Follow approved manufacturer recommendations.

C. Hydrophilic and PVC Intersections

1. Maintain continuity of waterstops at all intersections and transitions.
2. Joinery between PVC and HYDROTITE shall be sealed using LEAKMASTER.
3. Follow approved manufacturer recommendations.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

This section specifies cast-in place structural concrete.

1.02 RELATED SECTIONS

A. Section 03 10 00 - Concrete Forming and Accessories

1.03 REFERENCES

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2009).
- B. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete; American Concrete Institute International; 1998.
- C. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.
- D. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 1996.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 1989 (Reapproved 2000).
- F. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.
- G. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.
- H. ACI 308 - Standard Practice for Curing Concrete; American Concrete Institute International; 1992 (Reapproved 2008).
- I. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary; American Concrete Institute International; 2011.
- J. ACI 350R – Environmental Engineering Concrete Structures; American Concrete Institute International; 2006.
- K. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement; 1997.
- L. ASTM A 497 - Standard Specification for Steel Welded Wire fabric, Deformed, for Concrete Reinforcement; 1997.
- M. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 1996a.
- N. ASTM C 33 - Standard Specification for Concrete Aggregates; 1999a.
- O. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 1999.

- P. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete; 2000.
- Q. ASTM C 150 - Standard Specification for Portland Cement; 1999a.
- R. ASTM C 171 - Standard Specification for Sheet Materials for Curing Concrete; 1997a.
- S. ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 1994a.
- T. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete; 1998.
- U. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 1998a.
- V. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete; 1999a.
- W. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete; 1999.
- X. ASTM C 685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 1998a.
- Y. ASTM C 881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 1999.
- Z. ASTM C 1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 1999.
- AA. ASTM C 1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink); 1999.
- AB. ASTM E 1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers; 1996.

1.04 SUBMITTALS

- A. Concrete mixture proportions shall be determined by the Contractor and submitted for review. The concrete mixture quantities of all ingredients per cubic meter yard and nominal maximum coarse aggregate size that will be used in the manufacture of each quality of concrete shall be stated. Proportions shall indicate the mass of cement, pozzolan and ground granulated blast-furnace (GGBF) slag when used, and water; the mass of aggregates in a saturated surface-dry condition; and the quantities of admixtures. The submission shall be accompanied by test reports from a laboratory complying with ASTM C 1077 which show that proportions thus selected will produce concrete of the qualities indicated. No substitution shall be made in the source or type of materials used in the work without additional tests to show the quality of the new material and concrete are satisfactory.
- B. The curing medium and methods to be used shall be submitted for review and approval.
- C. If concrete is to be placed under cold-weather conditions, the proposed materials, methods, and protection shall be submitted for approval.
- D. If concrete is to be placed under hot-weather conditions, the proposed material and methods shall be submitted for review and approval.
- E. Aggregate quality tests shall be submitted at least 30 days prior to start of concrete placement.

- F. The results of the initial mixer uniformity tests shall be submitted at least 5 days prior to the initiation of placing.
- G. Cementitious materials, including cement and pozzolan, (and Ground Granulated Blast Furnace Slag) will be accepted on the basis of the manufacturer's certification of compliance, accompanied by mill test reports that materials meet the requirements of the specification under which they are furnished. Certification and mill test reports shall be from samples taken from the particular lot furnished. No cementitious materials shall be used until notice of acceptance has been given by the Contracting Officer. Cementitious material will be subject to check testing from samples obtained at the source, at transfer points, or at the project site, as scheduled by the Contracting Officer, and such sampling will be by or under the supervision of the Owner at its expense. Material not meeting specifications shall be promptly removed from the site of work.
- H. Air-Entraining Admixture shall be certified for compliance with all specification requirements.
- I. Other chemical admixtures shall be certified for compliance with all specification requirements.
- J. Epoxy Resin and Latex Bonding Compound shall be certified for compliance with all specification requirements.
- K. Descriptive literature of the Non-shrink Grout proposed for use shall be furnished together with a certificate from the manufacturer stating that it is suitable for the application or exposure for which it is being considered.

1.05 PRE-CONCRETE CONFERENCE

- A. General: At least fifteen (15) days prior to submittal of design mixes, conduct a meeting to review proposed methods of concrete construction to achieve the required results.
- B. Agenda: Includes but is not limited to:
 - 1. Submittals.
 - 2. Coordination of work.
 - 3. Availability of material.
 - 4. Concrete mix design including admixtures.
 - 5. Methods of placing, finishing, and curing.
 - 6. Finish criteria required to obtain required flatness and levelness.
 - 7. Timing of floor finish measurements.
 - 8. Material inspection and testing.
- C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; Resident Engineer; and Consulting Engineer.
- D. Minutes of the meeting: Contractor shall take minutes and type and distribute the minutes to attendees within five days of the meeting.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Portland Cement: ASTM C150 Type I, I-P, or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed five (5) percent.
- C. Coarse Aggregate: ASTM C33.
 - 1. Size #57
 - 2. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 789.
 - 3. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.
- D. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a No. 4 sieve, 10 percent maximum shall pass a No. 100 sieve.
- E. Mixing Water: Fresh, clean – potable or reclaimed.
- F. Admixtures:
 - 1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
 - 2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
 - 3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water.
 - 4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
 - 5. Air Entraining Admixture: ASTM C260.
 - 6. Calcium Nitrite corrosion inhibitor: ASTM C494 Type C.
 - 7. Concrete Waterproofing Admixture shall be included for the designated structures as specified in Section 07 16 16.
 - 8. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
 - 9. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.
- G. Expansion Joint Filler: ASTM D1751.

- H. Sheet Materials for Curing Concrete: ASTM C171.
- I. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye. Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.
- J. Non-Shrink Grout:
 - 1. ASTM C1107, pre-mixed, produce a compressive strength of at least 2500 psi at three days and 5000 psi at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a four (4) foot by four (4) foot base plate.
 - 2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent under an eighteen (18)-inch by thirty-six (36)-inch base plate.

2.02 CONCRETE MIX DESIGN

- A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318. The concrete compressive strength F_c' shall be 4,000 psi unless otherwise indicated on the drawings.
 - 1. If trial mixes are used, make a set of at least four (4) cylinders in accordance with ASTM C192 for test purposes from each trial mix; test two for compressive strength at seven (7) days and at twenty-eight (28) days.
 - 2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, fly ash, admixtures, weight of fine and coarse aggregate per cubic yard measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement -fly ash ratio, and consistency of each cylinder in terms of slump. Include dry unit weight of lightweight structural concrete.
 - 3. Prepare a curve showing relationship between water-cement-fly ash ratio at seven (7)-day and twenty-eight (28)-day compressive strengths. Plot each curve using at least three specimens.
 - 4. If the field experience method is used, submit complete standard deviation analysis.
- B. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of Resident Engineer or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement and fly ash, providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. Resident Engineer may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement and fly ash and approval of design mix.
- C. Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Fly ash may be substituted for up to twenty (20) percent of the minimum cement factor at option of Contractor, except fly ash may not be used in concrete designated as architectural concrete.

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

Concrete Strength	Water/Cement Ratio
Min. 28 Day Comp. Str. psi	Max. Water Cement Ratio
4000 ¹ .	0.45

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 1200 psi in excess of f'c.
- D. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

TABLE II - MAXIMUM SLUMP, INCHES

Type of Construction	Normal Concrete Weight
Reinforced Footings and Substructure Walls	3 inches
Slabs, Beams, Reinforced Walls, and Building Columns	4 inches

- E. Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-range-water-reducing admixture may have a maximum slump of 9 inches. The concrete shall arrive at the job site at a slump of two (2) inches to three (3) inches. This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.
- F. Air-Entrainment: Air-entrainment of normal weight concrete shall conform to Table III. Air-entrainment of lightweight structural concrete shall conform to Table IV. Determine air content by either ASTM C173 or ASTM C231.

TABLE III - TOTAL AIR CONTENT

Location	Air Content
Concrete Exposed to Weather	4.0% to 6.0%

- G. Concrete slabs placed at air temperatures below 50 degrees Fahrenheit use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).
- H. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. Air content as shown in Table III.
- I. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three (3) twenty-eight (28)-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 500 psi below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, Resident Engineer may require any one or any combination of the following corrective actions, at no additional cost to the Owner:

1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
2. Require additional curing and protection.
3. If five consecutive tests fall below ninety-five (95) percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, Resident Engineer may direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.
4. If strength of core drilled specimens falls below eighty-five (85) percent of minimum value given in Table I, Resident Engineer may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.
5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the Resident Engineer.

PART 3 EXECUTION

3.01 PREPARATION

A. Mixing

1. All concrete shall be ready-mixed concrete and shall be mixed and delivered in accordance with the requirements of "Specifications for Ready-Mixed Concrete", ASTM C94 and ACI 318 to produce concrete with the required strength, slump and air content.
2. The concrete producer shall furnish with each load of concrete a numbered delivery ticket showing name of Contractor, name and location of project, date and time batched, truck number, number of cubic yards in load, specified strength, slump, and mix design number.
3. In the event concrete is mixed at a central batching plant, the delivery shall be arranged so that intervals between batches are kept at a minimum, and in any event not more than thirty (30) minutes. Trucks shall be in first class condition and kept in constant rotation during delivery.
4. When concrete is delivered in a truck mixer or agitator, no water from the truck water system or elsewhere shall be added after the initial introduction of mixing water for the batch, except when on arrival at the job site the slump of the concrete is less than that specified. Such additional water to bring the slump within required limits shall be injected into the mixer, provided the maximum water-cement ratio specified is not exceeded. The drum or blades shall be turned an additional 30 revolutions or more at mixing speed until the concrete is within the proper slump limits.

- B.** Discharge of concrete after initial batching shall be completed within ninety (90) minutes, or before the drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates. In hot weather (as defined by ACI) the discharge of the concrete shall be completed within sixty (60) minutes.

- C. Maximum delivery temperature of concrete shall be 100°F. Minimum delivery temperature as follows:

Atmospheric Temperature	Minimum Concrete Temperature
30 degrees to 40 degrees F	60 degrees F
0 degrees to 30 degrees F	70 Degrees F

3.02 VAPOR BARRIER

- A. Except where membrane waterproofing is required, interior concrete slab on grade shall be placed on a continuous vapor barrier.
1. Vapor barrier joints lapped six (6) inches and sealed with compatible waterproof pressure-sensitive tape.
 2. Patch punctures and tears.

3.03 CONSTRUCTION JOINTS

- A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 95 feet in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow forty-eight (48) hours to elapse between pouring adjacent sections unless this requirement is waived by Resident Engineer.
- B. Locate construction joints in suspended floors near the quarter-point of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder shall be offset a distance equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.
- C. Place concrete for columns slowly and in one operation between joints. Install joints in concrete columns at underside of deepest beam or girder framing into column.
- D. Allow two (2) hours to elapse after column is cast before concrete of supported beam, girder or slab is placed. Place girders, beams, grade beams, column capitals, brackets, and haunches at the same time as slab unless otherwise shown.
- E. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal. Waterstops selection shall be defined in specification section 03 10 00.

3.04 EXPANSION JOINTS

- A. Clean expansion joint surfaces before installing pre-molded filler and placing adjacent concrete.
- B. Where indicated install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal and as specified in Section 03 10 00.

3.05 PLACING CONCRETE

- A. Preparation:
1. Remove hardened concrete, wood chips, shavings and other debris from forms.
 2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.

3. Have forms and reinforcement inspected and approved by Resident Engineer before depositing concrete.
 4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.
- B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.
1. Preparing surface for applied topping:
 - a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
 - b. Broom clean and keep base slab wet for at least four hours before topping is applied.
 - c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.
- C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete subject to approval of Resident Engineer.
- D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.
1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
 2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.
 3. Do not drop concrete freely more than 10 feet for concrete containing the high-range water-reducing admixture (superplasticizer) or 5 feet for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
 4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 20 inches in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
 5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after its initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
 6. On bottom of members with severe congestion of reinforcement, deposit 1 inch layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.

7. Concrete on metal deck:
 - a. Concrete on metal deck shall be minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.
- E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 18 inch intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.
 1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
 2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

3.06 HOT WEATHER

- A. Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer.

3.07 COLD WEATHER

- A. Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by Resident Engineer.

3.08 PROTECTION AND CURING

- A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least seven (7) days after placing, except wet curing period for high-early-strength concrete shall be not less than three (3) days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by Resident Engineer.
 1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage 400 square feet per gallon on steel troweled surfaces and 300 square feet per gallon on floated or broomed surfaces for the curing/sealing compound.
 2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets two (2) inches. Tightly seal joints with tape.

3. Paper: Utilize widest practical width paper and overlap adjacent sheets two (2) inches. Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

3.09 REMOVAL OF FORMS

- A. Remove in a manner to assure complete safety of structure after the following conditions have been met.
 1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after twenty-four (24) hours, provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.
 2. Take particular care in removing forms of Architectural exposed concrete to ensure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.
- B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least seventy (70) percent of minimum twenty-eight (28)-day compressive strength specified. For post-tensioned systems supporting forms and shoring not removed until stressing is completed. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

3.10 CONCRETE SURFACE PREPARATION

- A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.
- B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland cement as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than one (1) inch. Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least six (6) inches surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately one (1) hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.
- C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

3.11 CONCRETE SLAB FINISHES

A. General

1. Finish slab concrete per the requirements of ACI 302.1R.
2. Use manual screeds, vibrating screeds, or roller compacting screeds to place concrete level and smooth.
3. Do not use "jitterbugs" or other special tools designed for purpose of forcing coarse aggregate away from surface and allowing layer of mortar, which will be weak and cause surface cracks or delamination, to accumulate.
4. Do not dust surfaces with dry materials.
5. Round off edges of slabs with steel edging tool, except where cove finish is shown. Steel edging tool radius shall be 1/4 inch for slabs subject to wheeled traffic.

B. Type S-1 (Bull Float Finish):

1. Finish slab to receive fill and mortar setting bed by screeding with straightedges to bring surface to required finish plane.
2. Wood float finish to compact and seal surface.
3. Remove laitance and leave surface clean.
4. Coordinate with other finish procedures.

C. Type S-2 (Steel Troweled Finish):

1. Finish by screeding and floating with straightedges to bring surfaces to required finish elevation. Use evaporation retardant.
2. While concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, wood float to true, even plane with no coarse aggregate visible.
3. Use sufficient pressure on wood floats to bring moisture to surface.
4. After surface moisture has disappeared, hand trowel concrete to produce smooth, impervious surface, free from trowel marks.
5. Burnish surface with an additional troweling. Final troweling shall produce ringing sound from trowel.
6. Do not use dry cement or additional water during troweling, nor will excessive troweling be permitted.
7. Power Finishing:
 - a. Approved power machine may be used in lieu of hand finishing in accordance with directions of machine manufacturer.
 - b. Do not use power machine when concrete has not attained necessary set to allow finishing without introducing high and low spots in slab.

D. Type S-4 (Broomed Finish):

1. Finish as specified for Type S-1 floor finish, except omit final troweling and finish surface by drawing fine-hair broom lightly across surface.
2. Broom in same direction and parallel to expansion joints, or, in the case of inclined slabs, perpendicular to slope, except for round roof slab, broom surface in radial direction.

3.12 CONCRETE SLAB TOLERANCES

- A. Concrete Thickness Tolerances shall be 3/8 inch greater or 1/4 inch less than specified as specified in ACI code section 117.
- B. Concrete Level Tolerances shall be F_{25} as defined in ACI code section 117 or 1/4 inch gap under an unlevelled ten (10) ft. straightedge.
- C. Slope slabs to floor drain and gutter, and shall adequately drain regardless of tolerances.

3.13 CONCRETE WALL FINISHES

A. Type W-1 (Ordinary Wall Finish):

1. Point & Patch tie holes.
2. Knock off projections.
3. Patch defective areas.

B. Type W-2 (Smooth Wall Finish):

1. Point & Patch tie holes.
2. Grind off projections, fins, and rough spots.
3. Patch defective areas and repair rough spots resulting from form release agent failure or other reasons to provide smooth uniform appearance.

C. Type W-4 (Smooth Rubbed Wall Finish):

1. Only water curing will be permitted on walls being rubbed.
2. Patch and repair defective areas as specified for Type W-2.
3. Perform rubbing while green concrete can be physically worked and smoothed without adding other materials, if structurally possible, the day following placement. Finish no later than three (3) days after placement has been completed.
4. Remove forms at such a rate that all finishing, form tie filling, fin removal, and patching can be completed on same day forms are removed while curing wall.
5. After pointings have set sufficiently to permit working on surface, thoroughly saturate entire surface with water for period of three (3) hours and rub until uniform surface is obtained.
6. Rub either by hand with carborundum stone of medium-coarse grade or abrasive of equal quality, or mechanically operated carborundum stone.

7. Mechanically operated carborundum stones shall be approved by Engineer before concrete finishing.
8. No cement grout, other than cement paste drawn from the concrete itself by the rubbing process shall be used.
9. Finish Paste Formed by Rubbing by Either Brushing or Floating as Follows:
 - a. Brushing:
 - i. Carefully strike with clean brush.
 - ii. Brush in long direction of surface being finished.
 - b. Floating:
 - i. Spread uniformly over surface and allow to reset.
 - ii. Finish by floating with canvas, carpet face, or cork float, or rub down with dry burlap.
10. Continue water curing of wall during finishing operation in areas not being rubbed.
11. Move water curing onto rubbed areas as soon as water will not erode rubbed surface.

D. Type W-5 (Cementitious water-proof coating)

1. Patch and repair defective areas as specified for Type W-2.
2. Substrate must be clean, sound, and free of surface contaminants. Remove dust, laitance, grease, oils, curing compounds, form release agents and all foreign particles by mechanical means. An open-textured, sandpaper-like substrate is ideal. Substrate shall be in accordance with ICRI Guideline No. 03732 for coatings and fall within CSP4. All surfaces must be saturated surface dry (SSD), with no standing water at time of application.
3. Apply cementitious water proof coating identified as Thoroseal by ChemRex, Inc., Sealcoat 1000 by Dayton Superior, SikaTop 144 by the Sika Corporation, or DRYLOK Basement & Masonry Waterproofer by UGL per the manufacturer's recommendations and as described below:
 - a. Thoroseal by ChemRex Inc.
 1. Prepare a mixing solution of 1 part Acryl 60 and 3 parts water.
 2. Mix one 50-pound bag of Thoroseal with 8 quarts of mixing solution from item 1 above.
 3. 1st coat shall be applied at a rate of 225 sq. feet per 50lb bag.
 4. 2nd coat shall be applied at a rate of 450 sq. feet per 50lb bag.
 - b. Sealcoat 1000 by Dayton Superior
 1. Prepare a mixing solution of 1 part Ad Bond (J-40) to 3 parts clean water.

2. Mix one 50lb bag of Sealcoat 1000 with 8 quarts of mixing solution from item 1 above.
 3. 1st coat shall be applied at a rate of 225 sq. feet per 50lb bag.
 4. 2nd coat shall be applied at a rate of 450 sq. feet per 50lb bag.
- c. Sikatop 144 by Sika Corporation
1. Mix components A and B at a 1:1.647 by weight ratio
 2. 1st coat 100 sq. feet per gallon
 3. 2nd coat 150 sq. feet per gallon
- d. DRYLOK Basement & Masonry Waterproofer by UGL
1. Add 2 pints of cold water for each 10 pounds (7 pints per 35 pound container) of DRYLOK Powdered Basement & Masonry Waterproofer
 2. Stir until mixture is free of lumps. Thin with an additional 2 pints (950 mL) of water for normal application or 1.5 pints (750 mL) of water for heavy applications.
 3. Wait for 15 minutes, restir and apply. Allow first coat to dry 12 to 24 hours drying time and repeat first coat procedures. Recommended film thickness per coat is a maximum of 15 wet mils per coat, 1.24 lbs/sq. yard.

3.14 CONCRETE WALL TOLERANCES

- A. Concrete Wall Tolerances shall be as defined in specification section "03 10 00 Concrete Forming and Accessories" and as indicated in ACI code section 301.

3.15 BEAM AND COLUMN FINISHES (B=Beam, C=Column)

- A. Type B-1: Match wall Type W-1.
- B. Type B-2: Match wall Type W-2.
- C. Type B-3: Match wall Type W-3
- D. Type B-4: Match wall Type W-4
- E. Type B-5: Match wall Type W-5
- F. Type C-1: Match wall Type W-1.
- G. Type C-2: Match wall Type W-2.
- H. Type C-3: Match wall Type W-3
- I. Type C-4: Match wall Type W-4
- J. Type C-5: Match wall Type W-5.

3.16 CONCRETE BEAM AND COLUMN TOLERANCES

- A. Concrete Beam and Column Tolerances shall be as defined in specification section "03 10 00 Concrete Forming and Accessories" and as indicated in ACI code section 301.

3.17 BACKFILL AGAINST WALLS

- A. Do not backfill against walls until concrete has obtained specified twenty-eight (28)-day compressive strength.
- B. Place backfill simultaneously on both sides of wall, where required, to prevent differential pressures.

3.18 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- E. Compressive Strength Tests: ASTM C39/C39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.
- F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
- H. Concrete cylinder tests:
 - 1. During construction, prepare test cylinders for compressive strength testing, using six (6)-inch diameter by twelve (12)-inches long single use molds, complying with ASTM C31.
 - a. Make a set of three test cylinders from each pour of fifty (50) cubic yards or less, plus one additional set of cylinders for each additional fifty (50) cubic yards or fraction thereof.
 - b. Identify each and tag cylinder as to date of pour and location of concrete which it represents.
 - c. Deliver cylinders to testing lab selected by the Owner.
 - d. Cost for preparation and delivery of cylinders shall be borne by the Contractor. Cost for testing cylinders will be borne by the Owner.
 - 2. Should strengths shown by test cylinders fail to meet specified strengths for the concrete represented, then:
 - a. Engineer shall have the right to require changes in the mix proportions as he deems necessary on the remainder of the work.

- b. Additional curing of those portions of the structure represented by the failed test cylinders shall be accomplished as directed by the Engineer.
 - c. Upon failure of the additional curing to bring the concrete up to specified strength requirements, strengthening or replacement of those portions of the structure shall be as directed by the Engineer.
 - d. The Engineer may require additional testing of concrete in question by either non-destructive methods such as the Swiss Hammer, Windsor Probe or Ultrasonics or by coring and testing the concrete in question in accordance with ASTM C42. Such testing shall be performed at no additional cost to the Owner.
- I. Other field concrete tests:
 - 1. Slump tests: Either the Engineer or a testing laboratory representative will make slump tests of concrete as it is discharged from the mixer.
 - a. Slump test may be made on any concrete batch at the discretion of the Engineer.
 - b. Failure to meet specified slump requirements (prior to addition of any superplasticizers) will be cause for rejection of the concrete.
 - 2. Temperature: The concrete temperature may be checked at the discretion of the Engineer.
 - 3. Entrained air: Air content of the concrete will be checked by a representative of the testing laboratory at the discretion of the Engineer.
- J. Coordination of laboratory services: The Contractor shall be responsible for coordination of laboratory services.
 - 1. Maintain a log recording quantities of each type of concrete placed, date and location of pour.
 - 2. Inform the testing laboratory of locations and dates of concrete placement and other information as required to be identified in the laboratory's test reports.
- K. Tests required because of extensive honeycombing, poor consolidation of the concrete or any suspected deficiency in the concrete will be paid for by the Contractor.
- L. Dimensional tolerances:
 - 1. Dimensional tolerances for allowable variations from dimensions or locations of concrete work, including the locations of embedded items shall be as given in ACI 301.
 - 2. Where anchor bolts or other embedded items are required for equipment installation, comply with the manufacturer's tolerances if more stringent than those stated in ACI 301.

- M. Watertight concrete:
1. All liquid containing structures, basements or pits below grade shall be watertight.
 2. Any visible leakage or seepage shall be repaired as instructed by the Engineer at no expense to the Owner.
 3. Where physical evidence of honeycombing, cold joints or other deficiencies which may impair the watertightness of a structure exists, the Engineer may at his discretion call for leak testing of the structure.
 - a. Fill the structure with water and allow to stand for not less than forty-eight (48) hours.
 - b. Make repairs on the structure until all visible leaks are sealed and the leakage rate of the water in the structure is less than 0.1-percent of the volume held in the structure per day.
 - c. The cost of testing and repairs shall be performed at no expense to the Owner.
- N. Concrete which fails to meet strength requirements, dimensional tolerances, watertightness criteria, or is otherwise deficient due to insufficient curing, improper consolidation or physical damage shall be replaced or repaired as instructed by the Engineer at no expense to the Owner.

3.19 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Owner and within twenty-four (24) hours of test.
- B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Engineer. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

3.20 MEASUREMENT AND PAYMENT

- A. Payment will be made for work under this Section per the Contractor's bid for the related items listed in Specification Section 00 41 00 Bid Form.

END OF SECTION

SECTION 03 40 00
PRECAST CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Lintels and bond beams.
- B. Wetwells
- C. Utility Vaults
- D. Manholes
- E. Headwalls

1.02 RELATED SECTIONS

- A. 03 30 00 - Cast-In Place Concrete

1.03 REFERENCES

- A. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary; American Concrete Institute International; 2014.
- B. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 1997a.
- C. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 1998.
- D. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement; 1997.
- E. ASTM A 416/A 416M - Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete; 1998.
- F. ASTM A 497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement; 1997
- G. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 1996a.
- H. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 1999.
- I. ASTM A 767/A 767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 1997.
- J. ASTM C 150 - Standard Specification for Portland Cement; 1999a.
- K. AWS D1.1 - Structural Welding Code - Steel; American Welding Society; 2000.
- L. AWS D1.4 - Structural Welding Code - Reinforcing Steel; American Welding Society; 1998.
- M. PCI MNL-116S - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products; Precast/Prestressed Concrete Institute; 2013, Tenth Edition.

- N. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete; Precast/Prestressed Concrete Institute; 1999.
- O. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete; Precast/Prestressed Concrete Institute; 1988, Second Edition.

1.04 DESIGN REQUIREMENTS

- A. Size components to withstand design loads in a restrained condition as follows:
 - 1. Horizontal Assembly: 150 psf live and dead loads.
 - 2. Vertical Assembly: 20 psf wind load.
 - 3. As shown on the drawings.
- B. Maximum Allowable Deflection: 1/180 span.
- C. Design members exposed to the weather to provide for movement of components without damage, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to seasonal or cyclic day/night temperature ranges.
- D. Design system to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.
- E. Shall be manufactured in accordance with Prestressed Concrete Institute's Manual 116 Manual for quality control for plans and production of Precast, prestressed concrete products and SC D.O.T. Standard Specifications.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate standard component configurations, design loads, deflections, cambers, and bearing requirements.
- C. Shop Drawings: Indicate layout, unit locations, fabrication details, unit identification marks, reinforcement, connection details, support items, dimensions, openings, and relationship to adjacent materials. Indicate design loads, deflections, cambers, bearing requirements, and special conditions.
- D. Samples: Submit two panels, 24 x 24 inches (610 x 610 mm) in size, illustrating surface finish treatment.
- E. Design Data: Submit design data reports indicating calculations for loadings and stresses of fabricated, designed framing.

1.06 QUALITY ASSURANCE

- A. Perform work of this section in accordance with requirements of PCI MNL-116S, PCI MNL-120, and PCI MNL-123.
- B. Fabricator Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- C. Erector Qualifications: Company specializing in erecting products of this section with minimum five (5) years of documented experience.

- D. Design precast concrete members under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in the State of South Carolina.
- E. Welder: Qualified within previous 12 months in accordance with AWS D1.1 and AWS D1.4.

1.07 REGULATORY REQUIREMENTS

Conform to ACI 318 for design load and construction requirements applicable to work of this section.

1.08 PRE-INSTALLATION MEETING

- A. Convene a pre-installation conference one week prior to commencing work of this section.
- B. Instruct others when field cutting of required openings are 10 inches (254 mm) and smaller.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Handle precast members in position consistent with their shape and design. Lift and support only from support points.
- B. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.
- C. Protect members to prevent staining, chipping, or spalling of concrete.
- D. Mark each member with date of production and final position in structure.

1.10 PROJECT/SITE CONDITIONS

Coordinate the work of framing components not pre-tensioned but associated with the work of this section.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Precast Concrete:
 - 1. Sherman Precast.
 - 2. Tindall Concrete Products.
 - 3. Hanson
 - 4. Approved Equal.

2.02 MATERIALS

- A. Cement: White Portland, conforming to ASTM C 150, Type I.
- B. Aggregate, Sand, Water, Admixtures: Determined by precast fabricator as appropriate to design requirements and PCI MNL-116S.

2.03 REINFORCEMENT

- A. Tensioning Steel Tendons: ASTM A 416/A 416M, Grade 250 (1725); seven-wire stranded steel cable; low-relaxation type; full length without splices; uncoated.

- B. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420).
 - 1. Plain billet-steel bars.
 - 2. Unfinished.
 - 3. Shop fabricated and bent cold.
- C. Welded Steel Wire Fabric: ASTM A 185 plain type; in flat sheets; unfinished.

2.04 ACCESSORIES

- A. Connecting and Supporting Devices: Plates, angles, items cast into concrete, and inserts conforming to PCI MNL-123, and as follows:
 - 1. Material: Carbon steel conforming to ASTM A 36/A 36M.
 - 2. Finish: Prime painted, except where device surfaces will be in contact with concrete or will require field welding.
- B. Grout:
 - 1. Non-shrink, non-metallic, minimum yield strength of 10,000 psi (69 MPa) at 28 days.
 - 2. Epoxy.
- C. Bearing Pads: High density plastic, Vulcanized elastomeric compound molded to size, Neoprene (Chloroprene), or Tetrafluoroethylene (TFE); Shore A Durometer; 1/8 inch (3 mm) thick, smooth both sides.
- D. Bolts, Nuts and Washers: High strength steel type recommended for structural steel joints.

2.05 FABRICATION

- A. Fabrication procedure to conform to PCI MNL-116S.
- B. Maintain plant records and quality control program during production of precast members. Make records available upon request.
- C. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are embedded and located as indicated on shop drawings.
- D. Tension reinforcement tendons as required to achieve design load criteria.
- E. Provide required openings with a dimension larger than 10 inches (250 mm) and embed accessories provided under other sections of the specifications, at indicated locations.

2.06 FINISHES

- A. Ensure exposed-to-view finish surfaces of precast concrete members are uniform in color and appearance.
- B. Cure members under identical conditions to develop required concrete quality, and minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
- C. Architectural Finish: Surface holes or bubbles over 1/4 inch (6 mm) filled with matching cementitious paste, fins or protrusions removed and surface ground smooth.

- D. Precast manufacturer shall coat inside of all wet well structures and receiving manholes (manhole force main discharges into) with two-component, self-priming, chemically cured, coal tar epoxy protective coating.

2.07 FABRICATION TOLERANCES

- A. Conform to PCI MNL-116S.
- B. Maximum Variation from Nominal Dimension: 1 inch (25 mm).
- C. Maximum Variation from Intended Camber: 5/8 inch (15 mm).
- D. Maximum Out of Square: 1/8 inch/10 feet (3 mm/3 m), non-cumulative.
- E. Maximum Misalignment of Anchors, Inserts, Openings: 1/8 inch (3 mm).
- F. Maximum Bowing of Members: Length of Bow/ 360.

2.08 SOURCE QUALITY CONTROL AND TESTS

- A. Section 01 40 00 - Quality Requirements: Provide mix design for concrete.
- B. Test samples in accordance with applicable ASTM standard.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that site conditions are ready to receive work and field measurements are as shown on shop drawings.

3.02 PREPARATION

- A. Prepare support equipment for the erection procedure, temporary bracing, and induced loads during erection.

3.03 WETWELLS, UTILITY VAULTS AND MANHOLES

- A. Concrete bases may be precast or cast-in-place. The concrete base of precast and cast-in-place structures shall be placed on an (eight) 8-inch No. 57 stone mat or as shown on the drawings. Each precast section shall have not more than two holes for the purpose of handling and laying. These holes shall be tapered and shall be plugged with rubber stoppers or mortar installation. Brick or concrete ring to support cover shall be a minimum of 3 inches high but not more than 18 inches high.
- B. Openings larger than 1-1/2 inches in diameter shall be precast into the appropriate section.
- C. Any openings added during construction shall be approved by the precast manufacturer and be formed by coring. No other method for adding holes will be considered.
- D. Joints of the precast sections shall be tongue and groove type. Sections shall be joined using O-ring rubber gaskets conforming to ASTM C443 or preformed mastic sealer. In addition, the joint shall be sealed inside and out with cement mortar using one part Portland cement to two parts clean sand meeting ASTM C144. The joints shall be watertight.
- E. Shaped bottoms shall be as shown on the drawings. They shall be constructed of one monolithic pour using 3000-psi concrete.

- F. Brickwork required to complete the precast concrete structures shall be constructed using mortar of one part Portland cement to two parts clean sand, meeting ASTM C144 and thoroughly mixed to a workable plastic consistency.
- G. Any damage to the coating during storage, handling, transportation or installation of the section shall be repaired immediately to provide complete coverage and protection per manufacturer's recommendations. Mortar joints shall receive two (2) coats of waterproofing after the section is installed and the mortar has set and dried.

3.04 ERECTION

- A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.
- B. Align and maintain uniform horizontal and vertical joints, as erection progresses.
- C. Maintain temporary bracing in place until final support is provided. Protect members from staining.
- D. Provide temporary lateral support to prevent bowing, twisting, or warping of members.
- E. Adjust differential camber between precast members to tolerance before final attachment.
- F. Install bearing pads.
- G. Level differential elevation of adjoining horizontal members with grout to maximum slope of 1:12.
- H. Set vertical units dry, without grout, attaining joint dimension with lead or plastic spacers.
- I. Grout underside of column bearing plates.
- J. Secure units in place. Perform welding in accordance with AWS D1.1.

3.05 ERECTION TOLERANCES

- A. Erect members level and plumb within allowable tolerances.
- B. Conform to PCI MNL-116S.
- C. Design and erect to the following tolerances:
 - 1. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch/10 feet and 3/8 inch in 100 feet (6 mm/3 m and 9 mm in 30 mm), non-cumulative.
 - 2. Maximum Offset from True Alignment between Members: 1/4 inch (6 mm).
 - 3. Maximum Variation from Dimensions Indicated on Reviewed Shop Drawings: Plus or minus 1/8 inch (3 mm).
- D. Exposed Joint Dimension: 3/8 inch (9 mm) plus or minus 1/4 inch (6 mm).
- E. When members cannot be adjusted to conform to design or tolerance criteria, cease work and advise the Engineer. Execute modifications as directed.

3.06 PROTECTION

- A. Protect members from damage caused by field welding or erection operations.

B. Provide non-combustible shields during welding operations.

3.07 CLEANING

Clean weld marks, dirt, or blemishes from surface of exposed members.

END OF SECTION

SECTION 31 00 00

EARTHWORK

PART 1 GENERAL

1.01 SCOPE

- A. This Section includes earthwork and related operations, including, but not limited to dewatering, excavating all classes of material encountered, pumping, draining and handling of water encountered in the excavations, handling, storage, transportation and disposal of all excavated and unsuitable material, construction of fills and embankments, backfilling around structures, compacting, all sheeting, shoring and bracing, preparation of subgrades, surfacing and grading and any other similar, incidental or appurtenant earthwork operations which may be necessary to properly complete the work.
- B. The Contractor shall provide all services, labor, materials and equipment required for all earthwork and related operations, necessary or convenient to the Contractor, for furnishing complete work as shown on the Drawings or specified in these Contract Documents.

1.02 RELATED SECTIONS

- A. Section 00 21 13 – Instructions to Bidders
- B. Section 01 45 29 – Testing Laboratory Services
- C. Section 31 10 00 - Site Preparation
- D. Section 31 22 00 – Grading
- E. Section 31 23 16 - Excavation
- F. Section 31 25 00 - Erosion and Sedimentation Control

1.03 GENERAL

- A. The elevations shown on the Drawings as existing are taken from the best existing data and are intended to give reasonably accurate information about the existing elevations. They are not precise and the Contractor shall become satisfied as to the exact quantities of excavation and fill required.
- B. Earthwork operations shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards.
- C. All excavated and filled areas for structures, trenches, fills, topsoil areas, embankments and channels shall be maintained by the Contractor in good condition at all times until final acceptance by the Owner. All damage caused by erosion or other construction operations shall be repaired by the Contractor using material of the same type as the damaged material.
- D. The Contractor shall control grading in a manner to prevent surface water from running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water can be uninterrupted in existing gutters, other surface drains, or temporary drains. Free access must be provided to all fire hydrants and meters.
- E. Tests for compaction and density shall be conducted by an independent testing laboratory selected in accordance with Section 01 45 29 of these Specifications.

1. The soils testing laboratory is responsible for the following:
 - a. Field compaction testing shall be based on using the maximum dry density determined by the Standard Proctor Compaction Test in accordance with ASTM D 698.
 - b. Determination of in-place backfill density shall be done in accordance with ASTM D 1556, "Density and unit weight of Soil In Place by the Sand-Cone Method", ASTM D 2937, "Density of Soil In Place by the Drive-Cylinder Method" or ASTM D 2922, "Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)".
 - c. Field density tests for each lift; one test for each 5,000 square feet of fill or minimum one test per lift.
 - d. Inspecting and testing stripped site, subgrades and proposed fill materials.
2. Contractor's duties relative to testing include:
 - a. Notifying laboratory of conditions requiring testing.
 - b. Coordinating with laboratory for field testing.
 - c. Providing representative fill soil samples to the laboratory for test purposes. Provide 50 pound samples of each fill soil.
3. Inspection
 - a. Earthwork operations, suitability of excavated materials for fill and backfill and placing and compaction of fill and backfill is subject to inspection. Engineer will observe earthwork operations.
 - b. Foundations and shallow spread footing foundations are required to be inspected by an engineer to verify suitable bearing and construction.

F. All earthwork operations shall comply with the requirements of OSHA Construction Standards, Part 1926, Subpart P, Excavations, Trenching and Shoring and Subpart O, Motor Vehicles, Mechanized Equipment and Marine Operations and shall be conducted in a manner acceptable to the Engineer.

G. It is understood and agreed that the Contractor has made a thorough investigation of the surface and subsurface conditions of the site and any special construction problems which might arise as a result of nearby watercourses and floodplains. The Contractor shall be responsible for providing all services, labor, equipment and materials necessary or convenient to the Contractor for completing the work within the time specified in these Contract Documents.

H. Safety

Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P "Excavation, Trenching & Shoring" as described in OSHA publication 2226.

PART 2 PRODUCTS

2.01 SOILS CLASSIFICATIONS

Bedding materials listed here include a number of processed materials plus the soil types defined according to the Unified Soil Classification System (USCS) in ASTM D 2487, Standard Method for Classification of Soils for Engineering Purposes. (See below for description of soil classification). These materials are grouped into five broad categories according to their suitability for this application:

- A. Class I - Angular, 1/4 to 1 1/2 inches (6 to 40 mm) graded stone, including such as coral, slag, cinders, crushed shells and crushed stone. Note - The size range and resulting high voids ratio of Class I material make it suitable for use to dewater trenches during pipe installation. This permeable characteristic dictates that its use be limited to locations where pipe support will not be lost by migration of other embedment materials into the Class I material. When such migration is possible, the material's minimum size range should be reduced to finer than 1/4 inch (6 mm) and the gradation properly designed to limit the size of the voids.
- B. Class II - Coarse sands and gravels with maximum particle size of 1 1/2 inch (40 mm), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW and SP are included in this class. Note - Sands and gravels which are clean or borderline between clean and with fines should be included. Coarse-grained soils with less than 12% but more than 5% fines are neglected in ASTM D2487 and the USCS and should be included. The gradation of Class II material influences its density and pipe support strength when loosely placed. The gradation of Class II material may be critical to the pipe support and stability of the foundation and embedment if the material is imported and is not native to the trench excavation. A gradation other than well graded, such as uniformly graded or gap graded, may permit loss of support by migration into void spaces of a finer grained natural material from the trench wall and foundation.
- C. Class III - Fine sand and clayey (clay filled) gravels, including fine sands, sand-clay mixtures and gravel-clay mixtures. Soil Types SM, GC, SM and SC are included in this class.
- D. Class IV - Silt, silty clays and clays, including inorganic clays and silts of not to high plasticity and liquid limits. Soil Types MH, ML, CH and CL are included in this class. Note- Caution should be used in the design and selection of the degree and method of compaction for Class IV soils because of the difficulty in properly controlling the moisture content under field conditions. Some Class IV soils with medium to high plasticity and with liquid limits greater than 50% (CH, MH, CH-MH) exhibit reduced strength when wet and should only be used for bedding, haunching and initial backfill in arid locations where the pipe embedment will not be saturated by ground water, rainfall and/or exfiltration from the pipeline system. Class IV soils with low to medium plasticity and with liquid limits lower than 50% (CL, ML, CL-ML) also require careful consideration in design and installation to control moisture content but need not be restricted in use to arid locations.
- E. Class V - This class includes the organic soils OL, OH and PT as well as soils containing frozen earth, debris, rocks larger than 1 1/2 inch (40 mm) in diameter and other foreign materials. These materials are not recommended for bedding, haunching or initial backfill.

DESCRIPTION OF EMBEDMENT MATERIAL CLASSIFICATIONS

SOIL CLASS	SOIL TYPE	DESCRIPTION MATERIAL CLASSIFICATION
Class I Soils *	---	Manufactured angular, granular material, 3/4 to 1-1/2 inches (6 to 40 mm) size, including materials having regional significance such as crushed stone, or rock, broken coral, crushed slag, cinders, or crushed shells.
Class II Soil **	GW	Well-graded gravels and gravel-sand mixtures, little or no fines. 50% or more retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
	GP	Poorly graded gravels and gravel-sand mixtures, little or no fines. 50% or more retained on No. 4 sieve. More than 95% retained on No. 200 sieve. Clean
	SW	Well-graded sands and gravelly sands, little or no fines. More than 50% passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
	SP	Poorly graded sands and gravelly sand, little or no fines. More than 50% passes No. 4 sieve. More than 95% retained on No. 200 sieve. Clean.
Class III Soil ***	GM	Silty gravels, gravel-sand-silt mixtures. 50% or more retained on No. 200 sieve.
	GC	Clayey gravels, gravel-sand-clay mixtures. 50% or more retained on No. 4 sieve. More than 50% retained on No. 200 sieve.
	SM	Silty sands, sand-silt mixtures. More than 50% passes No. 4 sieve. More than 50% retained on No. 200 sieve.
	SC	Clayey sands, sand-clay mixtures. More than 50% passes No. 4 sieve. More than 50% retained on No. 200 sieve.
Class IV Soils	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. Liquid limit 50% or less. 50% or more passes No. 200 sieve.
	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.
	CH	Inorganic clays of high plasticity, fat clays. Liquid limit greater than 50%. 50% or more passes No. 200 sieve.
Class V Soils	OL	Organic silts and organic silty clays of low plasticity. Liquid limit 50% or less. 50% or less. 50% or more passes No. 200 sieve.
	OH	Organic clays of medium to high plasticity. Liquid limit 50% or less. 50% or more passes No. 200 sieve.

PT Peat, muck and other highly organic soils.

* Soils defined as Class I materials are not defined in ASTM D2487.

** In accordance with ASTM D2487, less than 5% pass No. 200 sieve.

*** In accordance with ASTM D2487, more than 12% pass No. 200 sieve. Soils with 5% to 12% pass No. 200 sieve fall in borderline classification, e.g. GP-GC.

2.02 FILL MATERIAL

- A. Sand Fill: Material shall consist of a clean sand with a fineness modulus of 1.6 to 3.1 and containing not more than ten (10) percent by weight finer than No. 200 U.S. Standard Sieve.
- B. Earth Fill: Material shall consist of inorganic material free of roots, cobbles and boulders and classified as SM, ML, SC, or CL by ASTM D2487-85 "Standard Methods for Classification of Soils for Engineering Purposes". Earth Fill shall also conform to the following:
 - 1. Liquid Limit = 50 maximum
 - 2. Plasticity Index = 20 maximum
 - 3. Dry Unit Weight = 90 pcf minimum maximum density

2.03 UNSUITABLE SITE FILL MATERIAL

- A. Material which does not conform to the above classifications (soil classification SP, SW.GM, CH, MH, OH, OL and PT) may be used as Site Fill material in areas identified on the drawings as "spoil areas", in areas with no structures and or roads and other non-critical areas.

2.04 SHEETING, BRACING AND TIMBERING

- A. Sheeting, Bracing and Timbering: The Contractor shall furnish, place and maintain all sheeting, bracing and timbering required to properly support trenches and other excavations in open cut and to prevent all movement of the soil, pavement, structures, or utilities outside of the trench or pit.
 - 1. General
 - a. Cofferdams and bracing design, including computations, shall be prepared before commencing construction operations. Drawings and design computations shall be signed and sealed by a professional engineer registered in the State of South Carolina. The drawings and design computations shall be submitted to the Engineer for informational purposes only.
 - b. Sheeting, bracing and timbering shall be so placed as to allow the work to be constructed to the lines and grades shown on the Drawings and as ordered by the Engineer.
 - c. If at any time the method being used by the Contractor for supporting any material or structure in or adjacent to any excavation is not reasonably safe, the Contractor shall provide additional bracing and support necessary to furnish the added degree of safety.
 - d. All sheeting in contact with the concrete or masonry shall be cut off as directed by the Engineer and left in place.

2. Timber: Timber may be substituted for steel sheet piling when approved by the Engineer. Timber for shoring, sheeting or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations.
3. Steel Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations and/or live loads. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The Contractor shall provide closure and sealing between sheet piling and existing facilities. Steel piling shall be removed, unless otherwise directed by the Engineer.
4. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the structures and adjacent property. Leave sheeting in place when, in the opinion of the Engineer, it cannot be safely removed. Cut off sheeting left in place at least two feet below the surface.

2.05 FILTER FABRIC

- A. Filter fabric associated with bedding shall be a UV stabilized, spunbonded, continuous filament, needle punched, polypropylene, nonwoven geotextile.
- B. The fabric shall have an equivalent open size (EOS or AOS) of 120 - 70. The fabric shall also conform to the minimum property values listed in the following table:

Fabric Property	Unit	Test Procedure	Average Value	
			Typical	Minimum
Weight	oz/yd ²	ASTM D 3776	8.3	
Thickness	mils	ASTM D 1777	105	
Grab Strength	lbs.	ASTM D 4632	240	210
Grab Elongation	%	ASTM D 4632	>50	50
Tear Strength	lbs.	ASTM D 4533	100	85
Mullen Burst	psi	ASTM D 3786	350	320
Puncture Resistance	lbs.	ASTM D 4833	115	100
Permittivity	sec ⁻¹	ASTM D 4491	1.7	
Water Permeability	cm/sec	ASTM D 4491	0.4	
Water Flow Rate	gpm/ft ²	ASTM D 4491	120	
UV Resistance (500 hrs)	%	ASTM D 4355	>85	
PH			2 - 13	

- C. Filter fabric shall be Polyfelt TS 700, Trevira 1125, SuPac 7-MP or approved equal.

2.06 CONCRETE

Concrete for initial backfill or encasement shall have a compressive strength of not less than 3,000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

PART 3 EXECUTION

3.01 GENERAL

- A. Safety: Comply with local regulations and with the provisions of the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc., Occupational Safety and Health Act and all other applicable safety regulations.
- B. Topsoil
 - 1. Remove all topsoil to a depth at which subsoil is encountered, from all areas under buildings, pavements and from all areas which are to be cut to lower grades or filled.
 - 2. With the Engineer's approval, topsoil to be used for finish grading may be stored on the site.
 - 3. Other topsoil may be used for fill in non-critical areas with approval of the Engineer.
 - 4. Properly dispose of all excess topsoil in the designated area.
- C. Bracing and Sheeting
 - 1. Furnish, put in place and maintain all sheeting, bracing and shoring as may be required to properly support the sides of all excavations and to prevent all movement of earth which could in any way injure the work, adjacent property or workers.
 - 2. Properly support all excavations where necessary to conform to all pertinent rules and regulations and these Specifications, even though, such locations are not indicated on the Drawings.
 - 3. Exercise care in the removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of the excavation faces being supported and damage to the work and adjacent property.
 - 4. Do not leave any sheeting or bracing in the trench or excavation after completion of the work, unless approved by the Engineer.
- D. Obstructions
 - 1. Remove and dispose of all boulders, sidewalks, driveways, pavement, pipes and the like, as required for the performance of the work.
 - 2. Exercise care in excavating around catch basins, inlets and manholes so as to not disturb or damage these structures.
 - 3. Avoid removing or loosening castings or pushing dirt into catch basins, inlets and manholes.
 - 4. Damaged or displaced structures or casting shall be repaired, replaced and dirt entering the structures during the performance of the work shall be removed at no additional cost to the Owner.
- E. Utilities to be Abandoned
 - 1. When pipes, conduits, sewers, or other structures are removed from the trench, leaving dead ends in the ground, such ends shall be fully plugged or sealed with brick and non-shrink grout.

2. Abandoned structures such as manholes or chambers shall be entirely removed.
3. All materials from abandoned utilities shall be removed from the site.
4. All salvageable materials shall become the property of the Owner.
5. All equipment to be salvaged is noted in the Specifications and shall be turned over to the Owner at a designated location.

F. Extra Earth Excavation

1. In case soft or excessively wet material which, in the opinion of the Engineer, is not suitable, is encountered below the final subgrade elevation of an excavation or underneath a structure, the Engineer may order the removal of this material and its replacement with crushed stone, filter fabric, or other suitable material in order to make a suitable foundation for the construction of the structure.

G. Cutting Paved Surfaces and Similar Improvements

1. Remove existing pavement as necessary for installing pipe utilities and appurtenances or as otherwise shown on the Drawings.
2. Before removing any pavement, mark the pavement neatly, paralleling pipe lines and existing street lines. Space the marks the width of the trench.
3. Break asphalt pavement along the marks using rotary saws or other suitable tools. Break concrete pavement along the marks by use of scoring with a rotary saw and breaking below the score by the use of jackhammers or other suitable tools.
4. Do not pull pavement with machines until completely broken and separated from pavement to remain.
5. Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement. No additional payment will be made for removing and replacing damaged adjacent pavement.
6. Remove and replace sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.
7. The Contractor may tunnel under curbs that are encountered. Remove and replace any curb disturbed by construction to the nearest undisturbed joint.

3.02 EXCAVATION

A. Method

1. All excavation shall be by open cut from the surface except as indicated on the Drawings.
2. All excavations for pipe appurtenances and structures shall be made in such a manner and to such depth and width, as will give ample room for building the structures and for bracing, sheeting and supporting the sides of the excavation, for pumping and draining groundwater which may be encountered and for the removal from the excavation of all materials excavated.
3. Take special care so that the soil below the bottom of the structure to be built is left undisturbed.

- B. Grades: Excavate to grades indicated on the Drawings. Where excavation grades are not indicated on the Drawings, excavate as required to accommodate installation.
- C. Disposal of Excavated Material
 - 1. Remove and properly dispose of all excavated material not needed to complete filling, backfilling and grading.
 - 2. Dispose of excess earth and rock excavated materials at locations on-site designated by the Engineer. Off-site disposal of all other material shall be and in accordance with all requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or on any street. No debris shall be deposited on any private property, except by written consent of the property owner. In no case shall any material be shoved onto abutting private properties, or be buried in embankments or trenches on the Project.

3.03 EXCAVATING FOR STRUCTURES

- A. Earth Excavation: Earth excavation shall include all substances to be excavated other than rock. Earth excavation for structures shall be to limits not less than two feet outside wall lines, to allow for formwork and inspection and further as necessary to permit the trades to install their work. All materials loosened or disturbed by excavation shall be removed from surfaces to receive concrete or crushed stone.
- B. Excavation for Foundations: Footings and slabs on grades shall rest on undisturbed earth, rock or compacted materials to insure proper bearing.
 - 1. Unsuitable Foundation Material: Any material, in the opinion of the Engineer, which is unsuitable for foundation shall be removed and replaced with compacted crushed stone, or with compacted fill material as directed by the Engineer. No determination of unsuitability will be made until all requirements for dewatering are satisfactorily met.
 - 2. Pipe Trenches Beneath Structures: Where piping or conduit passes beneath footings or slabs resting on grade, trenches shall be excavated to provide a minimum 6-inch clearance from all surfaces of the pipe or conduit. The trench shall be backfilled to the base of the structure with concrete.
 - 3. Unauthorized Excavation: Care shall be taken that excavation does not extend below bottom levels of footings or slabs on earth. Should the excavation, through carelessness or neglect, be carried below such levels, the Contractor shall fill in the resulting excess excavation with concrete under footings and compacted crushed stone or other approved material under slabs. Should excavation be carried beyond outside lines of footings such excess excavation shall be filled with concrete, or formwork shall be provided, as directed by the Engineer.
- C. Unsuitable Bearing
 - 1. If suitable bearings for foundations are not encountered at the elevations indicated on the Drawings, immediately notify the Engineer.
 - 2. Do not proceed further until instructions are received.

3.04 DEWATERING REQUIREMENT

- A. The Contractor may use any dewatering method he deems feasible so long as it results in working in the dry and stable soil conditions.

- B. The Contractor shall conform and meet all conditions, obtain necessary permits and requirements of the regulatory agencies that have jurisdiction.
- C. It is the intent of these specifications that an adequate dewatering system be installed to lower and control the groundwater in order to permit excavation, construction, grading and the placement of fill materials, all to be performed under dry conditions. The dewatering system shall be adequate to pre-drain the water-bearing strata above and below the bottom of the excavation.
- D. The Contractor shall be solely responsible for the arrangement, location and depths of dewatering system necessary to accomplish the work described under this section of the specifications. The dewatering shall be accomplished in a manner that will reduce the hydrostatic head below any excavation to the extent that the water level in the construction area are a minimum of three (3) feet below the prevailing excavation surface and any surface to be compacted; will prevent the loss of fines, seepage, boils, quick conditions, or softening of the foundation strata; will maintain stability of the sides and bottom of the excavation; and will result in all construction operations being performed in the dry.
- E. The Contractor shall promptly dispose of all water removed from the excavations in such a manner as will not endanger public health, damage public or private property, or affect adversely any portion of the work under construction or completed by him or any other Contractor. Contractor shall obtain written permission from the Owner for any property involved before digging ditches or constructing water courses for the removal of water.
- F. The disposal of water from the dewatering system shall meet the requirements of all regulatory agencies having jurisdiction.
- G. If the dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system, then loosening of the foundation strata, or instability of the slopes, or damage to the foundations or structures may occur. The supply of all labor and materials and the performance of all work necessary to carry out additional work for reinstatement of the structures of foundation soil resulting from such inadequacy or failure shall be undertaken by the Contractor subject to the approval of the Engineer and at no additional expense to the Owner.

3.05 COMPACTION

- A. Fill materials supporting roadways, parking areas, sidewalks, structures and buildings and backfill around structures shall be compacted to ninety-five (95) percent of the standard proctor density. The top twelve (12)-inches of fill materials supporting structures or pavement shall be compacted to ninety-eight (98) percent of the standard proctor density. Fill placed for general site grading shall be compacted to ninety (90) percent of the standard proctor density.
- B. Compaction of embankments shall be by vibratory sheepsfoot or pad-foot rollers with staggered, uniformly spaced knobs and suitable cleaning devices. The projected area of each knob and the number and spacing of the knobs shall be such that the total weight of the roller and ballast when distributed over the area of one row of knobs shall be 250 psi. Placement and compaction of materials shall extend at least five (5) feet beyond the final contours sufficiently to insure compaction of the material at the resulting final surface. Final contours shall then be achieved by a tracked bulldozer shaping the face of the embankment.
- C. Compaction of backfill next to walls shall be accomplished with hand-powered tamping equipment. The backfill shall be placed in 8-inch maximum lifts, with each lift compacted to ninety-five (95) percent of standard proctor density.

- D. If tests indicate that density of fill is less than that specified, the area shall be, as directed by the Engineer, either recompacted or undercut, filled and compacted until specified density is achieved.
- 3.06 FILL**
- A. Controlled Fill
1. The fill for roadways, parking areas, walks, structures and building slabs on grade shall be controlled fill.
 2. After the existing ground or excavated area has been proofrolled and examined by the Engineer, all holes and other irregularities shall be filled and compacted before the main fill is placed.
 3. The fill shall be placed in even layers not exceeding eight (8)-inches in depth and shall be thoroughly compacted as herein specified.
 4. If an analysis of the soil being placed shows a marked difference from one location to another, the fill being placed shall not be made up of a mixture of these materials.
 5. Each different type of material shall be handled continuously so that field control of moisture and density may be based upon a known type of material.
 6. No fill shall be placed following a heavy rain without first making certain on isolated test areas that compaction can be obtained without damage to the already compacted fill.
- B. Proofrolling
1. All areas where roadways, parking areas, sidewalks, structures and buildings are to be constructed on cut areas, compacted fill and other areas where indicated on the Drawings, shall be proofrolled to detect soft spots prior to the placement of fill material or building foundations.
 2. Proofrolling shall be performed using a fully loaded tandem-axle dump truck 20 tons or other suitable pneumatic tired equipment over the subgrade before the subgrade is shaped.
 3. Proofrolling shall be witnessed by the Engineer.
 4. Subgrade shall be proofrolled with ten (10) overlapping passes of the roller. Depressions that develop during the proofrolling operation shall be filled with suitable material and those filled areas shall be proofrolled with six passes of the roller. If, after having been filled and proofrolled, the subgrade areas that still "pump" or "rut", shall be further evaluated by a geotechnical engineer and remedial work be determined based on the conditions found at locations under structures or pavement. The contractor shall execute remedial work determined by the geotechnical engineer to achieve a subgrade acceptable to the Engineer.
 5. After the proofrolled subgrade has been accepted by the Engineer, the surface of the subgrade shall be finish rolled with a smooth steel wheel roller weighing not less than ten (10) tons. Finished surface of the subgrade shall be within a tolerance of 1/4-inch at every point.
 6. Conduits, pipes, culverts and underdrains shall be neither disturbed nor damaged by proofrolling operations. Rollers shall neither pass over, nor approach closer than five feet to, conduits, pipes, culverts and underdrains unless the tops of those products are deeper than three feet.

- C. Placement
 - 1. Prior to placement of any material in embankments, the area within embankment limits shall be stripped of topsoil and all unsuitable materials removed in accordance with this Section. The area shall then be scarified to a depth of at least six (6)-inches.
 - 2. Fill materials shall be placed in continuous, approximately horizontal layers extending the full width of the embankment cross-section and the full dimension of the excavation where practical and having an uncompacted thickness of not over 8-inches.
- D. Final Grading: Upon completion of construction operations, the area shall be graded to finish contour elevations and grades shown on the Drawings. Graded areas shall be made to blend into conformation with remaining ground surfaces. All surfaces shall be left smooth and free to drain.
- E. Excess Material: Surfaces and slopes of waste fills shall be left smooth and free to drain.
- F. Moisture
 - 1. Fill materials shall be placed at optimum moisture content within practicable limits, but not less or more than two percent of optimum. Optimum moisture shall be maintained by sprinkling the layers as placed or by allowing materials to dry before placement.
 - 2. If fill material is too wet, provide and operate approved means to assist the drying of the fill until suitable for compaction.
 - 3. If fill material is too dry, provide and operate approved means to add moisture to the fill layers.

3.07 BACKFILLING

- A. Backfill carefully to restore the ground surface to its original condition. Dispose of excess material in accordance with this Section.
- B. Compact backfill underlying roadways, parking areas, sidewalks, structures and buildings in accordance with the requirements of Article 3.06 of this Section.
- C. Backfilling Around Structures
 - 1. General
 - a. Remove debris from excavations before backfilling.
 - b. Do not backfill against foundation walls until so directed by the Engineer nor until all indicated perimeter insulation and/or waterproofing is in place.
 - c. Protect such insulation and/or waterproofing during filling operations.
 - d. Do not backfill against water retaining structures until successful leakage tests have been completed.
 - e. Wherever possible, backfilling shall be simultaneous on both sides of walls to equalize lateral pressures.
 - f. Do not backfill against walls until all permanent construction is in place to furnish lateral support on both top and bottom of wall.

- g. Backfilling against walls shall take place after all the concrete in the affected members has attained the specified strengths.
 - h. To prevent excessive lateral pressure on external walls, large compaction equipment shall not be allowed within a zone wall footing.
2. Materials: Backfill material placed against structures built or encountered during the work of this Section shall be suitable fill material. No broken concrete, bricks or similar materials will be permitted as backfill.

3.08 GRADING

- A. General: Perform all rough and finish grading required to attain the elevations indicated on the Drawings. Perform finish grading to an accuracy of ± 0.10 foot.
- B. Treatment After Completion of Grading
 - 1. After grading is completed, permit no further excavation, filling or grading, except with the approval of the Engineer.
 - 2. Use all means necessary to prevent the erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

3.09 SETTLEMENT

- A. The Contractor shall be responsible for all settlement of backfill, fills and embankments which may occur within one year after final acceptance of the Work by the Owner.
- B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within thirty (30) days after receipt of written notice from the Engineer or Owner.

3.10 CLEAN-UP

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

3.11 MEASUREMENT AND PAYMENT

- A. Payment will be made for work under this Section per the Contractor's bid for the related items listed in Specification Section 00 41 00 Bid Form.

END OF SECTION

SECTION 31 10 00
SITE PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of built site elements.
- B. Clearing and protection of vegetation.
- C. Removal of existing debris.

1.02 RELATED SECTIONS

- A. Section 01 74 19 – Waste Management
- B. Section 31 11 00 – Clearing and Grubbing.
- C. Section 31 22 00 – Grading.
- D. Section 31 23 16 – Excavation.
- E. Section 31 23 23.13 – Backfill and Compaction.
- F. Section 31 25 00 – Erosion and Sedimentation Controls.

1.03 REFERENCES

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration and Demolition Operations; 2013.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
 - 1. Vegetation removal limits.
 - 2. Areas for temporary construction and field offices.
 - 3. Areas for temporary and permanent placement of removed materials.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 PROJECT CONDITIONS

- A. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers or other pollution.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least seven (7) days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least three (3) days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports and foundations of disconnected and abandoned utilities.
- H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.02 VEGETATION

- A. Scope: Remove trees, shrubs, brush and stumps in areas to be improved.
- B. Do not begin clearing until vegetation to be relocated has been removed.
- C. Do not remove or damage vegetation beyond the following limits:
 - 1. Limits of Disturbance as illustrated on Construction Drawings
 - 2. Twenty-five (25) feet outside perimeter of pervious paving areas that must not be compacted by construction traffic.
 - 3. Exception: Specific trees and vegetation indicated on drawings to be removed.
 - 4. Exception: Selective thinning of undergrowth specified elsewhere.
- D. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.
- E. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
 - 1. Chip, grind, crush or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.

2. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
 3. Existing Stumps: Treat as specified for other vegetation removed; remove stumps and roots to depth of eighteen (18)-inches.
 4. Sod: Re-use on site if possible; otherwise sell if marketable, and if not, treat as specified for other vegetation removed.
 5. Fill holes left by removal of stumps and roots, using suitable fill material, with top surface neat in appearance and smooth enough not to constitute a hazard to pedestrians.
- F. Dead Wood: Remove all dead trees (standing or down), limbs and dry brush on entire site; treat as specified for vegetation removed.
- G. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.03 DEBRIS

- A. Remove debris, junk and trash from site.

3.04 WASTE REMOVAL

- A. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 – Waste Management.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

3.05 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this section and all costs for same shall be included in the overall lump sum bid for this project.

END OF SECTION

SECTION 31 11 00
CLEARING AND GRUBBING

PART 1 GENERAL

1.01 DESCRIPTION

- A. Work included: Remove all organic vegetative mater as required to complete the construction as indicated on the construction plans.
- B. Related work:
 - 1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these Specifications.
 - 2. Section 01 71 23 – Field Engineering.
 - 3. Section 02 41 00 – Demolition
 - 4. Section 31 10 00 – Site Preparation.
 - 5. Section 31 25 00 – Erosion and Sedimentation Controls.

1.02 QUALITY ASSURANCE

- A. Use required number of workmen that are properly trained and have experience in the crafts and who are completely familiar with the specified requirements herein and the methods for proper performance of the work specified in this section.
- B. Use the proper equipment that is adequate in size, capacity and numbers to accomplish the work within the timeframe of the Project schedule.
- C. Comply with requirements of governmental agencies having jurisdiction within the Project area.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 AREA INCLUDED

- A. All areas where new construction is taking place or as illustrated on the plans.

3.02 PROCEDURES

- A. Clearing and grubbing: The entire area within the limits described above shall be cleared and grubbed at a minimum depth of six (6)-inches.
- B. Areas that are to be selectively cleared shall consist of removing vegetation, brush, stumps, etc., from the area. Special care shall be taken to avoid damage to trees that are left. Grubbing will not be required in areas designated for selective clearing.
- C. Removal of trees and shrubs: All trees being taken down must be removed avoiding damage to trees and existing features that are to remain. All parts of the trees being

removed are to be completely taken from the site and properly disposed of. Any shrubs or small trees that are undesirable may be selectively removed as directed.

- D. Stumps and roots: All stumps and roots larger than two (2)-inches in diameter shall be completely removed by grubbing except in areas of building site, parking areas and drives; they must be cut off no less than 18-inches below any subgrade. The area of operation then shall be cleared of resulting debris and matted roots, weeds and other organic matter shall be hauled away from the site. Generally, all material that cannot be compacted to ninety (90)-percent maximum density in lawn areas and ninety-five (95)-percent of maximum density elsewhere must be removed.
- E. Protection of trees: Trees that are to remain in place will need to be protected in areas where earthwork cut or fill is eighteen inches or less and in existing parking areas. Contractor must obtain approval from Engineer prior to removal of significant trees covered by local tree ordinances. Existing trees that are remaining in place during and after construction must be protected by constructing barricades around each tree.
- F. Erosion and Sediment Control: Construct and maintain erosion and sediment control devices as illustrated on the construction plans and in accordance with Section 31 25 00 – Erosion and Sedimentation Control of these specifications.

3.03 MEASUREMENT AND PAYMENT

- A. Payment will be made for work under this Section per the Contractor's bid for the related items listed in Specification Section 00 41 00 Bid Form.

END OF SECTION

SECTION 31 22 00

GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work included: Cut, fill, excavate, backfill, compact and grade the site as necessary to bring the roads, drives, building sites, paved areas and open areas to the lines and grades shown on the drawings.
 - 1. The work includes, but is not necessarily limited to:
 - a. Building site preparation.
 - b. Roadway, parking area, drive and walk subgrade preparation.
 - c. Excavations and formations of embankments.
 - d. Dressing of graded areas, shoulders and ditches.
 - 2. Subsurface Classification: All excavation is unclassified and excavation of every description, regardless of material encountered within the grading limits of the project, shall be performed to the lines and grades indicated.
- B. Removal and storage of topsoil.
- C. Rough grading the site for improvements.
- D. Topsoil and finish grading.

1.02 RELATED SECTIONS

- A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions and Sections in Division 1 of these specifications.
- B. Section 31 11 00 – Clearing and Grubbing.
- C. Section 31 23 16 – Excavation.
- D. Section 31 23 23.13 – Backfill and Compaction
- E. Section 31 25 00 – Erosion and Sedimentation Controls.
- F. Section 32 11 23 – Aggregate Base Course.

1.03 Definitions

- A. Open areas: Open areas shall be those areas that do not include building sites, paved areas, street right-of-way and parking areas.
- B. Maximum density: Maximum weight in pounds per cubic foot of a specific material.
- C. Optimum moisture: Percentage of water in a specific material at maximum density.

- D. Rock excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery. To be considered as rock excavation, the material shall be continuous; individual boulders or rocks in soil will not be considered rock excavation.
- E. Muck: Materials unsuitable for foundation because of organic content, saturation to the extent that it is somewhat fluid and must be removed by dragline, dredge or other special equipment, are designated as muck. No extra payment will be made for muck removal.
- F. Unsuitable material: Unsuitable material is defined as earth material unsatisfactory for its intended use and as classified by the soils technician. In addition to organic matter, sod, muck, roots and rubbish, highly plastic clay soils of the CH and MH descriptions and organic soils of the OL and OH descriptions, as defined in the Unified Soil Classification System shall be considered as unsuitable material.
- G. Suitable material: Where the term suitable material is used in specification sections pertaining to earthwork, it means earth or materials designated as being suitable for their intended use by soils technicians or the Engineer. Suitable material shall be designated as meeting the requirements of the Unified Soil Classification System types SW, GW, GC, SC, SM, ML, CL or as designated in these specifications.
- H. Select material: Select material is defined as granular material to be used where indicated on the drawings or where specified herein consisting of soils conforming to the Unified Soil Classification types SW, SM, GW or GM or as otherwise approved by the Engineer as select fill. Select material shall contain no stones or rubble larger than 1-1/2 inches in diameter.
- I. Crushed stone (gravel): Crushed stone shall be No. 57 aggregate or equal conforming to ASTM C-33.
- J. Excavation: Excavation is defined as unclassified excavation of every description regardless of materials encountered.

1.04 SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts and slope gradients.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with State of South Carolina Department of Transportation standards.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- C. Comply with requirements of governmental agencies having jurisdiction.
- D. A testing laboratory, retained by the Contractor and approved by the Owner, will make such tests as are deemed advisable. Test as specified in Section 01 45 29, Testing Laboratory Services.

- E. The Contractor shall schedule his work so as to permit a reasonable time for testing before placing succeeding lifts of fill material and shall keep the laboratory informed of his progress. The cost of the initial tests shall be paid for by the Contractor. Subsequent tests required as a result of improper compaction shall also be paid for by the Contractor.
- F. Contractor shall provide all required equipment and contact Engineer to setup time for Proof Roll Testing across all areas that have been graded. The Engineer and Geotechnical Engineer will provide final approval to the Contractor during site visit. Any additional cost required from multiple testing visits and trip will be the responsibility of the Contractor, not the Owner nor Engineer.

1.06 PROJECT CONDITIONS

- A. Protect above- and below-grade utilities that remain.
- B. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving and curbs from grading equipment and vehicular traffic.
- C. The Contractor must determine for himself the volume of material required by the site.

1.07 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01 60 00 - Product Requirements.

1.08 JOB CONDITIONS

- A. Notification of intent to excavate:
 - 1. South Carolina Underground Utility Damage Prevention Act (S.C. Code Ann, 58-35-10, 2012) requires persons to ascertain the location of underground public utility property prior to excavation or demolition in certain situations. The Act also requires such persons to give timely notice of intent to excavate or demolish prior to commencing such operations. Failure to comply could subject the violator to a civil penalty of up to one thousand dollars (\$1,000) for each violation of the Act.
 - 2. Notification of intent to excavate may be given by calling this toll free number: 1-800-922-0983.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

- A. General:
 - 1. Soil material used as fill, backfill, subgrade for structures or pavements, embankments, or site grading shall consist of suitable material as found available on site until such supply of on-site material is depleted.
 - a. Provide suitable material free from organic matter and deleterious substances, containing no rocks or lumps over six (6) inches in greatest dimension and with not more than fifteen (15)% of the rocks or lumps larger than 2-1/2 inches in their greatest dimension.
 - b. Do not permit rocks having a dimension greater than one (1) inch in the upper six (6) inches of fill or embankment.

2. Should the quantity of suitable on-site material be insufficient to complete the work, suitable borrow material as approved by the Engineer shall be provided by the Contractor at no additional expense to the Owner.
 3. Select materials may be provided from on-site if acceptable material as approved by the Engineer is available on site. Otherwise approved select material shall be provided by the Contractor from an off-site source.
- B. Topsoil:
1. Use topsoil consisting of material removed from the top three (3) to six (6) inches of existing on-site soils.
 2. Use topsoil containing no stones, roots or large clods of soil.
 3. Stockpile topsoil separate from other excavated material.

2.02 WEED KILLER

- A. Provide a dry, free-flowing, dust free chemical compound, soluble in water, capable of inhibiting growth of vegetation and approved for use on this work by governmental agencies having jurisdiction.

2.03 EQUIPMENT

- A. Use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner without undue waste or damage of material.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench mark and intended elevations for the Work are as indicated.
- B. Surface Conditions:
 1. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

- A. Identify required lines, levels, contours and datum.
- B. Stake and flag locations of known utilities.
- C. Locate, identify and protect utilities that remain, from damage.
- D. Notify utility company to remove and relocate utilities.
- E. Clearing and grubbing: Clear and grub areas to be graded prior to commencement of the grading operations.
- F. Where so directed by the Owner, protect and leave standing designated desirable trees.

- G. Complete any demolition and/or removal work as may be required prior to grading operations.
- H. Dispose of all clearing, grubbing and demolition debris and other deleterious material off the project site. Vegetation, roots, brush, rubbish, stumps, etc. may be burned on-site where permitted by local authorities and regulations and approved by the Engineer.
- I. Topsoil: Strip topsoil to a depth of three (3) to six (6) inches without contamination from the subsoil and stockpile topsoil separate from other excavated materials.
 - 1. Transport and deposit topsoil in storage piles convenient to areas that are to receive topsoil or in other locations as indicated or approved by the Engineer.
 - 2. Deposit topsoil in areas that are already graded and will not be disturbed by on-going construction.
 - 3. Dispose of unsuitable or unusable stripped material off-site or as otherwise directed by the Engineer.
- J. Sampling and preliminary testing:
 - 1. Prior to beginning the grading operations, the Contractor shall submit to the Engineer his proposed sequence of excavation operations.
 - 2. Based upon the sequence of excavation, samples of the fill materials will be obtained as excavation proceeds and tested for grain size permeability and moisture density relationship using the Standard Proctor Method (ASTM D698, Method A).
 - 3. Allow sufficient time for completion of laboratory tests before any fill operations begin, using the soils being tested.

3.03 ROUGH GRADING

- A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
- B. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- C. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.
- D. When excavating through roots, perform work by hand and cut roots with sharp axe.
- E. Perform excavating of every type of material encountered within the limits of the Work to the lines, grades and elevations indicated and specified herein.
- F. Suitable excavated materials:
 - 1. Use all suitable materials removed from the excavation as far as practicable in the formation of the embankments, subgrades, shoulders, building sites and other places as directed.
 - 2. Unless otherwise indicated on the drawings or approved by the Engineer, surplus suitable material shall be removed from the site and disposed of by the Contractor.

- G. Unsuitable excavated material: Remove from the site and dispose of all unsuitable material unless otherwise approved by the Engineer.
- H. Rock excavation:
1. Notify the Engineer upon encountering rock or similar material which cannot be removed or excavated by conventional earth moving or ripping equipment.
 2. Do not use explosives without written permission from the Engineer.
 3. When explosives are permitted, use only experienced powdermen or persons who are licensed or otherwise authorized to use explosives. Store, handle and use explosives in strict accordance with all regulatory bodies and the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc.
 4. The Contractor shall be solely responsible for any damage resulting from the use of explosives.
 5. The Contractor is responsible for securing all permit required in performing this work.
- I. Unauthorized excavation:
1. Excavation of material to depths below the grades indicated unless so directed by the Engineer will be deemed unauthorized excavation.
 2. Unauthorized over excavation shall be backfilled and compacted without any additional expense to the Owner.
- J. In the event that it is necessary to remove unsuitable material to a depth greater than that shown on the drawings or otherwise specified, the Contractor, upon receiving direction from the Engineer, shall remove, replace and compact such material as directed by the Engineer at no additional expense by the Owner.
- K. Filling and Backfilling
1. Use fills formed of suitable material placed in layers of not more than 8" in depth measured loose and rolled and/or vibrated with suitable equipment until compacted.
 2. Do not place rock that will not pass through a six (6)-inch diameter ring within the top twelve (12) inches of the surface of the completed fill or rock that will not pass through a three (3) inch diameter ring within the top six (6) inches of the completed fill.
 3. Do not use broken concrete or asphaltic pavement in fills.
 4. Selection of borrow material:
 - a. Material in excess of that available on the site shall be suitable material furnished by the Contractor from private sources selected by the Contractor. The material shall be approved by the Engineer before use. All expenses involved in securing, developing, transporting and placing the material shall be borne by the Contractor.

L. Placing and compacting:

1. Place backfill and fill materials in layers not more than eight (8) inches in loose depth.
2. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content.
3. Compact each layer to required percentage of maximum density for the area.
4. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
5. Place backfill and fill materials evenly adjacent to structures, to required elevations.
6. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structures to approximately the same elevation in each lift.

M. Moisture control:

1. Do not use soil material that is either too dry or too wet to achieve proper compaction.
2. Where subgrade or layer of soil material is too dry to achieve proper compaction, uniformly apply water to surface of soil material such that free water does not appear on the surface during or subsequent to compacting operations.
3. Remove and replace, or scarify and air dry, soil material that is too wet to permit compacting to the specified density.
4. Soil material that has been removed because it is too wet to permit compacting may be stockpiled or spread and allowed to dry. Assist drying by disking, harrowing, or pulverizing until moisture content is reduced to a satisfactory value as determined by moisture-density relation tests approved by the Engineer.

N. Compaction requirements:

1. Compact soils to not less than the following percentages of maximum dry density as determined in accordance with ASTM D698, Method A (Standard Proctor).
2. Fill beneath structures and beneath an area extending 10' beyond the limits of the foundation:
 - a. Top twelve (12) inches of Subgrade 100%
 - b. All other fill material 98%
3. Beneath Roadways:
 - a. Top twelve (12) inches of Subgrade 100%
 - b. All other fill material 95%

4. Embankments:
 - a. Top twelve (12) inches of Subgrade 98%
 - b. All other fill material 95%
5. Beneath Sidewalks:
 - a. Top twelve (12) inches of Subgrade 95%
 - b. All other fill material 90%
6. Lawns and unpaved areas:
 - a. All other fill material 90%
- O. Placing of Special Materials:
 1. Placing impervious liner materials:
 - a. Place selected fine grain soils on bottom and side slopes of the basin to the indicated depth.
 - b. Inspect and proofroll the stripped and grubbed subgrade prior to placement of any liner material, as specified hereinafter.
 - c. Spread liner material in eight (8)-inch maximum, loose lift thickness to provide a six (6) inch compacted lift thickness.
 - d. Adjust soil moisture content to one (1) to three (3) percentage points "wet" of the optimum moisture contents.
 - e. Compact at 98% of maximum density.
 - f. Maintain liner material sufficiently moist to prevent drying and cracking, until such time as the basin is filled.
- P. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL

- A. Stockpile excavated topsoil on site.
- B. Stockpile subsoil to be re-used on site; remove remainder from site.
- C. Stockpiles: Use areas designated on site; pile depth not to exceed eight (8) feet (2.5 m); protect from erosion.

3.05 FINISH GRADING

- A. General:
 1. Uniformly grade the areas within limits of grading under this Section, including adjacent transition areas.

2. Smooth the finished surfaces within specified tolerance.
 3. Grade with uniform levels or slopes between points where elevations are shown on the drawings, or between such points and existing grades.
 4. Where a change of slope is indicated on the drawings, construct a rolled transition section having a minimum radius of approximately 8'-0", unless adjacent construction will not permit such a transition, or if such a transition defeats positive control of drainage.
- B. Before Finish Grading:
1. Verify subgrade has been contoured and compacted.
- C. Remove debris, roots, branches, stones, in excess of 1/2 inch (13 mm) in size. Remove soil contaminated with petroleum products.
- D. Grading adjacent to structures: Grade areas adjacent to buildings to achieve drainage away from the structures and to prevent ponding.
- E. Ditches and gutters and swales:
1. Cut accurately to the cross sections, grades and elevations shown.
 2. Maintain excavations free from detrimental quantities of leaves, sticks, trash and other debris until completion of the work.
 3. Dispose of excavated materials as specified herein; do not in any case deposit materials within 3'0" of the edge of a ditch.
- F. Upon completion of site grading and other related site work, topsoil shall be uniformly spread over the graded or improved areas. Topsoil shall be evenly distributed to conform to final grade elevations shown on the plans.
- G. Where topsoil is to be placed, scarify surface to depth of three (3) inches (75 mm).
- H. In areas where vehicles or equipment have compacted soil, scarify surface to depth of three (3) inches (75 mm).
- I. Place topsoil in areas where grassing/seeding are indicated.
- J. Place topsoil to the following compacted thicknesses:
- K. Areas to be seeded with grass not less than: three (3) inches (75 mm).
- L. Place topsoil during dry weather.
- M. Remove roots, weeds, rocks and foreign material while spreading topsoil.
- N. Near plants spread topsoil manually to prevent damage.
- O. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
- P. Lightly compact placed topsoil.

- Q. Any surplus topsoil materials shall be disposed of in approved areas on the site.

3.06 TOLERANCES

- A. Top Surface of Subgrade: Plus or minus 1/10 foot (30 mm) from required elevation.
- B. Top Surface of Finish Grade: Plus or minus 1/2 inch (13 mm).
- C. Construct areas outside of building or structure lines true to grades shown.
 - 1. Where no grade is indicated, shape finish surface to drain away from buildings or structures, as approved by the Engineer.
- D. Degree of finish shall be that ordinarily obtainable from bladegrader, supplemented with hand raking and finishing.

3.07 FIELD QUALITY CONTROL

- A. See Section 31 23 23.13 - Backfill and Compaction, for compact density testing and the following:
- B. Secure the Engineer's construction review and observation and approval of subgrades and fill layers before subsequent construction is permitted thereon.
- C. Field density determinations will be made, at no additional cost to the Owner, to ensure that the specified densities are being obtained. Field density tests will be performed as determined by the Engineer, considering the following:
 - 1. At areas to receive paving, at least one field density test for every 5,000 sq. ft. of subgrade area, but not less than three tests.
 - 2. In each compacted fill layer, one field density test for every 5,000 sq. ft. of overlaying paved area, but not less than three tests.
 - 3. In fill beneath structures, one field density test for every 2,500 sq. ft. in each layer.
 - 4. Other tests as deemed necessary by the Engineer.
- D. If, in the Engineer's opinion based on reports of the testing laboratory, subgrade or fills which have been placed are below specified density, provide additional compacting and testing until specified requirements are met.
 - 1. Additional testing will be provided by the Owner-approved testing laboratory and all costs for the additional testing will be borne by the Contractor.
- E. Proofrolling:
 - 1. The Contractor shall proofroll subgrade of areas to receive paving, structures on fill or impervious lining material.
 - a. Make not less than three (3) passes of a 25 to 50 ton rubber tired roller over the full area.

- b. Unstable, soft or otherwise unsuitable materials revealed by the proofrolling shall be removed and replaced with satisfactory materials, compacted as specified herein.

3.08 CLEANING AND PROTECTION

- A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.
- B. Leave site clean and raked, ready to receive landscaping.
- C. Existing utilities:
 - 1. Unless shown to be removed, locate and protect active utility lines shown on the drawings or otherwise made known to the Contractor prior to excavating. If damaged, repair or replace at no additional cost to the Owner.
 - 2. If active utility lines are encountered and are not shown on the drawings or otherwise made known to the Contractor, promptly notify the Engineer and take necessary steps to assure that service is not interrupted.
 - 3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
 - 4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure his instructions.
 - 5. Do not proceed with permanent relocation of utilities until written instructions are received from the Engineer.
- D. Protection of persons and property:
 - 1. Barricade open holes and depressions occurring as part of this Work and post warning lights on property adjacent to or with public access.
 - 2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 - 3. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, washout and other hazards created by operations under this Section.
- E. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors and to other work being performed on or near the site.
- F. Maintain access to adjacent areas at all times.
- G. Excavate and backfill in a manner and sequence that will provide proper drainage at all times.

3.09 MAINTENANCE

- A. Protection of newly graded areas:
 - 1. Protect newly graded areas from traffic and erosion and keep free from trash and weeds.
 - 2. Repair and re-establish grades in settled, eroded and rutted areas to the specified tolerances.
- B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape and compact to the required density prior to further construction.

3.10 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the lump sum bid price.

END OF SECTION

SECTION 31 23 16

EXCAVATION

PART 1 GENERAL

1.01 WORK REQUIRED BY THIS SECTION

- A. Excavating for storm drainage swales.

1.02 RELATED SECTIONS

- A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions and Sections in Division 01 of these Specifications.
- B. Section 01 70 00 – Execution Requirements
- C. Section 31 22 00 – Grading.
- D. Section 31 23 23.13 – Backfill and Compaction.
- E. Section 31 25 00 – Erosion and Sedimentation Controls.

1.03 PROJECT CONDITIONS

- A. Verify that survey benchmarks and intended elevations for the Work are as indicated.
- B. Protect plants, lawns, rock outcroppings and other features to remain.
- C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving and curbs from excavating equipment and vehicular traffic.

1.04 CLASSIFICATION:

- A. Classification: All excavation is unclassified and excavation of every description, regardless of material encountered within the excavation limits of the structure, shall be performed to the lines and grades indicated.

1.05 DEFINITIONS:

- A. Open areas: Open areas shall be those areas that do not include building sites, paved areas, street right-of-way and parking areas.
- B. Maximum density: Maximum weight in pounds per cubic foot of a specific material.
- C. Optimum moisture: Percentage of water in a specific material at maximum density.
- D. Rock excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery. To be considered as rock excavation, the material shall be continuous; individual boulders or rocks in soil will not be considered rock excavation.
- E. Muck: Materials unsuitable for foundation because of organic content, saturation to the extent that it is somewhat fluid and must be moved by dragline, dredge, or other special equipment, are designated as muck. No extra payment will be made for muck removal.

- F. Unsuitable material: Unsuitable material is defined as earth material unsatisfactory for its intended use and as classified by the soils technicians. In addition to organic matter, sod, muck, roots and rubbish, highly plastic clay soils of the CH and MH descriptions and organic soils of the OL and OH descriptions, as defined in the Unified Soil Classification System shall be considered as unsuitable material.
- G. Suitable material: Where the term suitable material is used in specification sections pertaining to earthwork, it means earth or materials designated as being suitable for their intended use by soils technicians or the Engineer. Suitable material shall be designated as meeting the requirements of the Unified Soil Classification System types SW, GW, GC, SC, SM, ML, CI or as designated in these specifications.
- H. Select material: Select material is defined as granular material to be used where indicated on the drawings or where specified herein consisting of soils conforming to the Unified Soil Classification types SW, SM, GW, or GM or as otherwise approved by the Engineer as select fill. Select material shall contain no stones or rubble larger than 1-1/2 inches in diameter.
- I. Crushed stone (gravel): Crushed stone shall be No. 57 aggregate or equal conforming to ASTM C 33.
- J. Excavation: Excavation is defined as unclassified excavation of every description regardless of materials encountered.

1.06 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Comply with requirements of governmental agencies having jurisdiction
- C. Testing: A testing laboratory, retained by the Contractor and approved by the Owner, will make such tests as are deemed advisable. Test as specified in Section 01 45 29, Testing Laboratory Services.
 - 1. Schedule fill and backfill operations so as to permit a reasonable time for inspection and testing before placing succeeding lifts and keep the laboratory and Engineer informed of progress.
 - 2. Notify the Engineer and allow sufficient time for observation and/or testing of foundation subgrades prior to commencing any work on the exposed excavation.

1.07 JOB CONDITIONS

- A. If conditions encountered during construction warrant additional removal of unsuitable material below foundation subgrades, then remove unsuitable material and replace it as specified at no additional expense to the Owner.

1.08 PRODUCT HANDLING

- A. Comply with pertinent provisions of Section 01 60 00 Product Requirements.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 PREPARATION

- A. Identify required lines, levels, contours and datum locations.
- B. See Section 31 22 00 - Grading, for additional requirements.
- C. Locate, identify and protect utilities that remain and protect from damage.
- D. Notify utility company to remove and relocate utilities.

3.02 EXCAVATING

- A. Underpin adjacent structures that could be damaged by excavating work.
- B. Excavate to accommodate new structures and construction operations.
- C. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- D. Preparation for Piling Work: Excavate to working elevations. Coordinate special requirements for piling.
- E. Slope banks of excavations deeper than four (4) feet (1.2 meters) to angle of repose or less until shored.
- F. Do not interfere with forty-five (45) degree bearing splay of foundations.
- G. Cut utility trenches wide enough to allow inspection of installed utilities.
- H. Hand trim excavations. Remove loose matter.
- I. Remove lumped subsoil, boulders and rock up to 1/3 cu yd (0.25 cum) measured by volume.
- J. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; See Section 31 23 23.13 – Backfill and Compaction.
- K. Conform to elevations and dimensions shown within a tolerance of 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removing concrete formwork, installation of services, other construction required and for construction observation.
- L. Where earth will stand, shallow footing excavations may be cut to the exact size of the footing.
- M. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- N. Remove excavated material that is unsuitable for re-use from site.
- O. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 22 00 - Grading.
- P. Remove excess excavated material from site.

3.03 FOUNDATION SUBGRADES

- A. Excavate foundations and footings to a level bottom in firm, solid, suitable material.
- B. Take care not to disturb the bottom of the excavation unless further compaction of the subgrade is required.
- C. Notify the Engineer in due time to permit observation of the completed excavation prior to performing work on the foundation subgrade.
- D. Should unsuitable or soft material be encountered at subgrade elevation, remove such material and replace with compacted suitable material or crushed stone from firm earth up to the indicated elevation.
 - 1. In wet excavations or where groundwater is normally present, replace unsuitable material with crushed stone or lean concrete.
 - 2. In dry excavations above the normal groundwater level, replace unsuitable material with compacted suitable material.
 - 3. Unsuitable material shall be removed and replaced at no expense to the Owner.
 - 4. Where rock is encountered at foundation level:
 - a. Use drilling, picking, wedging or similar methods leaving the foundation rock in an entirely solid and unshattered condition.
 - b. Roughen approximately level surfaces to provide satisfactory bond with concrete.
 - c. Cut steps or benches in sloped surfaces to provide satisfactory bond.

3.04 DRAINAGE

- A. Provide drainage and control grading in the vicinity of the work to prevent drainage into the excavation.

3.05 ROCK EXCAVATION

- A. Notify the Engineer upon encountering rock or similar material that cannot be removed or excavated by conventional earth moving or ripping equipment.
- B. Do not use explosives without written permission from the Engineer.
- C. When explosives are permitted, use only experienced powdermen or persons who are licensed or otherwise authorized to use explosives. Store, handle and use explosives in strict accordance with all regulatory bodies and the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc.
- D. The Contractor shall be solely responsible for any damage resulting from the use of explosives.
- E. The Contractor is responsible for securing all permits required in performing this work.
- F. Do not use blasting adjacent to existing buildings or structures. Remove rock at such locations using jack hammers and bull points.

3.06 UNAUTHORIZED EXCAVATION

- A. Excavation of material to depths below the grades indicated unless so directed by the Engineer will be deemed unauthorized excavation.
- B. Backfill and compact unauthorized over excavation at no expense to the Owner.
 - 1. In wet excavations or excavations below normal groundwater elevations: Use crushed stone or lean concrete as directed by the Engineer.
 - 2. In dry excavations above normal groundwater elevations: Use compacted suitable material.

3.07 DEWATERING

- A. Remove all surface and subsurface waters from excavations and maintain the excavation in a dry condition during construction operations.
- B. Maintain the water level below the excavation subgrade during excavation and construction.
 - 1. Material disturbed below the foundation subgrade due to improper dewatering shall be removed and replaced with crushed stone or lean concrete at no expense to the Owner.
 - 2. Use sumps, pumps, drains, trenching or well point system as necessary to maintain a dry excavation.
 - 3. Dewatering by trench pumping will not be permitted if migration of fine grained natural material (running sand) from bottom, side walls or bedding material will occur.
- C. Dispose of water pumped from excavations in storm drains having capacity, canals, trenches or other approved locations.
 - 1. Contractor is responsible for acquiring all permits required to discharge the water and shall protect waterways from turbidity during the operation.
 - 2. Prevent flooding of streets, roadways, or private property.
 - 3. Provide engines driving dewatering pumps with residential type mufflers.

3.08 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

3.09 PROTECTION

- A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

- C. Protect structures, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, washout and other hazards created by operations under this Section.
- D. Unless shown to be removed, locate and protect active utility lines shown on the drawings or otherwise made known to the Contractor prior to excavating. If damaged, repair or replace at no additional cost to the Owner.
- E. If active utility lines are encountered and are not shown on the drawings or otherwise made known to the Contractor, promptly notify the Engineer and take necessary steps to assure that service is not interrupted.
- F. Barricade open holes and depressions occurring as part of this work and post warning lights on property adjacent to or with public access. Operating warning lights during hours from dusk to dawn each day and as otherwise required.
- G. Side slopes: Slope, bench and/or shore sides of excavations and trench walls to maintain stability of the wall or sides. Pile materials obtained from the excavation a minimum of four feet from the edge of the excavation.
- H. Shoring and sheeting: Where necessary, shore and sheet excavations with members of sizes and arrangement sufficient to prevent injury to persons, damage to structures or injurious caving or erosion.
 - 1. Furnish, put in place and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction and to protect adjacent structures from undermining or other damage. Any movement or bulging that may occur shall be corrected immediately by the Contractor. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and compacted.
 - 2. Take all precautions to prevent distress of existing structures because of sheeting installation or removal. Where the removal of sheeting may cause damage to existing or newly constructed structures, such sheeting shall be left in place at no expense to the Owner.
 - 3. All sheeting and shoring operations and maintenance thereof shall be the responsibility of the Contractor.

3.10 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the lump sum bid.

END OF SECTION

SECTION 31 23 16.13

TRENCHING FOR SITE UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Backfilling and compacting for underground utilities.

1.02 RELATED REQUIREMENTS

- A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Sections in Division 1 of these Specifications.
- B. Section 01 71 23 - Field Engineering.
- C. Section 31 22 00 - Grading.
- D. Section 31 23 16 - Excavation.
- E. Section 31 23 23.13 – Backfill and Compaction.
- F. Section 33 41 00 - Storm Utility Drainage Piping.

1.03 DEFINITIONS

- A. Subgrade Elevations: Indicated on drawings.

1.04 REFERENCES

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2010 (2009).
- B. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.
- C. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.
- D. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012.
- F. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- G. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- H. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.

- I. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.
- J. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils; 2010.
- K. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Samples: 10 lb. sample of each type of fill; submit in air-tight containers to testing laboratory.
- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- E. Compaction Density Test Reports.

1.06 DELIVERY, STORAGE AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.
- D. Protect plants, lawns, rock outcroppings and other features to remain.
- E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving and curbs from excavating equipment and vehicular traffic.

1.07 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner.

1.08 JOB CONDITIONS

- A. Existing utilities:

1. Approximate location of certain underground lines and structures are shown on the plans for information only, other underground lines or structures are not shown.
2. Locate these and other possible unknown utility lines using electronic pipe finder, or other approved means.
3. Locate, excavate and expose all existing underground lines in advance of trenching operations.
4. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these utilities in the execution of his work under this Section.
5. The Contractor shall familiarize himself with the existing conditions and be prepared to adequately care for and safeguard himself and the Owner from damage.

B. Notification of intent to excavate:

1. South Carolina Underground Utility Damage Prevention Act (S.C. Code Ann, 58-35-10, CT-SEQ, Supp. 1978) requires persons to ascertain the location of underground public utility property prior to excavation or demolition in certain situations. The Act also requires such persons to give timely notice of intent to excavate or demolish prior to commencing such operations. Failure to comply could subject the violator to a civil penalty of up to one thousand dollars (\$1,000) for each violation of the Act.
 - a. Notification of intent to excavate may be given by calling this toll free number: 811.

C. Protecting trees, shrubbery and lawns:

1. Trees and shrubbery in developed areas and along the trench line shall not be disturbed unless absolutely necessary and subject to the approval of the Engineer.
 - a. Any such trees and shrubbery necessary to be removed shall be heeled in and replanted.
2. Where trenches cross private property through established lawns, sod shall be cut, removed, stacked and maintained in suitable condition until replacement is approved by the Engineer.
 - a. Topsoil underlying lawn areas shall be removed and kept separate from general excavated materials.

D. Clearing:

1. Perform all clearing necessary for installation of the complete work.
2. Clearing shall consist of removing all trees, stumps, roots, brush and debris in the rights-of-way obtained for the Work.
3. All timber of merchantable size shall remain the property of the Owner and shall be trimmed and cut in such lengths as directed and stacked along the edge of the right-of-way.

4. All other material, including trimmings from above, shall be completely disposed of in a satisfactory manner.
- E. Removing and resetting fences:
1. Where existing fences must be removed to permit construction of utilities:
 - a. Remove such fences and, as the Work progresses, reset the fences in their original location and condition.
 - b. Provide temporary fencing or other safeguards as required to prevent stock and cattle from wandering to other lands.
- F. Restoration of disturbed areas:
1. Restore all areas disturbed by, during or as a result of construction activities to their existing or better condition.
 2. Do not interpret this as requiring replacement of trees and undergrowth in undeveloped sections of the rights-of-way.
- G. Minimizing silting and bank erosion during construction:
1. During construction, protective measures shall be taken and maintained to minimize silting and bank erosion of creeks and rivers adjacent to the work being performed during construction.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill: Subsoil excavated on-site.
1. Graded.
 2. Free of lumps larger than three (3) inches, rocks larger than two (2) inches and debris.
 3. Conforming to ASTM D 2487 Group Symbol CL.
- B. Granular Fill - Fill Type No. 57: Coarse aggregate, conforming to State of South Carolina Highway Department standard.
- C. Granular Fill - Gravel: Pit run washed stone; free of shale, clay, friable material and debris.
1. Graded in accordance with ASTM D 2487 Group Symbol GW.
 2. Graded in accordance with ASTM C 136, within the following limits:
 - a. 2 inch sieve: 100 percent passing.
 - b. 1 inch sieve: 95 percent passing.
 - c. 3/4 inch sieve: 95 to 100 percent passing.
 - d. 5/8 inch sieve: 75 to 100 percent passing.

- e. 3/8 inch sieve: 55 to 85 percent passing.
 - f. No. 4 sieve: 35 to 60 percent passing.
 - g. No. 16 sieve: 15 to 35 percent passing.
 - h. No. 40: 10 to 25 percent passing.
 - i. No. 200: 5 to 10 percent passing.
- D. Granular Fill - Pea Gravel: Natural stone; washed, free of clay, shale and organic matter.
- 1. Grade in accordance with ASTM D 2487 Group Symbol GM.
 - 2. Graded in accordance with ASTM C 136, within the following limits:
 - a. Minimum Size: 1/4 inch.
 - b. Maximum Size: 5/8 inch.
- E. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials and organic matter.
- 1. Grade in accordance with ASTM D 2487 Group Symbol SW.
 - 2. Graded in accordance with ASTM C 136; within the following limits:
 - a. No. 4 sieve: 100 percent passing.
 - b. No. 14 sieve: 10 to 100 percent passing.
 - c. No. 50 sieve: 5 to 90 percent passing.
 - d. No. 100 sieve: 4 to 30 percent passing.
 - e. No. 200 sieve: 0 percent passing.
- F. Topsoil: Topsoil excavated on-site.
- 1. Select.
 - 2. Graded.
 - 3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
 - 4. Acidity range (pH) of 5.5 to 7.5.
 - 5. Containing a minimum of 4 percent and a maximum of 25 percent inorganic matter.
 - 6. Conforming to ASTM D2487 Group Symbol OH.

2.02 EXCAVATED MATERIALS

- A. Perform all excavation of every description and of whatever substances encountered to depths indicated or specified.
- B. Pile material suitable for backfilling in an orderly manner at safe distance from banks or trenches to avoid overloading and to prevent slides or cave-ins.
- C. Remove and deposit unsuitable or excess materials as directed by the Engineer.

2.03 BACKFILL MATERIALS

- A. Provide from materials excavated for installation of utility.
 - 1. Select soil material free from organic matter and deleterious substances, containing no rocks or lumps over 2-inches in greatest dimension for backfill up to 12-inches above top of utility being covered.
 - 2. Do not permit rocks larger than 2-inches in greatest dimension in top 6-inches of backfill.

2.04 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.
- B. Should the quantity of suitable on-site material be insufficient to complete the work, provide suitable borrow material as approved by the Engineer at no additional expense to the Owner.
- C. Provide select materials from on-site if acceptable material as approved by the Engineer is available on-site. Otherwise, provide approved select material from an off-site source.

2.05 SOURCE QUALITY CONTROL

- A. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- B. If tests indicate materials do not meet specified requirements, change material and retest.
- C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.02 PREPARATION

- A. Identify required lines, levels, contours and datum locations.
- B. See Section 31 22 00 – Grading for additional requirements.
- C. Locate, identify and protect utilities that remain and protect from damage.

- D. Notify utility company to remove and relocate utilities.
- E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving and curbs from excavating equipment and vehicular traffic.
- F. Protect plants, lawns, rock outcroppings and other features to remain.

3.03 PROTECTION OF EXISTING UTILITIES AND ADJACENT STRUCTURES

- A. Existing utilities:
 - 1. Unless shown to be removed, protect active utility lines shown on the drawings or otherwise made known to the Contractor prior to trenching. If damaged, repair or replace at no additional cost to the Owner.
 - 2. If active utility lines are encountered and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.
 - 3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
 - 4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Engineer and secure his instructions.
 - 5. Do not proceed with permanent relocation of utilities until written instructions are received from the Engineer.
 - 6. Locations within streets or highways:
 - a. Comply with the South Carolina Department of Transportation's (SCDOT) "Encroachment Permit" issued for the Work and the South Carolina Department of Transportation's (SCDOT) "A Policy for Accommodating Utilities on Highway Rights-of-Way".
 - b. Take all precautions and comply with all requirements as may be necessary to protect the improvements, including barricades for protection of traffic.
 - c. Keep minimum of one lane open to traffic at all times where utility crosses street or highway.
 - 7. Protection of persons and property:
 - a. Barricade open holes and depressions occurring as part of the Work and post warning lights on property adjacent to or with public access.
 - b. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 - c. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, washout and other hazards created by operations under this Section.

8. Dewatering:
 - a. Remove all water, including rain water, encountered during trench and sub-structure work to an approved location by pumps, drains and other approved methods.
 - b. Keep trenches and site construction area free from water.
9. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors and to other work being performed on or near the site.
10. Maintain access to adjacent areas at all times.

3.04 TRENCHING

- A. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Cut trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
- G. Remove lumped subsoil, boulders and rock up to 1/3 cu. yd. measured by volume.
- H. Remove excavated material that is unsuitable for re-use from site.
- I. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 22 00.
- J. Remove excess excavated material from site.
- K. Trench Excavation:
 1. Remove all materials of whatever substance encountered.
- L. Where trenching occurs in existing lawns, remove turf in sections and keep damp. Replace turf upon completion of the backfilling.
- M. Open cut:
 1. Excavate for utilities by open cut.
 2. If conditions at the site prevent such open cut and if approved by the Engineer, tunneling may be used.
 3. Short sections of a trench may be tunneled if, in the opinion of the Engineer, the conductor can be installed safely and backfill can be compacted properly into such tunnel.

4. Remove boulders and other interfering objects and backfill voids left by such removals, at no additional cost to the Owner.
 5. Remove wet or otherwise unstable soil incapable of properly supporting the utility, as determined by the Engineer, to depth required and backfill to proper grade with stone bedding material, at no additional cost to the Owner.
 6. Excavating for appurtenances:
 - a. Excavate for manholes and similar structures to a distance sufficient to leave at least 12-inches clear between outer surfaces and the embankment or shoring that may be used to hold and protect the banks.
 - b. Overdepth excavation beyond such appurtenances that has not been directed will be considered unauthorized. Fill with sand, gravel, or lean concrete as directed by the Engineer and at no additional cost to the Owner.
- N. Trench to the minimum width necessary for proper installation of the utility, with sides as nearly vertical as possible. Accurately grade the bottom to provide uniform bearing for the utility.
1. Dig to a true grade and to provide a smooth continuous support along the entire length of the pipe line.
 2. Excavate to a width not less than 12 inches greater than the outside diameter of the pipe.
 3. Trench depth shall provide a minimum of 4 feet of cover over the pipe as measured along the pipe centerline.
 4. Where the pipeline crosses creeks, drainage ditches or land subject to flooding, the depth of cover shall be 4' minimum.
 5. Where the pipeline crosses existing gas mains or other utilities, a minimum of 24 inches of separation under the existing utility shall be maintained. Additional depth of excavation as required to maintain separation shall be completed at no additional cost to the Owner.
 6. At any creek, draw, gully, embankment or other place where rough terrain exists, the trench shall be graded to avoid the use of bends or deflections greater than 2-1/2° per joint unless otherwise approved by the Engineer.
 - a. Where changes in direction occur requiring greater than 2-1/2° deflection, field bending of the pipe is to be used with minimum bending radius being no less than 10 times the pipe diameter.
- O. Provide sheeting and shoring necessary for protection of the Work and for the safety of personnel.
1. Remove in units when level of backfilling has reached the elevation necessary to protect the utility work and adjacent property.
 2. Shoring at the bottom of trenches over 10-feet deep for sewers 15-inches and larger in size, shall remain in place and be cut off no less than 2-inches above top of pipe, at no additional cost to the Owner.

3. When, in the opinion of the Engineer, other sheeting cannot be safely removed, it shall be left in place and the Contractor will be paid for such sheeting at the prices bid.
 - a. Cut such sheeting off at least 2-feet below finished surface.
 - b. No lumber for sheeting or shoring exceeding that size customarily used will be paid for unless the use of larger sizes has been ordered, in writing, by the Engineer.
- P. Depressions:
 1. Dig bell holes and depressions for joints after the trench has been graded. Provide uniform bearing for the pipe on prepared bottom of the trench.
 2. Except where rock is encountered, do not excavate below the depth indicated or specified.
 3. Where rock is encountered, excavate rock to a minimum overdepth of 4-inches below the trench depth indicated or specified and to provide 6-inches clearance in any horizontal direction from all parts of the utility and appurtenances.
- Q. Comply with pertinent OSHA regulations in regards to the excavation of utilities.

3.05 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.06 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Backfill trenches and excavations immediately after the pipes are laid, unless other protection is directed or indicated.
- C. Select and deposit backfill materials with special reference to the future safety of the pipes.
- D. Reopen trenches which have been improperly backfilled, to a depth as required for proper compaction. Refill and compact as specified, or otherwise correct to the approval of the Engineer.
- E. Surplus material shall be disposed of as directed by the Engineer.
- F. Original surface shall be restored to the approval of the Engineer.
- G. Fill up to subgrade elevations unless otherwise indicated.
- H. Lower portion of trench:

1. Deposit approved backfill and bedding material in layers of 6-inches maximum thickness and compact with suitable tampers to the density of the adjacent soil until there is a cover of not less than 36-inches over sewers and 12-inches over other utility lines.
 2. Take special care in backfilling and bedding operations not to damage pipe and pipe coatings.
- I. Remainder of trench:
1. Except for special materials for pavements, backfill the remainder of the trench with material free from stones larger than 6-inches or 1/2 the layered thickness, whichever is smaller, in any dimension.
 2. Deposit backfill material in layers not exceeding the thickness specified and compact each layer to the minimum density directed by the soil engineer.
- J. Undeveloped areas:
1. Backfill in wooded, swampy or undeveloped areas shall be as specified hereinbefore, except that tamping of the backfill above a level 2-feet over the top of the pipe will not be required.
 2. Mound excavated material neatly over the ditch to provide for future settlements.
- K. Employ a placement method that does not disturb or damage other work.
- L. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- M. Maintain optimum moisture content of fill materials to attain required compaction density.
- N. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.
- O. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.
- P. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- Q. Correct areas that are over-excavated.
1. Thrust bearing surfaces: Fill with concrete.
 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- R. Compaction Density Unless Otherwise Specified or Indicated:
1. Under paving, slabs-on-grade and similar construction: 100 percent of maximum dry density.
 2. At other locations: 95 percent of maximum dry density.
- S. Reshape and re-compact fills subjected to vehicular traffic.

3.07 BEDDING AND FILL AT SPECIFIC LOCATIONS

- A. Use general fill unless otherwise specified or indicated.
- B. Utility Piping:
 - 1. Bedding: Use general fill.
 - 2. Cover with general fill.
 - 3. Fill up to subgrade elevation.
 - 4. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.
- C. At Pipe Culverts:
 - 1. Bedding: Use general fill.
 - 2. Cover with general fill.
 - 3. Fill up to subgrade elevation.
 - 4. Compact in maximum 8 inch lifts to 95-percent of maximum dry density.

3.08 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.09 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D3017, or ASTM D6938.
- C. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- D. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.
- E. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- F. Frequency of Tests:
 - 1. At least one (1) field density test for every fifty (50) linear feet of trench within each lift.

3.10 CLEANING

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 31 23 23.13

BACKFILL AND COMPACTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Filling, backfilling and compacting for structure volume below grade.
- B. Backfilling and compacting for utilities outside the structure to utility main connections.
- C. Filling holes, pits and excavations generated as a result of removal (demolition) operations.

1.02 RELATED SECTIONS

- A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Sections in Division 01 of these Specifications.
- B. Section 02 30 00 – Subsurface Evaluation
- C. Section 03 30 00 – Cast-in-Place Concrete.
- D. Section 31 22 00 – Grading.
- E. Section 31 23 16 – Excavation.
- F. Section 31 25 00 – Erosion and Sedimentation Controls.

1.03 REFERENCES

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2001 (2004).
- B. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.
- C. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2000a.
- D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2000.
- E. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2002
- F. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 1994(R 2001).
- G. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2006.
- H. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.

- I. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.
- J. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils; 2005.

1.04 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: Indicated on drawings.
- C. Open areas: Open areas shall be those areas that do not include building sites, paved areas, street right-of-way and parking areas.
- D. Maximum density: Maximum weight in pounds per cubic foot of a specific material.
- E. Optimum moisture: Percentage of water in a specific material at maximum density.
- F. Muck: Materials unsuitable for foundation because of organic content, saturation to the extent that it is somewhat fluid and must be moved by dragline, dredge, or other special equipment, are designated as muck. No extra payment will be made for muck removal.
- G. Unsuitable material: Unsuitable material is defined as earth material unsatisfactory for its intended use and as classified by the soils technicians. In addition to organic matter, sod, muck, roots and rubbish, highly plastic clay soils of the CH and MH descriptions and organic soils of the OL and OH descriptions, as defined in the Unified Soil Classification System shall be considered as unsuitable material.
- H. Suitable material: Where the term suitable material is used in specification sections pertaining to earthwork, it means earth or materials designated as being suitable for their intended use by soils technicians or the Engineer. Suitable material shall be designated as meeting the requirements of the Unified Soil Classification System types SW, GW, GC, SC, SM, ML, CI or as designated in these specifications.
- I. Select material: Select material is defined as granular material to be used where indicated on the drawings or where specified herein consisting of soils conforming to the Unified Soil Classification types SW, SM, GW, or GM or as otherwise approved by the Engineer as select fill. Select material shall contain no stones or rubble larger than 1-1/2 inches in diameter.
- J. Crushed stone (gravel): Crushed stone shall be No. 57 aggregate or equal conforming to ASTM C 33.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Samples: 10 lb (4.5 kg) sample of each type of fill; submit in air-tight containers to testing laboratory.
- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- E. Compaction Density Test Reports

BACKFILL AND COMPACTION

1.06 PROJECT CONDITIONS

- A. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.

1.07 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Comply with requirements of governmental agencies having jurisdiction.
- C. Testing: A testing laboratory, retained by the Contractor and approved by the Owner, will make such tests as are deemed advisable. Test as specified in Section 01 45 29, Testing Laboratory Services.
 - 1. Schedule fill and backfill operations so as to permit a reasonable time for inspection and testing before placing succeeding lifts and keep the laboratory and Engineer informed of progress.
 - 2. Notify the Engineer and allow sufficient time for observation and/or testing of foundation subgrades prior to commencing any work on the exposed excavation.

1.08 JOB CONDITIONS

- A. Comply with pertinent provisions of Section 01 60 00 – Product Requirements.

PART 2 PRODUCTS

2.01 SOIL MATERIAL GENERAL

- A. Soil material used as fill, backfill or subgrade for structures shall consist of suitable material.
 - 1. Provide suitable material free from organic matter and deleterious substances, containing no rocks or lumps over six (6) inches in greatest dimension and with not more than fifteen (15)% of the rocks or lumps larger than 2-1/2 inches in their greatest dimension.
 - 2. Do not permit rocks having a dimension greater than one (1)-inch in the upper six (6)-inches of fill or subgrade.
- B. Where select material is indicated on the drawings or specified, use select granular material as defined herein and approved by the Engineer.

- C. Where indicated on the drawings or specified, use gravel or crushed stone as defined herein.
- D. Where indicated on the drawings or otherwise where desired, provide a lean concrete "mud slab" beneath foundations.
- E.
 - 1. Use 2000 psi concrete and a minimum thickness of 2-1/2 inches.
 - 2. With prior approval of the Engineer, a "mud slab" may be substituted for gravel base material except where the gravel base is required for drainage or for use with pressure relief valves.

2.02 FILL MATERIALS

- A. General Fill: Subsoil excavated on-site.
 - 1. Graded.
 - 2. Free of lumps larger than three (3) inches (75 mm), rocks larger than two (2) inches (50 mm) and debris.
 - 3. Conforming to ASTM D 2487 Group Symbol CL.
- B. Granular Fill- Fill Type #57: Coarse aggregate, conforming to State of South Carolina Highway Department standard.

2.03 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. If tests indicate materials do not meet specified requirements, change material and retest.
- C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Identify required lines, levels, contours and datum locations.

3.02 PREPARATION

- A. Scarify subgrade surface to a depth of six (6) inches (150 mm) to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING AND BACKFILLING

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- D. Maintain optimum moisture content of fill materials to attain required compaction density.
- E. Slope grade away from building minimum two (2) inches in ten (10) ft (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- F. Correct areas that are over-excavated.
 - 1. Other areas: Use general fill, flush to required elevation, compacted to minimum 98 percent of maximum dry density.
- G. Compaction Density Unless Otherwise Specified or Indicated.
- H. Reshape and re-compact fills subjected to vehicular traffic.
- I. Use suitable material for all filling and backfilling operations.
- J. Fill under structures: Deposit suitable material in layers not exceeding eight (8)-inches in depth and compact each layer using proper equipment.
- K.
 - 1. Do not place rock that will not pass through a six (6)-inch diameter ring within the top twelve (12)-inches of the surface of the completed fill or rock that will not pass through a three (3)-inch diameter ring within the top six (6)-inches of the completed fill.
 - 2. Do not place broken concrete, bricks, or asphaltic pavement in fills.
 - 3. Where indicated on the drawings, provide select granular material.
- L. Backfill excavations as promptly as progress of the Work permits, but not until completion of the following:
 - 1. Inspection and acceptance of construction below finish grade including, where applicable, damp proofing and waterproofing.
 - 2. Inspecting, testing, approving and recording locations of underground utilities.
 - 3. Removing concrete formwork.
 - 4. Removing shoring and bracing and backfilling of voids with satisfactory materials.
 - 5. Removing trash and debris.
 - 6. Foundation walls have been in place seven (7) days.
- M. Placing and compacting:
 - 1. Place backfill and fill materials in layers not more than eight (8)-inches in loose depth.

BACKFILL AND COMPACTION

2. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content within $\pm 2\%$.
3. Compact each layer to required percentage of maximum density for area.
4. Do not place backfill or fill material on surfaces that are muddy, frozen, or containing frost or ice.
5. Place backfill and fill materials evenly adjacent to structures, to required elevations.
6. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift.
7. Do not operate heavy equipment closer to foundation or retaining walls than a distance equal to height of backfill above the footing.
 - a. Compact remaining area using power driven hand tampers.
8. Where the construction includes basement or other underground walls having structural floors over them, do not backfill such walls until the structural floors are in place and have attained sufficient strength to support the walls.

3.04 FILL AT SPECIFIC LOCATIONS

- A. Over Buried Utility Piping, Conduits and Duct Bank in Trenches:
 1. Bedding: Use general fill.
 2. Cover with general fill.
 3. Fill up to subgrade elevation.
 4. Compact in maximum eight (8) inch (200 mm) lifts to ninety-five (95) percent of maximum dry density.
- B. At Lawn Areas:
 1. Use general fill.
 2. Fill up to six (6) inches (150 mm) below finish grade elevations.
 3. Fill up to subgrade elevations.
 4. Compact to ninety-five (95) percent of maximum dry density.
 5. See Section 31 22 00 - Grading for topsoil placement.

3.05 COMPACTION REQUIREMENTS

- A. Compact soils to not less than the following percentages of maximum dry density as determined in accordance with ASTM D698, Method A (Standard Proctor).
- B. Existing in place subgrade below structures where subgrade has been disturbed by water, improper dewatering, or construction traffic.

1. Top twelve (12) inches of subgrade: 100%
 2. Below top twelve (12) inches of subgrade: 98%
- C. Fill beneath structures and beneath an area extending ten (10) feet beyond the limits of the foundation:
1. Top twelve (12) inches of subgrade: 100%
 2. Below top twelve (12) inches of subgrade: 98%
- D. Compaction of suitable material used to replace unsuitable material below foundation subgrades:
1. Top twelve (12) inches of subgrade: 100%
 2. Below top twelve (12) inches of subgrade: 98%

3.06 BACKFILLING, FILLING AND COMPACTION

- A. Use suitable material for all filling and backfilling operations.
- B. Fill under structures: Deposit suitable material in layers not exceeding eight (8) inches in depth and compact each layer using proper equipment.
1. Do not place rock that will not pass through a six (6)-inch diameter ring within the top twelve (12) inches of the surface of the completed fill or rock that will not pass through a three (3)-inch diameter ring within the top six (6) inches of the completed fill.
 2. Do not place broken concrete, bricks, or asphaltic pavement in fills.
 3. Where indicated on the drawings, provide select granular material.
- C. Backfill excavations as promptly as progress of the Work permits, but not until completion of the following:
1. Inspection and acceptance of construction below finish grade including, where applicable, damp proofing and waterproofing.
 2. Inspecting, testing, approving and recording locations of underground utilities.
 3. Removing concrete formwork.
 4. Removing shoring and bracing and backfilling of voids with satisfactory materials.
 5. Removing trash and debris.
 6. Foundation walls have been in place seven (7) days.
- D. Placing and compacting:
1. Place backfill and fill materials in layers not more than eight (8) inches in loose depth.
 2. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content within \pm two (2)%.

BACKFILL AND COMPACTION

3. Compact each layer to required percentage of maximum density for area.
4. Do not place backfill or fill material on surfaces that are muddy, frozen, or containing frost or ice.
5. Place backfill and fill materials evenly adjacent to structures, to required elevations.
6. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift.
7. Do not operate heavy equipment closer to foundation or retaining walls than a distance equal to height of backfill above the footing.
 - a. Compact remaining area using power driven hand tampers.
8. Where the construction includes basement or other underground walls having structural floors over them, do not backfill such walls until the structural floors are in place and have attained sufficient strength to support the walls.

3.07 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus one (1) inch (25 mm) from required elevations

3.08 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Secure the Engineer's construction observation and approval of subgrades and fill layers before subsequent construction is permitted thereon.
- C. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- D. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.
- E. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- F. Frequency of Tests:
 1. At areas to receive paving, at least one field density test for every 5,000 sq.ft. of subgrade area, but not less than three (3) tests.
 2. In each compacted fill layer, one (1) field density test for every 5,000 sq.ft. of overlaying paved area, but not less than three (3) tests.
 3. In fill beneath structures, one (1) field density test for every 2,500 sq.ft. in each layer.
 4. Other tests as deemed necessary by the Engineer

BACKFILL AND COMPACTION

G. If, the Engineer's opinion based on reports of the testing laboratory, subgrade or fills that have been placed are below specified density, provide additional compacting and testing until specified requirements are met.

1. Additional testing will be provided by the Owner's selected testing laboratory and all costs for the additional testing will be borne by the Contractor.

H. Proofrolling:

1. Upon request by the Engineer, proofroll the subgrade of structure foundations.

a. Make not less than three (3) passes of a twenty-five (25) to fifty (50) ton rubber tired roller over the full area.

b. Unstable, soft or otherwise unsuitable materials revealed by the proofrolling shall be removed and replaced with satisfactory material and compacted as specified herein.

3.09 DEWATERING

A. Remove all surface and subsurface waters from excavations and maintain the excavation in a dry condition during construction operations.

B. Maintain the water level below the excavation subgrade during excavation and construction.

1. Material disturbed below the foundation subgrade due to improper dewatering shall be removed and replaced with crushed stone or lean concrete at no expense to the Owner.

2. Use sumps, pumps, drains, trenching or well point system as necessary to maintain a dry excavation.

3. Dewatering by trench pumping will not be permitted if migration of fine grained natural material (running sand) from bottom, side walls or bedding material will occur.

C. Dispose of water pumped from excavations in storm drains having capacity, canals, trenches or other approved locations.

1. Contractor is responsible for acquiring all permits required to discharge the water and shall protect waterways from turbidity during the operation.

2. Prevent flooding of streets, roadways, or private property.

3. Provide engines driving dewatering pumps with residential type mufflers.

3.10 CLEAN-UP

A. Leave unused materials in a neat, compact stockpile.

B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

1. Unstable, soft or otherwise unsuitable materials revealed by the proofrolling shall be removed and replaced with satisfactory material and compacted as specified herein.

BACKFILL AND COMPACTION

- C. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stock

3.11 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this section and all costs for same shall be included in the lump sum bid.

END OF SECTION

SECTION 31 25 00

EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Work included: Implement, Protect, Comply and Enforce the South Carolina Department of Health and Environmental Control approved construction stormwater pollution prevention plan (C-SWPPP) during the construction of this project to reduce soil erosion and siltation to the lowest reasonably achievable level.

1.02 GENERAL

- A. Exercise every reasonable precaution, throughout the life of the project, to prevent the eroding of soil and the silting of rivers, streams, lakes, reservoirs, other water impoundments, ground or roadway surfaces, or other property. Erosion control practices to be used for this project are shown on the drawings and are to conform to South Carolina Department of Health and Environmental Control regulations.

PART 2 PRODUCTS

2.01 CRUSHED STONE

- A. Provide #57 crushed stone for project entrance and exit.
- B. Provide #57 crushed stone for temporary sediment barriers around inlets and for temporary stone check dams.

2.02 GRASSING

- A. Comply with Section 32 92 00 – Turf and Grasses.

2.03 SILT FENCE

- A. Posts:
 - 1. Posts shall be self-fastener angle steel, five (5) feet in length.
- B. Woven wire shall conform to the requirements of ASTM A 116, Class I zinc coating for wire. Each woven square shall measure 5.33" X 12". The top and bottom wires shall be ten (10) gauge. All other wires shall be 12-1/2 gauge.
- C. Filter fabric shall be synthetic fabric as manufactured by Celanese Fibers Co., DuPont, Industrial Netting or approved equal.

2.04 EROSION CONTROL BLANKET

- A. Use erosion control blanket S150 or SC250 North American Green as note in the Construction Plans, or similar products by profile products, or approved equal.

2.05 RIP-RAP

- A. Comply with Section 31 37 00 - Rip-Rap.

2.06 FILTER FABRIC (Temporary Stone Check Dam)

- A. Use Stabilenka Filter Fabric (T-140N), Mirafil (140N) or approved equal.

PART 3 EXECUTION

3.01 GENERAL

- A. Construct and maintain all erosion control measures until the substantial completion of the project.

3.02 TEMPORARY CONSTRUCTION ENTRANCE/EXIT

- A. Construct a gravel area or pad at points where vehicles enter and leave a construction site.
- B. Clear the entrance and exit area of all vegetation, roots and other objectionable material and properly grade and place gravel to the grade and dimensions shown on the plans.
- C. Construct drainage channels to carry water to a sediment trap or other suitable outlet.
- D. Use geotextile fabrics to improve stability of the foundation in locations subject to seepage or high water table.
- E. Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site by periodic top dressing with two inches of stone.
- F. After each rainfall, inspect any structure used to trap sediment and clean it out as necessary.
- G. Immediately remove objectionable materials spilled, washed, or tracked onto public roadways.

3.03 TEMPORARY GRASSING

- A. Provide a temporary cover for erosion control on disturbed areas that will remain unstabilized for a period of more than thirty (30) days in accordance with Section 32 92 00 – Turf and Grasses.
- B. This practice applies to cleared areas, diversions, dams, temporary sediment basins, temporary road banks and topsoil stockpiles where vegetation is needed for less than one (1) year.
- C. Provide grassing on slope 5% or greater within fourteen (14) days of disturbance. Comply with Section 32 92 00 – Turf and Grasses.

3.04 SILT FENCE

- A. Provide silt fence barrier where shown on the plans and on utility construction parallel to the disturbed trench where perpendicular sheet flow runoff occurs on disturbed areas with slopes greater than 4%.

- B. Place at the extreme limits of the area to be disturbed as shown on the plans.
- C. Construct temporary sediment barriers of filter fabric, buried at the bottom, stretched and supported by posts and install below small disturbed areas as indicated on the drawings to retain sediment by reducing the flow velocity to allow sediment deposition.
- D. Provide spacing between posts 5'-0" on center, minimum.
- E. Remove sediment deposits prior to reaching one-third height of the fence.
- F. Monitor site frequently and place additional silt fencing should evidence indicate that erosion is about to occur at locations other than those shown on plan.

3.05 INLET PROTECTION

- A. Construct temporary sediment barriers around storm drain curb inlets using block and gravel as indicated on the drawings.
- B. Inspect structure after each rainfall and repair as required.
- C. Remove sediment when trap reaches one-half capacity.
- D. Remove structure when protected areas have been stabilized.

3.06 EROSION CONTROL BLANKET

- A. Provide on areas as shown on the plans or on all embankments with slopes equal to or steeper than 2-1/2:1.

3.07 TEMPORARY STONE CHECK DAMS

- A. Utilize temporary stone check dams as indicated on the plans or directed by Engineer.
- B. Provide temporary stone check dams constructed of both rip-rap and #57 stone, as illustrated on the plans.

3.08 MAINTENANCE

- A. Place all erosion control devices or measures prior to any land disturbing activity within the drainage area they are located.
- B. Periodically check erosion control devices and clean or otherwise remove silt build-up as necessary to maintain them in proper working order.

3.09 REMOVAL

- A. Remove temporary structures after protected areas have been stabilized.

3.10 MEASUREMENT AND PAYMENT

- A. Payment will be made for work under this Section per the Contractor's bid for the related items listed in Specification Section 00 41 00 Bid Form.

END OF SECTION

EROSION AND SEDIMENTATION CONTROLS

SECTION 31 37 00

RIPRAP

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Furnishing all labor, materials and equipment and performing all operations in conjunction with placing protective coatings of broken stone in accordance with these specifications and in conformity with the lines, grades and thicknesses shown on the plans or established by the Engineer.

1.02 RELATED REQUIREMENTS

- A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions and Sections in Division 1 of these Specifications.
- B. Section 31 23 23.13 – Backfill and Compaction.
- C. Section 31 25 00 – Erosion and Sedimentation Controls.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with State of South Carolina Department of Transportation Highways standards.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- C. Maintain one copy of each document on site.

1.04 SUBMITTALS

- A. Comply with pertinent provisions of Section 01 30 00 – Administrative Requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Riprap: Granite type; broken stone; solid and non-friable; 6-inch minimum size, twelve (12)-inch maximum size.
- B. Aggregate: Granular fill as specified in Section 31 23 23.13 – Backfill and Compaction.
- C. Filter Fabric
 - 1. Comply with Section 31 25 00 – Erosion and Sedimentation Controls.

PART 3 EXECUTION

3.01 RIP-RAP PLACEMENT

- A. Place riprap at culvert pipe ends, embankment slopes and as indicated.

- B. Where thickness is not shown on the plans, it shall be twelve (12)-inches.
- C. The slope upon which this rip-rap is to be placed shall conform with the cross section shown on the plans or as directed by the Engineer.
- D. Properly compact depressions that may be filled in trimming and shaping the slope.
- E. Install filter fabric, lapping sides twelve (12)-inches.
- F. Begin placing in a trench at least two (2)-feet below the toe of the slope.
- G. Firmly imbed against the slope and the adjoining piece with the sides in contact and with broken joints.
- H. Fill the spaces between the larger pieces with spalls of suitable size, thoroughly ram into place.
- I. The finished surface shall present an even, tight surface true to line, grade and section.

3.02 MEASUREMENT AND PAYMENT

- A. Payment will be made for work under this Section per the Contractor's bid for the related items listed in Specification Section 00 41 00 Bid Form.

END OF SECTION

SECTION 31 50 00

EXCAVATION SUPPORT AND PROTECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes temporary excavation support and protection systems.

1.03 PERFORMANCE REQUIREMENTS

- A. Design, furnish, install, monitor and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
 - 1. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a licensed professional engineer in South Carolina, using performance requirements and design criteria indicated.
 - 2. Prevent surface water from entering excavations by grading, dikes, dewatering or other means.
 - 3. Install excavation support and protection systems without damaging existing buildings, structures and site improvements adjacent to excavation.
 - 4. Monitor vibrations, settlements and movements.

1.04 SUBMITTALS

- A. Shop Drawings: For excavation support and protection system.
- B. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by a professional engineer licensed in South Carolina responsible for their preparation.
- C. Coordinate first paragraph below with qualification requirements in Section 01 40 00 - Quality Requirements. Qualification Data: For qualified professional engineer.
- D. Other Informational Submittals:
 - 1. Photographs: Show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems. Submit before Work begins.
 - 2. Record Drawings: Identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions.

- a. Note locations and capping depth of wells and well points.

1.05 QUALITY ASSURANCE

- A. Pre-installation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to excavation support and protection system including, but not limited to, the following:
 - a. Geotechnical report.
 - b. Existing utilities and subsurface conditions.
 - c. Proposed excavations.
 - d. Proposed equipment.
 - e. Monitoring of excavation support and protection system.
 - f. Working area location and stability.
 - g. Coordination with waterproofing.
 - h. Abandonment or removal of excavation support and protection system.

1.06 PROJECT CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - 1. Notify Owner no fewer than two days in advance of proposed interruption of utility.
 - 2. Do not proceed with interruption of utility without Owner's written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
 - 2. The geotechnical report is included elsewhere in the Technical Specifications.
- C. Survey Work: Engage a qualified land surveyor to survey adjacent existing buildings, structures and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 - 1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Engineer if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36, ASTM A 690, or ASTM A 992.
- C. Steel Sheet Piling: ASTM A 328, ASTM A 572, or ASTM A 690; with continuous interlocks.
 - 1. Corners: Site-fabricated mechanical interlock.
- D. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
- E. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- F. Tiebacks: Steel bars, ASTM A 722.
- G. Tiebacks: Steel strand, ASTM A 416.

PART 3 EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards that could develop during excavation support and protection system operations.
 - 1. Shore, support and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.
- D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.02 SOLDIER PILES AND LAGGING

- A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not

more than 1:120 out of vertical alignment.

- B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil and compact.
- C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.03 SHEET PILING

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.04 TIEBACKS

- A. Tiebacks: Drill, install, grout and tension tiebacks. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
 - 1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.
 - 2. Maintain tiebacks in place until permanent construction is able to withstand lateral soil and hydrostatic pressures.

3.05 BRACING

- A. Bracing: Locate bracing to clear columns, floor framing construction and other permanent work. If necessary to move brace, install new bracing before removing original brace.
 - 1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Engineer.
 - 2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
 - 3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.06 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities and utilities.
 - 1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlaying construction and abandon remainder.
 - 2. Fill voids immediately with approved backfill compacted to density specified in Division 31 Sections.

3. Repair or replace, as approved by Engineer, adjacent work damaged or displaced by removing excavation support and protection systems.
- B. Leave excavation support and protection systems permanently in place.

3.07 MEASUREMENT AND PAYMENT

- A. No separate measurement or direct payment will be made for the work under this Section and all costs for same shall be included in the price bid for the item to which it pertains.

END OF SECTION

SECTION 32 92 00

TURF AND GRASSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Seeding and Fertilization
- B. Provide grassing for the area specified herein, or as indicated, for a complete and proper installation.
- C. Highway and street shoulders: All areas disturbed by the construction process.

1.02 RELATED REQUIREMENTS

- A. Documents affecting work in this section include, but are not necessarily limited to, General Conditions, and Sections in Division 1 of these Specifications.
- B. Section 31 23 23.13 – Backfill and Compaction
- C. Section 31 25 00 – Erosion and Sedimentation Controls

1.03 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnsongrass, Poison Ivy, Nut Sedge, Nimble Will, Blindweed, Bentgrass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.04 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Seed: Conform to all State laws and to all requirements and regulations of the South Carolina Department of Agriculture.
 - 1. Deliver to site each variety of seed individually packaged and tagged to show name, net weight, origin, and lot number.
- C. Fertilizer: Conform to State fertilizer law.

1.05 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements, for submittal procedures.
- B. Comply with pertinent provisions of Section 01 30 00 – Administrative Requirements.
- C. Product Data: Within fifteen (15) calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Complete materials list of items proposed to be provided under this Section.

2. Material Safety Data Sheets for all materials to be used.
3. Installation/Application Instructions for all relevant materials (i.e. erosion blankets, hydraulic mulches)

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- C. Comply with pertinent provisions of Section 01 60 00 – Produce Requirements
- D. At time of delivery, furnish the Engineer invoices of all materials received in order that application rates may be determined.
- E. Immediately remove from the site materials that do not comply with the specified requirements, and promptly replace with materials meeting the specified requirements.

PART 2 PRODUCTS

2.01 GRASS SEED

- A. Provide grass seed that is:
 1. Free from noxious weed seeds
 2. Current year crop seed
 3. Treated with appropriate fungicide at time of mixing
 4. Delivered to the site in sealed containers with dealer's guaranteed analysis
- B. Water: Clean, fresh and free of substances that could inhibit vigorous growth of grass.
- C. Stakes: Softwood lumber, chisel pointed
- D. String: inorganic fiber
- E. Lime and pH Adjustment
 1. For Dry Seeding operations provide agricultural grade, standard ground limestone conforming to the current "Rules, Regulations and Standards of the Fertilizer Board of Control" issued at Clemson University.
 2. For Hydraulic Seeding operations, provide NeutralLime Dry by Profile Products or approved equal to raise pH or Aqua-pHix by Profile Products or approved equal to lower pH at rate determined by soil analysis or at manufacturer's recommended rate.
 3. Bag tags or delivery slip for bulk loads shall indicate brand or trade name, calcium carbonate equivalent, and other pertinent data to identify the lime.

- F. Wood Fiber Mulch
 - 1. Provide 100% thermally processed wood fiber or blended 70/30 wood/cellulose fiber manufactured specifically for discharging uniformly on the ground surface when dispersed by a hydro-seeding machine.
 - 2. Material shall contain thermally processed wood fibers so as to contain no germination or growth inhibiting factors and to achieve phyto-sanitization.
 - 3. Material shall contain basic green dye to facilitate visual metering.
- G. Flexterra HP-FGM or approved equal
 - 1. Provide Flexterra HP-FGM as manufactured by Profile Products or approved equal.
 - 2. Material shall contain thermally refined wood fibers and crimped synthetic fibers so as to contain no germination or growth inhibiting factors.
 - 3. Materials shall contain non-toxic green dye to facilitate metering.
 - 4. Material shall be 100% Bio-degradable.
- H. Straw Mulch/Dry Applied Mulching Pellets
 - 1. Provide straw or hay material.
 - a. Straw to be stalks of wheat, rye, barley or oats.
 - b. Hay to be timothy, peavine, alfalfa, or coastal Bermuda
 - 2. Material to be reasonably dry and reasonably free from mature seed bearing stalks, roots, or bulblets or Johnson Grass, Nutgrass, Wild Onion or any other Noxious weeds detailed in part 1.04 of this Section.
 - 3. Seed Aide Aero® manufactured by Profile Products or approved equal at a rate of 3,000 LBS/ACRE can be used as a weed free alternative to straw mulch.
- I. Erosion Control Blanket
 - 1. Provide on areas as shown on the plans
 - 2. Provide Erosion Control Blanket S-2, from Western Excelsior, or approved equal.

2.02 TESTS

- A. Provide analysis of topsoil fill under provisions of Section 01 40 00 – Quality Requirements
- B. Analyze to ascertain the percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter, and pH value.
- C. Submit minimum ten (10) oz (280 g) sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.

- D. Testing is not required if recent test are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.
- E. If pH is not in the range of 6.0 to 7.0, adjust accordingly with Lime.
- F. Organic matter must be 2.0% or greater. If organic matter percentage is less than 2%, contractor shall apply JumpStart or approved equal and/or BioPrime by Profile Products or approved equal to modify soil organic matter. JumpStart or approved equal and BioPrime or approved equal to be applied at rate determined by soil analysis or at manufacturer's recommended rate

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this Section.

3.02 PREPARATION

- A. Seed these areas immediately upon completion of grading or construction and cleanup operations.
 - 1. Slopes greater than 4:1
 - 2. Utility right-of-ways or any other disturbed area adjacent to wetlands.
- B. Bring all areas to proper line, grade and cross section indicated on the plans.
- C. Repair erosion damage prior to commencing seeding operations.
- D. Loosen seed bed to a minimum depth of three (3)-inches and track in slope so as the direction of the track marks is perpendicular to the direction of the slope.
- E. Ensure a minimum of two (2)-inches of topsoil exists in areas to be seeded.
- F. Remove all roots, clods, stones larger than one (1)-inch in any dimension, and other debris.

3.03 FERTILIZATION

- A. Apply fertilizer in accordance with manufacturer's instructions and the Soil Analyses as detailed in part 2.03 of this Section.
- B. Apply after smooth raking of topsoil and prior to roller compaction.
- C. Mix thoroughly into upper two (2) inches (50 mm) of topsoil.
- D. If seeding using a hydro-seeder apply fertilizer in slurry with mulch, seed, and lime.
- E. Spread uniformly over areas to be seeded at:
 - 1. Rate of 11 LBS/1000 sq. ft. when using 19-19-19.
 - 2. Rate of 20 LBS/1000 sq. ft. when using 10-10-10.
 - 3. Use approved mechanical spreaders for dry seeding application.

- F. Second Application of Fertilizer
 - 1. When plants are established and showing satisfactory growth, apply Nitrogen at the rate of one (1) lb. per 1000 sq. ft.
 - 2. Apply using dry seeding application unless otherwise directed by Engineer.
 - 3. Do not apply to stands of temporary grasses.

3.04 SEEDING

- A. Mixtures of different types of seed for the various schedules shall be weighted and mixed in proper proportions in the presence of the Engineer.
- B. Permanent Seeding Mix – Slopes 4:1 or Greater
 - 1. Schedule No. 1 – Planting Dates April 1 – September 15:
 - a. Slopemaster Spring/Summer Mix by Pennington Seed, Inc. or approved equal.
 - 25% Hulled Sahara Bermudagrass
 - 25% Unhulled Sahara Bermudagrass
 - 25% Pensacola Bahiagrass
 - 10% Durana White Clover
 - 10% Brown Top Millet
 - 5% Weeping Lovegrass
 - b. Rate 75 LBS/ACRE or 1.75 LBS/1000 sq. ft.
 - c. Seed to be coated with MYCO Advantage by Pennington Seed, Inc. or approved equal.
 - 2. Schedule No. 2 – Planting Dates September 15 – March 31:
 - a. Slopemaster Fall/Winter Mix by Pennington Seed, Inc. or approved equal.
 - 25% Unhulled Sericea Lespedeza
 - 20% Unhulled Sahara Bermudagrass
 - 20% Greystone Tall Fescue
 - 10% Pensacola Bahiagrass
 - 10% Durana White Clover
 - 10% Rye Grain
 - 5% Weeping Lovegrass
 - b. Rate 100 LBS/ACRE or 2.25 LBS/1000 sq. ft.
 - c. Seed to be coated with MYCO Advantage by Pennington Seed, Inc. or approved equal.
- C. Permanent Seeding Mix – Slopes 4:1 or Less
 - 1. Schedule No. 1 – Planting Dates April 1 – September 15:
 - a. Hulled Sahara Bermudagrass
 - b. Rate 75 LBS/ACRE or 1.75 LBS/1000 sq. ft.

2. Schedule No. 2 – Planting Dates September 15 – March 31:
 - a. Unhulled Sahara Bermudagrass
 - b. Rate 100 LBS/ACRE or 2.25 LBS/1000 sq. ft.
- D. Temporary Seeding Mix – All Disturbed Areas
1. Schedule No. 1 – Planting Dates April 1 – September 15:
 - a. Brown Top Millet
Rate 45 LBS/ACRE or 1 LBS/1000 sq. ft.
 2. Schedule No. 2 – Planting Dates September 15 – March 31:
 - a. Rye Grain
Rate 80 LBS/ACRE or 2 LBS/1000 sq. ft.
- E. Do not seed areas in excess of that which can be mulched on same day.
- F. Do not sow during rain, when the ground is too dry, or during windy periods.
- G. Immediately following seeding and compacting, apply mulch to a thickness of 1/8 inches (3 mm). Maintain clear of shrubs and trees.
- H. Apply water with a fine spray immediately after each area has been mulched. Saturate to four (4) inches (100 mm) of soil.
- I. Following germination, immediately re-seed areas without germinated seeds that are larger than four (4) by four (4) inches (100 mm by 100mm).

3.05 SOWING METHODS

- A. General:
1. Perform seeding during the periods and at the rates specified in the seeding schedules.
 2. Do not conduct seeding work when ground is frozen or excessively wet.
 3. Produce satisfactory stand of grass regardless of period of the year the Work is performed.
- B. Seeding, slopes less than four horizontal to one vertical:
1. Seeding of slopes of 4:1 or less will be done in one of the following two ways:
 2. Dry Seeding:
 - a. Sow seed not more than 24 hours after application of fertilizer and lime.
 - b. Use mechanical seed drills on accessible areas, rotary hand seeders, power sprayers, etc. may be used on steep slopes or areas not accessible to seed drills.

- c. Cover seed and lightly compact with culti-packer if seed drill does not.
- d. Within twenty-four (24) hours following compaction of seeded areas, uniformly apply straw mulch, as defined in Section 2.01, at a rate of 4000 LBS/ACRE or 90 LBS/1000 sq. ft.

3. Hydraulic Seeding:

- a. Apply seed, fertilizer, lime, and wood fiber mulch using hydraulic equipment.
- b. Equipment to have built-in agitation system with capacity to agitate, suspend and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed, lime, and water.
- c. Minimum capacity of slurry tank: 1000 gallons.
- d. Apply 100% wood or 70/30 wood/cellulose blend fiber mulch, defined in Section 2.01, at a rate of 2500 LBS/ACRE or 60 LBS/1000 sq. ft.
- e. Regulate slurry mixture so that amounts and rates of application will result in uniform application of all materials at not less than the specified amounts.
- f. Apply slurry in two directions so as to avoid "shadowing."
- g. Use color of fiber mulch as guide, spraying the prepared seed bed until a uniform visible coat is obtained.

C. Seeding, slopes greater than four horizontal to one vertical:

1. Seeding of slopes of 4:1 or greater will be done in one of the following two ways

2. Dry Seeding:

- a. Sow seed not more than twenty-four (24) hours after application of fertilizer and lime.
- b. Use mechanical seed drills on accessible areas, rotary hand seeders, power sprayers, etc. may be used on steep slopes or areas not accessible to seed drills.
- c. Cover seed and lightly compact with culti-packer if seed drill does not.
- d. Within twenty-four (24) hours following compaction of seeded areas, uniformly lay double netted excelsior blanket, as defined in Section 2.01, over seeded areas. Excelsior blanket installation and staple pattern shall conform strictly to manufacturer's instructions.

3. Hydraulic Seeding:

- a. Apply seed, fertilizer, lime, and Flexterra HP-FGM or approved equal mulch using hydraulic equipment.
- b. Equipment to have built-in agitation system with capacity to agitate, suspend and homogeneously mix a slurry of the specified amount of fiber, fertilizer, seed, lime, and water.

- c. Minimum capacity of slurry tank: 1000 gallons.
- d. Apply Flexterra HP FGM or approved equal, as defined in Section 2.01, at a rate of 3000 LBS/ACRE or 68 LBS/1000 sq. ft.
- e. Regulate slurry mixture so that amounts and rates of application will result in uniform application of all materials at not less than the specified amounts.
- f. Apply slurry in two directions so as to avoid "shadowing."
- g. Use color of fiber mulch as guide, spraying the prepared seed bed until a uniform visible coat is obtained.

3.06 MAINTENANCE

- A. Water to prevent grass and soil from drying out.
- B. Roll surface to remove minor depressions or irregularities.
- C. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.
- D. Remedy damage resulting from improper use of herbicides.
- E. Areas not showing satisfactory evidence of germination within six weeks of the seeding or which show bare spots, shall be immediately reseeded, fertilized and/or mulched.
- F. Protect seeded areas with warning signs during maintenance period.
- G. Maintain all seeded areas in satisfactory condition until final acceptance of Work.
- H. Repair any eroded areas.
- I. Mow as necessary to maintain healthy growth rate until final acceptance of the Work.

3.07 ACCEPTANCE

- A. Permanently seeded areas will be accepted when the stand of grass reaches 70% coverage.
- B. No acceptance will be made of temporary seeded areas.

3.08 MEASUREMENT AND PAYMENT

- A. Payment will be made for work under this Section per the Contractor's bid for the related items listed in Specification Section 00 41 00 Bid Form.

END OF SECTION

SECTION 33 05 13

MANHOLES AND STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage, and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures; American Concrete Institute International; 2009.
- B. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2008).
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2009.
- D. ASTM C55 - Standard Specification for Concrete Brick; 2009.
- E. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale); 2010.
- F. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections; 2009.
- G. ASTM C478M - Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric]; 2009.
- H. ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2008.
- I. ASTM C923M - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals [Metric]; 2008b.
- J. ASTM C1634 - Standard Specification for Concrete Facing Brick; 2009.
- K. ASTM D3753 - Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wetwells; 2005.
- L. IMIAWC (CW) - Recommended Practices & Guide Specifications for Cold Weather Masonry Construction; International Masonry Industry All-Weather Council; 1993.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

- B. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.

1.05 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.
- B. Maintain materials and surrounding air temperature to minimum 50°F prior to, during, and forty-eight (48) hours after completion of masonry work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C478 (ASTM C478M), with resilient connectors complying with ASTM C923 (ASTM C923M).
- B. Concrete: As specified in Section 03 30 00 – Cast-in-Place Concrete.
- C. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.
- D. Concrete Reinforcement: As specified in Section 03 30 00 – Cast-in-Place Concrete.

2.02 COMPONENTS

- A. Manhole Steps: Formed galvanized steel rungs; 3/4 inch diameter. Formed integral with manhole sections.

2.03 CONFIGURATION

- A. Shaft Construction: Concentric with concentric cone top section; lipped male/female dry joints; sleeved to receive pipe sections.
- B. Shape: Cylindrical.
- C. Clear Inside Dimensions: Forty-eight (48) inch diameter.
- D. Clear Inside Dimensions: As indicated.
- E. Design Depth: As indicated.
- F. Clear Lid Opening: As indicated.
- G. Pipe Entry: Provide openings as indicated.
- H. Steps: Twelve (12) inches wide, sixteen (16) inches on center vertically, set into manhole wall.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for manholes is correct.

3.02 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 MANHOLES

- A. Place concrete base pad, trowel top surface level.
- B. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.
- C. Form and place manhole cylinder plumb and level, to correct dimensions and elevations. As work progresses, build in fabricated metal items.
- D. Cut and fit for pipe.
- E. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.
- F. Set cover frames and covers level without tipping, to correct elevations.
- G. Coordinate with other sections of work to provide correct size, shape, and location.

3.04 SCHEDULES

- A. Storm Sewer Manholes: Precast concrete sections, galvanized steel steps, forty-eight (48) inch inside dimension, to depth indicated, with bolted lid.

3.05 MEASUREMENT AND PAYMENT

- A. All costs for manholes and structures shall be included in the lump sum price. No separate measurement or direct payment will be made for the work under this section.

END OF SECTION

**SECTION 33 05 23.16
JACK AND BORE CROSSINGS**

PART 1 GENERAL

1.01 SCOPE

The work covered in this section consists of furnishing all materials, labor, equipment, and other miscellaneous appurtenances necessary for the proper completion of pipeline crossings under roads, railroads, or creeks.

1.02 SUBMITTALS

Complete product data and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of Section 01 60 00 of the Contract Documents.

1.03 RELATED SECTIONS

- A. Section 33 05 40 Casing Pipes for Utilities

PART 2 PRODUCTS

2.01 MATERIALS:

Shall conform to requirements of South Carolina Department of Transportation (SCDOT) for crossings of State Highways or to the applicable railroad owner for railroad crossings if more stringent than the requirements specified within this section.

- A. Carrier Pipe:

1. Shall be ductile iron pipe, Pressure Class 350, of the size shown on the drawings.

- B. Casing Pipe:

1. Shall be steel pipe conforming to ASTM A-139, Grade B, electric fusion welded pipe having a minimum yield strength of 35,000 psi. The exterior of the casing pipe shall be coated with Kopper "Bitumastic Super Service Black", coal tar epoxy paint or equal. The size and wall thickness of the casing pipe for the indicated carrier pipe shall be as shown below:

Carrier Pipe I.D.- (Nom.) Inches	Casing Pipe I.D.-(Nom.) Inches	Casing Pipe Wall Thickness (Inches)
6	14	0.250
8	16	0.250
10	18	0.250
12	20	0.250
16	24	0.375
18	30	0.375
20	30	0.375
24	36	0.438
30	42	0.500

C. Casing Spacers:

Shall be Model CCS stainless steel casing spacers as manufactured by Cascade Waterworks Mfg. Co. of Yorkville, IL or approved equal.

PART 3 EXECUTION

3.01 GENERAL

Construction method shall conform to requirements of SCDOT for crossings of State Highways or to the applicable railroad owner for railroad crossings if more stringent than the requirements specified within this section.

3.02 JACKING PROCEDURES

- A. The diameter of the excavation shall conform to the outside diameter and circumference of the pipe as closely as practicable. Any voids which develop during the installation operation and which are determined by the Engineer to be detrimental to the roadbed shall be pressure grouted with an approved mix.
- B. The distance that the excavation extends beyond the end of the pipe will depend upon the character of the excavated material, but shall not exceed 2 feet in any case.
- C. The pipe shall be jacked from the low or downstream end. Variation in the final position of the pipe from the line and grade established by the Engineer will be permitted if approved by the Engineer, providing that the final grade of flow line shall be in the direction indicated on the plans. Wood blocking to adjust the grade of the carrier pipe may be required.
- D. When jacking of pipe is once begun, the operation shall be carried on without interruption, insofar as practicable, to prevent the pipe from becoming firmly set in the embankment.
- E. Any pipe damaged in jacking operations shall be removed and replaced by the Contractor at his expense.
- F. Pressure pipeline carriers shall be adequately blocked with pressure treated wood to prevent movement in the casing pipe.
- G. Casing pipe shall be welded by a certified welder in accordance with AWS and AISC Standards. Welds shall be continuous, watertight and develop a greater strength than the pipe. Welds shall be chipped and wire brushed immediately before applying coal tar coating.
- H. The ends of the casing pipe shall contain end seals as well as brick and mortar to affect a watertight seal.
- I. Bores under Paved Driveways and Surface Obstructions: When driveways and other obstructions are encountered along the proposed waterline, the Contractor shall avoid damaging the area by boring under the driveways or other surface obstruction as called for on the plans.
- J. The type of bore shall be determined by its length and the soil conditions of the bore location. Bore diameter shall not exceed four (4) inches larger than that of the carrier pipe. When bore lengths exceed 25 L.F., a casing pipe shall be carried along with the bore. After the piping has been inserted through the casing, the casing shall be removed from the bore hole. When bore lengths are less than 25 L.F., the casing pipe will not be required to be used unless soil conditions will not permit an uncased bore.

- K. Casing spacers shall be placed not more than three (3) feet from each end of each joint of piping. Spacers shall be installed in strict accordance with manufacturer's recommendations.

3.03 BORING PROCEDURES

- A. Holes are to be bored mechanically.
- B. The boring may be done using a pilot hole approximately 2-inches in diameter which shall be bored the entire length of the installation and shall be checked for line and grade on the opposite end of the bore. This pilot hole shall serve as the centerline of the larger diameter hole to be bored.
- C. The use of water or other fluids in connection with boring will be permitted only to the extent necessary to lubricate cuttings. Jetting will not be permitted.

3.04 MEASUREMENT AND PAYMENT

- A. Measurement for Jack and Bore Crossings shall be based on the distance in linear feet as shown on the plans and/or as shown in the bid form. Payment shall be made to the nearest linear foot.

END OF SECTION

SECTION 33 05 40

CASING PIPES FOR UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Provide and install casing pipes under surface structures, where indicated, as specified herein, and as needed for a complete and proper installation.

1.02 RELATED SECTIONS

- A. Section 33 05 23.16 Jack and Bore Crossings

1.03 REFERENCES

- A. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- B. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2003.
- C. NFPA 70 - National Electrical Code; National Fire Protection Association; 2005.
- D. SSPC-Paint 15 - Steel Joist Shop Paint; Society for Protective Coatings; 1999 (Ed. 2004).

1.04 SUBMITTALS

- A. Product data: Within fifteen (15) calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
 - 1. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
- B. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- C. Use equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver Material to project site.
- B. Store Material under cover and elevated above grade.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cascade Manufacturing, Pipeline Seal and Insulator, Inc. or approved equal.

2.02 MATERIALS

A. Casing Pipe for Dry Bores:

- 1. Steel complying with ASTM A139 for Grade B with minimum yield strength of 35,000 psi.
- 2. Provide ends suitable for field welding.
- 3. Minimum wall thickness as follows:

Diameter of Casing (Inches)	Minimum Wall Thickness (Inches)
14 and below	1/4 (0.250)
16-22	1/4 (0.250)
24-28	7/16 (0.438)
30-34	1/2 (0.500)
36-44	9/16 (0.563)
48-60	5/8 (0.625)

B. Casing Pipe Spacers

- 1. For piping installed in casing provide pipeline casing spacers.
- 2. Provide a minimum of 1 spacer per ten linear feet of pipe for ductile iron pipe and a minimum of 1 spacer per six linear feet for PVC pipe.
- 3. Provide spacer with shell of 14 gauge T-304 stainless steel.
- 4. Provide shell liner of .090" thick PVC, 85-90 durometer.
- 5. Runners from 2" wide ultra-high molecular weight polymer with a high resistance to abrasion and a coefficient of friction of 0.11 -0.13 in accordance with ASTM D 1894.
- 6. Support runners on 14 gauge reinforced T-304 stainless steel risers welded to shell.
- 7. All metal surfaces to be fully passivated.
- 8. The diameter as measured over the runners shall exceed the pipeline bell or coupling outside diameter.
- 9. Provide pipeline casing spacers as manufactured by Cascade Manufacturing, Pipeline Seal and Insulator, Inc. or approved equal.

- C. End Seals
 - 1. Provide 1/8-inch thick rubber end seal at each end of the casing.
 - 2. Secure to casing and carrier pipe with T-304 stainless steel bands.
- D. Vent Pipe
 - 1. Provide 2-Inch steel pipe for venting to the surface, welded to the casing and sloped to provide positive drainage back to the casing.
 - a. For casing pipes less than 150-LF, provide vent pipe at end with higher elevation.
 - b. For casing pipes 150-LF and longer, provide vent pipe at both ends.
 - c. For casing pipes with less than 1% positive slope, provide vent pipe at both ends.
- E. Drain Pipe
 - 1. Provide 1-Inch steel pipe for drainage to the surface; welded to the casing at the downstream end of the pipe.
 - a. For casing pipes with less than 1% positive slope, provide drain pipe at both ends.

PART 3 EXECUTION

3.01 ENTRY PITS

- A. Locate to avoid interference with traffic, adjacent structures, etc., to such extent possible.
- B. Excavate to required depth, providing sheeting and shoring necessary for protection of the Work and for safety of personnel.
- C. Maintain in dry condition by use of pumps, drains or other approved method.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install casings by dry-boring through the casing while simultaneously jacking the casing.
- C. Any proposed alternate method shall be approved in writing by the Engineer.
- D. Weld joints to provide a watertight joint.
- E. Casings for gravity sanitary sewer, storm drainage or shown to be installed to grade, shall not vary more than 3/32" per foot of length from the indicated grade.
 - 1. Remove and replace any improperly installed or otherwise defective casing at no additional cost to the Owner.

3.03 INSTALLING PIPE IN CASING

A. General:

1. Inspect carefully, insuring that all foreign material is removed from the casing and the casing meets alignment criteria for the type of carrier pipe being used.
2. For pressure systems, the casing deflection shall not exceed the maximum deflection recommended by the carrier pipe.
3. Install casing spacers on the carrier pipe per the manufacturer's instructions.
4. For sanitary and storm sewer provide spacer sizing and length necessary to obtain the pipe slope and elevations as shown on the plans.
5. Provide centered or restrained configuration.
6. Install the carrier pipe in the casing ensuring each joint is pushed "home" before the joint is installed into the casing.

3.04 INTERFACE WITH OTHER WORK

- #### A.
- Verify that the installation of this part of the construction does not interfere with the pipe installation.

3.05 ERECTION TOLERANCES

- #### A.
- Maximum Variation from true position: 4"-6" Deeper only.
- #### B.
- Maximum Offset from true alignment: 18"-24".

3.06 CASING ENDS

- #### A.
- Install rubber end seals in accordance with manufacturer's instructions.

3.08 MEASUREMENT AND PAYMENT

Measurement for Casings shall be based on the distance in linear feet as shown on the plans and/or as shown in the bid form. Payment shall be made to the nearest linear foot. Payment includes casing, end seals, vents, drains, and or any appurtenances necessary.

END OF SECTION

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES:

- A. Pipe and fittings for site water lines including domestic water lines and fire water lines.
- B. The scope of this project includes installation of new gate valves within the existing water system piping as detailed on the Construction Plans and as specified in this section.
- C. RELATED REQUIREMENTS
 - 1. Section 31 23 16 – Excavation
 - 2. Section 31 23 16.13 – Trenching
 - 3. Section 31 23 23.13 – Backfill and Compaction
 - 4. Section 31 50 00 – Excavation Support and Protection
 - 5. Section 03 30 00 – Cast-In-Place Concrete
 - 6. Section 03 30 53 – Flowable Fill

1.02 REFERENCES:

- A. ASME B16.18- Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2012 (ANSI B16.18).
- B. ASME B16.22- Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2010).
- C. ASTM B88 -Standard Specification for Seamless Copper Water Tube; 2009.
- D. ASTM D1785- Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2006.
- E. ASTM D2241 -Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2009.
- F. ASTM D2466- Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2006.
- G. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).
- H. ASTM D3035 -Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter; 2010.
- I. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals; 1998 (Reapproved 2005).

- J. AWS A5.8/A5.8M- Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2011 and errata.
- K. AWWA C104/A21.4- Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; American Water Works Association; 2008 (ANSI/AWWA C104/A21.4).
- L. AWWA C105/A21.5- Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; 2010 (ANSI/AWWA C105/A21.5).
- M. AWWA C111/A21.11 -Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; 2007 (ANSI/AWWA C111/A21.11).
- N. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 2009 (ANSI/AWWA C151/A21.51).
- O. AWWA C500- Metal-Seated Gate Valves for Water Supply Service; American Water Works Association; 2009.
- P. AWWA C502- Dry Barrel Fire Hydrants; American Water Works Association; 2005 (ANSI/AWWA C502/C502a).
- Q. AWWA C504- Rubber Seated Butterfly Valves; American Water Works Association; 2010.
- R. AWWA C508- Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; American Water Works Association; 2011 (ANSI/AWWA C508).
- S. AWWA C509- Resilient-Seated Gate Valves for Water Supply Service; American Water Works Association; 2009 (ANSI/AWWA C509).
- T. AWWA C600- Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; 2010 (ANSI/AWWA C600).
- U. AWWA C606- Grooved and Shouldered Joints; American Water Works Association; 2011.
- V. AWWA C900- Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution; American Water Works Association; 2008 (ANSI/AWWA C900/C900a).
- W. AWWA C901- Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service; American Water Works Association; 2008.
- X. NSF- National Sanitation Foundation.
- Y. UL 246- Hydrants for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. Comply with Section 01 30 00 – Administrative Requirements.
- B. Contractor must provide product data within 15 calendar days after receipt of the Owner's Notice to Proceed.
- C. Submit Specific Items:
 - 1. Materials List for specific items being provided under this section.

2. Specifications or other related data illustrating compliance with the requirements of this section.

1.04 QUALITY ASSURANCE:

- A. Perform Work in accordance with utility company requirements.
- B. Use required number of workmen that are properly trained and have experience in the crafts and who are completely familiar with the specified requirements herein and the methods for proper performance of the work specified in this section.
- C. All material specified in the section must be manufactured in the United States of America and properly marked "Made in the USA".

1.05 PRODUCT HANDLING

- A. Comply with Section 01 60 00 – Product Requirements.
- B. Storage of PVC Pipe:
 1. PVC Pipe must be stored as unit packages as received from the manufacturer prior to use.
 2. Units must be staked to prevent deformation to pipe barrel and bells.
 3. If a storage period of more than six (6) weeks is required, protect pipe from direct sunlight by using an opaque material.
- C. Avoid pipe damage from severe impact blows, gouging or cutting by metal surfaces or rocks.

PART 2 PRODUCTS

2.01 GENERAL:

- A. Except where a specific material is specified herein, use any pipe material or fittings.
- B. All materials and/or products that contact potable water must be third party certified as meeting the specifications of ANSI/NSF Standard 61. The certifying party shall be accredited by the ANSI.
- C. Pipe, fittings, packing, jointing materials, valves and fire hydrants shall conform to Section C of the AWWA Standards.
- D. Natural rubber or other material which will support microbiological growth may not be used for any gaskets, O-rings, and other products used for joining pipes, setting meters or valves, or other appurtenances which will expose the material to the potable water.

2.02 WATER PIPE AND FITTINGS:

- A. GENERAL:
 1. Pipe sizes 3" and larger: Use ductile iron or plastic pipe unless otherwise indicated on the plans. Asbestos Cement Pipe is not allowed.

2. Pipe sizes less than 3": Use plastic pipe.
 3. Any pipe, flux or solder utilized during construction shall be free of lead (lead free is defined for solder and flux as less than 0.2% content and for pipes and fittings the lead content shall be less than 8.0%).
 4. All Gaskets shall be integral with the pipe and factory installed.
 5. All pipe 4" and larger, materials and products shall be meet specifications of NSF Standard 61, certified by a third party.
 6. Any chemicals or products added to the water supply shall meet specifications of ANSI/NSF Standard 60, certified by a third party.
 7. Each valve shall have marking cast into the body indicating the size of valve, year of manufacture, and the working pressure class. Certifications rating a 150B valve body to a class 250 valve is not acceptable.
 8. All interior Wetted ferrous surfaces shall have a two-component epoxy spray coated with a nominal thickness of 3 to 4 mils. Coating material must be approved by AWWA and the US Food and Drug Administration for use with potable water.
 9. Coatings:
 - a. Buried Service: Provide bituminous coating.
 10. Water mains, which have been previously used for conveying potable water may be reused provided the materials and pipe meets applicable criteria from AWWA Section C, ANSI/NSF 61, and ASTM D1785 or D2241. The mains must be thoroughly cleaned and restored practically to their original conditions.
 11. Thermoplastic pipe shall not be used above grade.
 12. Solvent-weld PVC pipe and fittings shall not be used for water mains 4-inches and larger.
- B. Pipe:
1. Ductile Iron Pipe (DIP): AWWA C151:
 - a. Comply with ANSI/AWWA C151/A21.50 & A21.51, latest revision.
 - b. Pipe wall thickness shall be in accordance with Table 51.1 of ANSI/AWWA C151/A21.51, latest revision that includes a working pressure of 150 psi, depth of cover outlined with a Type 3 bedding conditions, and shall have a minimum Pressure Class of 150.
 - c. All DIP pipe shall have cement Mortar lining that complies with ANSI/AWWA C104/A21.4 latest revision, standard thickness.
 2. Plastic Pipe (PVC): AWWA C900, latest revision, Class 150:
 - a. General:
 - 1) All pipe shall have a NSF approval marking every 18" along the pipe.

- 2) All gaskets shall comply with ASTM F477, latest revision.
 - (a) Natural rubber gaskets are unacceptable.
- b. Pipe size 4"- 12" to comply with AWWA C900, latest revision, table 2, Pressure Class 150 (DR18).
3. Polyethylene (PE) Pipe: ASTM D 3035, for 100 psig (710 kPa) pressure rating
 - a. Comply with AWWA C906, latest revision, DR with a working pressure of 800 psi (min) at 140 degrees Fahrenheit.
 - b. The pipe supplied under this section shall be extra high molecular weight (EHMW) high-density polyethylene and shall conform to ASTM D1248, latest revision, (Type III C, Category 5, P34), having a minimum cell classification of 345464C per ASTM D3350, latest revision. The manufacturer making the pipe must also manufacture the pipe resin to ensure resin compatibility and product accountability. The fittings being supplied for the pipe under this section shall be made from a polyethylene having the same cell classifications equal to or exceeding that of the PE Pipe. All fittings being supplied for the PE Pipe must be provided by the same manufacturer.
 - c. Physical Properties:
 - 1) All pipe must conform to the physical properties described herein.
 - 2) Typical pipe properties:

Property	Test Method	Unit	Value
Material Designation	PPI/ASTM	PE3408	
Cell Classification	ASTM D3350		345464C
Density Black	ASTM D1505	gm/cc	0.955
Melt Index	ASTM D1238	gm/10m in	0.070
Flow Rate	ASTM D1238	gm/10m in	8.500
Tensile Strength,	ASTM D638	psi	5,000
Tensile Strength, Yield	ASTM D638	psi	3,500
Ultimate Elongation	ASTM D638	%	>800
Flexural Modulus	ASTM D790	psi	136,000

Environmental Stress Crack Resistance (ESCR)

Pent	ASTM F1473	hrs.	>100
Brittleness Temp	ASTM D746	°F	<-180
Hardness	ASTM D2240		64
Victate Softening Temp	ASTM D1525	°F	255
Izod Impact Strength, N	ASTM D256	ft-ibf/in	7
Mod Elasticity (short)	ASTM D638	psi	125,000
Mod Elasticity (long)	ASTM D638	psi	30,000
Thermal Exp. Coef.	ASTM D696	in/in/F	1.0x10 ⁻⁴
Average Mole. Weight	GPC		330,000
PPI Hydro. Design	ASTM D2837	psi@ 73°F	1,600
PPI Hydro. Design	ASTM D2837	psi@ 140°F	800
UV Stabilizer	ASTM D1603	%C	2.5

- d. Quality Control:
 - 1) All PE Pipe provided for under this section shall not contain any recycled materials except for materials of the same compounds generated in the manufacturer's plant from resin of the same specification and raw materials. The manufacturer's quality system shall be certified to be in accordance with ISO 9001:2000. Pipe, tubing and fittings shall be homogenous throughout, and free of visible cracks, holes, foreign inclusions, blisters, dents or other injurious defects. The pipe, tubing and fittings shall be as uniform as commercially practicable in color, opacity, density and other physical properties.
- e. The Owner reserves the right to reject any pipe, tubing or fittings failing to meet the Requirements set forth herein.
- f. The pipe dimensions specified herein shall have a nominal DIP size OD unless otherwise indicated. The DR (Dimension Ratio) of the pipe specified under this section shall be as specified.

2.03 PIPE JOINTS:

A. Ductile Iron Pipe Joints:

- 1. All pipe joints shall be mechanical or push-on type in accordance with ANSI/AWWA C111/CA21.11, latest revision and as modified by ANSI/AWWA C151/A21.51, latest revision.
- 2. Gasket lubricant must comply with ANSI/AWWA C111/A21.11, latest revision. Natural rubber gaskets are unacceptable.
- 3. The lubricants utilized for the joints during installation, must be compatible with pipe and gasket materials, not support bacteriological growth and not affect the water quality of the water line.
- 4. Lubricants must be NSF approved.
- 5. All pipe joints utilized for exposed piping shall be Class 53 minimum and flanged joints in accordance with ANSI/AWWA C115/A21.15, latest revision. All flanges shall be solid type utilizing full face red rubber gaskets, 1/16" thick for pipe size 10" or less and 1/8" thick for larger pipe sizes. All nuts and bolts must be hex head type and standard machined carbon steel.

B. Plastic Pipe Joints:

- 1. Join all pipe utilizing integral bell or coupling type joints with elastomeric gaskets.
- 2. Provide integral bell type joints in accordance with ASTM D2672, latest revision.
- 3. Provide pipe couplings in accordance with AWWA C900, latest revision.
- 4. All gaskets must be provided in accordance with ASTM F477, latest revision. Natural rubber gaskets are unacceptable.
- 5. Provide lubricants in accordance with paragraph 2.02 (C) (1) (c) & (d).

C. Polyethylene (PE) Pipe Joints:

1. All PE pipe shall be joined above ground adjacent to the trench where the piping is being installed (i.e. job site). The pipe must be joined in continuous lengths and performed with the butt fusion method in accordance with the manufacturer's recommendations. All joints shall carry a five (5) year warranty and provided in writing to the Owner by the contractor.
2. Where the PE pipe joins other types of waterline piping, provide mechanical joint adapters, and all costs associated with the adapters must be included in the price per linear foot cost of the PE piping.

D. Steel Pipe Joints:

1. All steel pipe joints must be welded type in accordance with AWWA C206, latest revision, or Victaulic System type. O-rings provided must comply with AWWA C200, latest revision.

2.04 PIPE FITTINGS:

A. Ductile Iron Pipe (DIP) fittings:

1. All DIP pipe fittings shall be rated at 250 psi and provided in accordance with AWWA C110/A21.10, latest revision. Any fittings utilized with push-on joint pipe must be provided in accordance with ANSI/AWWA C111/A21.11, latest revision, and all fittings shall have a cement mortar lining standard thickness, provided in accordance with ANSI/AWWA C104/A21.4, latest revision.

B. Plastic Pipe Fittings 4" and Larger:

1. All plastic pipe fittings shall be ductile iron type fittings rated at 250 psi in accordance with ANSI/AWWA C110/A21.10, latest revision. Adapter glands and gaskets shall be provided to accommodate any discrepancies in the pipe and fitting dimensions.

C. Plastic Pipe Fittings for pipe sizes 3" and smaller: Use PVC fittings rated at 160 psi at 73

D. Steel Pipe fittings shall be fabricated in accordance with AWWA C200 & C208, latest Revision, and reinforce all tees, laterals, and outlets in accordance with AWWA M-11, latest revision.

2.05 PIPE COUPLINGS:

A. Utilize pipe couplings where necessary to provide pipe connections and where illustrated on the plans. All couplings must be a mechanical joint ductile iron sleeve type with a minimum length of 12". Cut-in sleeves must be used when installing fittings in an existing line, and must be ductile iron with a mechanical joint.

B. Restrained joint couplings must be provided where restrained joints are specified.

2.06 RESTRAINED JOINT (RJ) PIPE:

A. Provide RJ Pipe and fittings as illustrated on the plans.

1. Placement of RJ Pipe and Fittings:

- a. Pipe size 12" and smaller: Place a distance of 18' each side of fitting.
 - b. Pipe size over 12": Place a distance of 36' each side of fitting.
2. For Class 160 PVC Pipe provide one (1) of the following:
- a. Snap-Lok by Griffin Pipe.
 - b. American Cast Iron Pipe Company.
 - 1) Use Flex-Ring for pipe size 4"-36".
 - 2) Use Lok-Ring for pipe size 42"-64".
 - c. TR-Fiex by US Pipe.
 - d. Super-Lock by McWane Pipe (Glow).
 - e. Gasket Locking Options:
 - 1) Fast Grip Gasket by American Cast Iron Pipe Company.
 - 2) Field Lok by US Pipe.
3. For Ductile Iron Pipe (DIP):
- a. When using mechanical joint pipe and fittings use retainer glands.
 - b. Use wedge type.
 - c. Use ductile iron gland in accordance with ASTM A536-80, latest revision, and if a standard gland cannot be utilized use a split gland.
 - d. Utilize ductile iron set screws that has been heat treated to a minimum hardness of 370 BHN that have twist-off nuts and will retain a permanent standard hex head.
 - e. the following rated pressure with a minimum 2:1 safety factor, 3"-16" 350 psi and 18"-48" 250 psi.
 - f. Utilize tee head bolts in accordance with ANSI/AWWA C111/A21.11, latest revision.
 - g. Utilize MEGALUG manufactured by EBAA Iron Sales, Inc. of Eastland, Texas or approved equal.
4. For C900 PVC Pipe: Restraint must be provided by mechanical means and the gasket sealing gland must be separate.
- a. Supportive Contact must be provided, the complete circumference of the pipe.
 - 1) Size 4" & 6": Restraint Width is 1-1/2".
 - 2) Size 8", 10" & 12" Restraint Width is 1-3/4".

- b. The restraint device must have machined serrations on the inside surface and provide circumferential loading over the entire restrainer.
 - 1) Restraint must increase with increase in line pressure.
 - 2) Provide at a minimum, eight (8) serrations per inch of restraint width.
 - c. The restraint device must be pressure rated at 350 psi or equal to the pipe on which it is utilized. The restraint device must also be capable of withstanding pressures that are two (2) times the pressure rating.
 - d. Apply epoxy coating finish in accordance with AWWA C213, latest revision.
 - e. Utilize MEGALUG manufactured by EBAA Iron Sales, Inc. or approved equal.
5. For C905 PVC Pipe: Restraint must be provided by mechanical means and the gasket sealing gland must be separate.
- a. The restraint device must have machined serrations on the inside surface and provide circumferential loading and be a two (2) piece configuration.
 - b. Body of restraint device must be manufactured from steel, ASTM A285, latest revision, Grade C, and have all surfaces coated with a fusion epoxy with the exception of the serrated areas of the device.
 - c. Supportive Contact must be provided, the complete circumference of the pipe.
 - 1) Size 14", 16" & 18": Restraint Width is 5".
 - 2) Size 20" & 24" Restraint Width is 7".
 - 3) Size 30" Restraint Width is 10".
 - d. Provide at a minimum, six (6) serrations per inch of restraint width.
 - e. Restraint Device must comply with ANSI/AWWA C111/21.11, latest revision.
 - f. The restraint device must be pressure equal to that of the pipe on which it is utilized. The restraint device must also be capable of withstanding pressures that are two (2) times the pressure rating.
 - g. Fusion epoxy coating must comply with AWWA C213, latest revision.
 - h. Utilize MEGALUG manufactured by EBAA Iron Sales, Inc. or approved equal.

2.07 TEE HEAD BOLTS:

- A. Utilize Cor-Ten steel tee head bolts in accordance with ASTM A242, latest revision, for mechanical joints.

2.08 PLUGS AND CAPS:

- A. Provide as indicated on the plans.
- B. Provide a 2" tap and 2" plug for all plugs and end caps.
- C. All plugs and caps must be restrained joint, and restrain all pipe joints for a distance of 18'.

2.09 POLYETHYLENE ENCASEMENT:

- A. Provide as indicated on the plans.
- B. Minimum standard thickness of eight (8) mils.
- C. Provide in accordance with AWWA C105, latest revision.

2.10 LINE DETECTION TAPE:

- A. Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Potable Water" in large letters at no greater than 24" on center.
- B. Place tape on all buried PVC piping and provide tape with a width of 2".
- C. Provide tape with a thickness of 5 mil and with a minimum 50 gauge solid aluminum foil core.
- D. Foil must be visible from both sides.
- E. Do not allow any ink or printing near the edges of the tape.
- F. Place 18" below ground surface within the pipe trench.
- G. Ink must be heat set mylar.
- H. Printing must be encased to avoid ink rub-off.
- I. Provide tape with a tensile strength of 28 lbs/in.
- J. Color to be blue.

2.11 COPPER TRACER WIRE: Provide Copper Tracer Wire for PVC or Polyethylene Pipe:

- A. Provide Copper Tracer Wire that is 12 gauge that is insulated and approved for direct burial by the manufacturer.
- B. Place Copper Tracer Wire a minimum of 6" above the water main.
- C. Stop Copper Tracer Wire at each valve and meter and provide a means for testing at each of these locations without interfering with the operation of these devices.
- D. Connect Copper Tracer Wire to the water main with duct tape every 20'.
- E. Copper Tracer Wire must also be placed in all water service line trenches.

- F. Connect Copper Tracer Wire installed along service line to the wire installed along the water main using a copper compression lug at the water service connection point.

2.12 VALVES:

A. General for all valve types:

1. 1-1/2" - Smaller: Provide Gate Valves or Ball Valves.
2. 2"-12": Provide Gate Valves.
3. 14" - Larger: Provide Double Disc Gate Valves or Butterfly Valves.
4. Open Valves by turning Counterclockwise.
5. Provide an operating nut 2" in size with an arrow indicating direction for open.
6. If the depth of the valve operating nut is greater than 36" deep, provide a stem extension for valve operation unless a position indicator and extension shaft is being used.
7. Provide two (2) part thermosetting epoxy on all internal ferrous surfaces.
8. Valve must be designed for external stem failure when excessive closing torque is applied, and have no failure for any of the pressure retaining parts in accordance with AWWA Section 3.2.
 - a. Provide factory test stating no leakage from either side of disc.
 - b. Shell to be tested to 500 psig.
9. If valves are installed in a horizontal position, double disc gate valves with bevel gears, grease case, and appurtenances must be provided.
10. For valves 14" and larger provide a valved bypass.
11. Apply two part thermosetting epoxy on exterior of all valves provided.
12. Stainless steel bolting is to be provided on all valves.
13. All valves must be made in the USA.
14. All wetted rubber compounds must be of synthetic rubber.
15. All valves provided must come from a manufacturer that is ISO 9001 certified.

B. Gate Valves 1-1/2"- Smaller:

1. Valves to be all bronze ball valves, that operates with a 1/4 turn with a stop, and has a 2" square nut operator.
2. Ball Valve to be Ford Model B11-QT67, or approved equal.
3. Provide valves with a working pressure of not less than 150 psi.

- C. Gate Valves 2"-12"
1. Valves utilized in this size range shall be double disc in accordance with AWWA C500, latest revision or resilient seated wedge valves in accordance with AWWA C509/C515, latest revision.
 2. If resilient seated wedge valves are used, these valves must have a bronze stem nut.
 3. Provide valves with a working pressure of not less than 250 psi.
 4. Valve used must be certified to NSF 61, latest edition.
 5. Provide the following for Resilient Wedge Valves:
 - a. Resilient iron wedge must be provided encapsulated with an elastomer, and must not have any thin spots and/or voids.
 - b. Between encapsulated wedge and interior epoxy coating, provide a polymer wedge guide bearing cap bearing surface that will reduce the operational torque and extend the service life of the valve.
- D. Valve Operator:
1. One (1) T-handle operator must be provided for every ten (10) valves installed.
 2. One (1) stainless steel T-handle operators must be provided for every four (4) buried T-head valves installed.

2.13 HYDRANTS:

- A. Fire Hydrants:
1. Comply with Utility Provider water regulations.
 2. Fire Hydrants must comply with AWWA C502, latest revision.
 3. Waterway valve opening 5 1/4".
 4. Provide a 6" bell connection with two (2) 2-1/2" hose connections and one (1) 4-1/2" steamer connection. Provide cap chain on all hydrant covers.
 5. Provide National Standard screw threads on all outlet nozzles.
 6. Open fire hydrants by turning Counter-Clockwise with an arrow cast in the top indicating the direction of opening.
 7. Provide a two (2) part breakable safety flange as an integral part of the barrel casting.
 8. Fire hydrants shall be placed as detailed on Construction Plans.
 9. Minimum cover for the fire hydrant lead pipe is 3'-6".
 10. Provide finish coat with industrial enamel, color to match Owner's standard.

11. Minimum distance between fire hydrant valve and fire hydrant is 3'.
 12. Fire hydrant valve open right.
 13. Provide one (1) fire hydrant wrench for every ten (10) hydrants installed.
 14. Provide fire hydrant manufactured by Mueller, Claw, American-Darling or approved equal.
- B. Roadway Reflector: Provide blue fire hydrant reflector for paved roadways where fire hydrants have been installed adjacent to roadways.
- C. Offset fitting:
1. Offset fittings are to be provided where fire hydrants connections are located 1'-4" above the finish grade.
 2. Offset fittings are to be located between the valve and the fire hydrant with a 12" offset.
 3. Provide ductile iron in accordance with AWWA C153, latest revision, utilizing compact design, and coated per AWWA C104, latest revision.
 4. Provide Offset fitting Grade Lok as manufactured by Assured Flow Sales, Inc. or approved equal.

2.14 FLUSH HYDRANTS:

- A Provide Mueller Company Model No. A-412, or approved equal.
- B. Valve opening to be 2-1/8".
- C. Provide one (1) 2-112" pipe connection.
- D. All outlet nozzle screw threads to be National Standard.
- E. Flush Hydrant to open Clockwise, and provide an arrow cast in the top of the hydrant that indicates the direction to open the hydrant.
- F. Hydrant lead pipe bury depth is 3'-0".
- G. Provide a finish coat of red enamel.
- H. Provide a cap chain.

2.15 VALVE BOXES:

- A Valve Boxes for each of the buried valves being installed.
- B. Valve Boxes that are cast iron extension type are suitable for a minimum bury depth of 3'-6" of cover over the pipe.
- C. Provide a Valve Box with a minimum inside diameter of 5", and a minimum wall thickness of 3/16".
- D. The words WATER, SEWER, SLUDGE, etc., as necessary, shall be cast in the cover of all

Valve Boxes being provided.

- E. Provide Tyler Series, Model No. 6850.
- F. Where the pipe bury depth requires the use of more than a two (2) piece box, use adjustable cast iron extensions.
- G. All valve boxes provided must be coated with two (2) shop coats of bitumastic paint.

2.16 VALVE BOX PROTECTION RING:

- A. Provide for each valve box installed as shown on plans outside of pavement.
- B. Provide reinforcing steel rings cast in the unit, one (1) 8" in diameter.
- C. Inside diameter of the Protection Ring to be 8".
- D. Outside diameter of the Protection Ring to be 18".
- E. Protection Ring thickness to be 5" at the interior diameter and sloped to 2" thick at the outside diameter.
- F. Protection Ring weight to be 110 lbs.
- G. All Protection Rings shall be embedded within existing grade or surface to allow maintenance activities.

2.17 SERVICE TAP SADDLE:

- A. The following materials must be provided when installing a service tap:
 - 1. Saddle Body: Provide Ductile Iron in accordance with ASTM A536, latest revision.
 - 2. All bales, straps, studs and hardware to be Type 304 stainless steel.
- B. For service taps 5" and larger provide double straps.
- C. Provide a fusion bonded nylon finish at an average thickness of 12 mils.
- D. Provide Rockwell, Model No. 317, or approved equal.

2.18 WATER MAIN TAPPING SLEEVE AND VALVE:

- A. Utilize the following for Tapping Sleeves on mains up to 24" in size and taps 12" and less in size:
 - 1. Ductile Iron split-type sleeve with flanged or grooved outlet.
 - 2. For each end of the sleeve provide bolts, follower rings and gaskets.
 - 3. Tapping sleeve must have a maximum working pressure of 150 psi.
 - 4. Bolts to be square headed with hexagon nuts.
 - 5. A 3/4" NPT test plug must be provided.

- B. Utilize the following for Tapping Sleeves on mains greater than 24" in size and taps greater than 12" in size:
1. All materials to be Type 304L stainless steel per ASTM A240, latest revision.
 2. All bolts are to be rolled threaded stainless steel in accordance with ASTM A153, latest revision, Type 304.
 3. All hex head nuts are to be Type 304 stainless steel and coated to prevent galling.
 4. Provide virgin SBR gaskets that have been compounded for water and wastewater service.
 5. Tapping sleeve must have a maximum working pressure of 200 psi.
 6. Approved manufacturer is ROMAC Industries Model SST, or approved equal.
- C. Tapping Sleeve Valve:
1. Valve material must be compatible with the tapping sleeve utilized.
 2. All valves used must conform to Paragraphs 2.05 above.
 3. Flange joints to tapping sleeve, utilize Push-on joint from pipe end.
- D. Tie Rods:
1. All rods are to be steel provided in accordance with ASTM A242, latest revision, and galvanized in accordance with ASTM A123, latest revision.
 2. The following are approved products:
 - a. Super Star Tierod (SS12) and Tiebolt by Star National Products, or approved equal.

2.19 AIR RELEASE VALVES:

- A. All Air Release Valves are to have a cast iron body and stainless steel internal trim and float.
- B. All Air Release Valves must have stainless steel seats with BUNA-N rubber valve.
- C. All Air Release Valves are to have a 1" NPT inlet with a bronze bushing that is 1"x3/4" in size.
- D. Approved Product is Crispin Model PL10, or approved equal.
- E. Provide precast manhole with access ring and cover.

2.20 MISCELLANEOUS PARTS AND ACCESSORIES:

- A. All miscellaneous parts and accessories are to be standard commercial grade and manufactured for the water systems where they are being utilized. They must also conform to the standards and specifications as set forth by AWWA, ASTM and ANSI.

2.21 CROSS CONNECTION DEVICES:

A. Reduced Pressure Principle Backflow Preventer

1. General:

- a. Provide Febco Model 825Y for water lines 3/4" to 2" in size.
- b. Provide Febco Model 825YD for water lines 2-1/2" to 10" in size.
- c. All backflow preventers provided must be listed on the approved list published by the South Carolina Department of Health and Environmental Control (SCDHEC), and tested before placing in service. Provide two (2) copies of the test results prior to placing into operation.
- d. No bypasses of the backflow preventers will be allowed unless there is equal backflow protection.

2. 3/4" to 2" Reduced Pressure Principle Backflow Preventer:

- a. Provide two (2) Y check valves that are independently operating and spring loaded.
- b. Backflow preventers must be designed to automatically reduce the pressure within the area between the check valves to 5 psi or less, lower than the inlet pressure.
- c. The differential relief valve must be designed to open and maintain proper differential should the differential pressure between upstream and the zone drop to 2 psi.
- d. The valve body and caps, the relief valve body and cover are to be made of Bronze in accordance with ASTM B584-78, latest revision.
- e. Provide a center stem guided check valve moving member.
- f. Provide stainless steel springs type 300 series.
- g. The diaphragm to seal area ratio must be 10:1 minimum, made of nitrile, fabric reinforced.
- h. Provide a removable seat ring on relief valve.
- i. Place check and relief valve components such that these components may be serviced without disassembling the waterline.
- j. Provide reversible, nitrile seats ASTM D2000, latest revision.
- k. Provided fully ported ball valves for all shut-off valves and test locks.
- l. Backflow Preventer assembly to be rated at 175 psi and a water temperature range between 32°F to 180°F.
- m. Backflow Preventer assemblies must meet the requirements of ASSE

Standard 1013; AWWA Standard Code C511-92, or latest revision; and USC Foundation of Cross Connection Control and Hydraulic Research, latest revision.

- n. All Reduced Pressure Principle Backflow Preventers must be constructed above ground with freeze protection during the winter months.
 - o. All relief valves must discharge onto grassed lawn areas as required by SCDHEC regulations and cannot be connected in any way to any storm drainage stormwater system.
3. 2-1/2" to 10" Reduced Pressure Backflow Preventers must meet the following requirements:
- a. Two (2) independent "Y" configured check valves and one (1) differential relief valve.
 - b. To automatically reduce pressure in zone between check valves. Should differential between zone and upstream pressure drop to 2 psi, differential relief valve will open, maintaining proper zone differential.
 - c. Provide Series 300 stainless steel internal parts and relief valve spring.
 - d. Provide reversible elastomeric seat discs on check valves and relief valves, and seat rings that are B-61 Bronze or Series 300 stainless steel.
 - e. Each check assembly must be center stem guided at the seat ring that includes replaceable non-corrosive bushings at the cover.
 - f. Provide ductile iron valve bodies and covers in accordance with ASTM A 536, Grade 65-45-12, latest revision, and to withstand a 10:1 safety factor over the water system working pressure.
 - g. Provide flanged ductile iron bodies in accordance with ANSI B16-1, Class 125, latest revision, with epoxy coating internally at a rate of 10-20 mils.
 - h. All orifices associated with the pressure sensing passages are to be located out of the normal debris flow path or within any settling areas.
 - i. Provide copper external sensing tubing in accordance with ASTM B280, latest revision.
 - j. All Backflow Preventer assemblies must be flanged, and provided with full port resilient wedge shut-off valves and four vandal resistant ball valve test cocks that are integral to the devices.
 - k. All Backflow Preventers are to be factory assembled and tested.
 - l. Construct Backflow Preventers such that all internal parts, including seat rings, can be serviced from the top or side and removed while the devices are still connected to the waterline.
 - m. All Backflow Preventers are to be rated 175 MWWP, and operate in with a water temperature between 322 and 1402 F.
 - n. All Reduced Pressure Principle Backflow Preventers must be constructed

above ground with freeze protection during the winter months.

- o. All relief valves must discharge onto grassed lawn areas as required by SCDHEC regulations and cannot be connected in any way to any storm drainage system.

B. Double-Check Backflow Preventer

1. General:

- a. Provide Febco Model 805YD Double-check Backflow Preventer, or approved equal for all water lines 2-1/2" to 10".
- b. Must be on the approved list published by SCDHEC and tested by a certified tester before placing into service and two (2) copies provided to Owner.
- c. Bypasses not allowed unless equipped with an equal backflow protection.

2. 2-1/2" through 10" double-check backflow preventers to consist of the following:

- a. Two independent "Y" configured check valves.
- b. Provide units that are spring-loaded and center stem guided type.
- c. Provide Series 300 stainless steel internal parts.
- d. The elastomeric seat disc must be reversible.
- e. Provide seat rings that are Bronze in accordance with ASTM B61, latest revision or seat rings that are series 300 stainless steel. Bolted seat rings to the valve bodies and incorporate a O-ring to facilitate field removal and replacement.
- f. All Double-check assemblies must be guided at the seat ring and at the cover by replaceable non-corrosive bushings to assure positive check seating.
- g. Verify that the head loss through backflow assemblies does not exceed 5.5 psi at operating velocities starting at 0 and up to 7.5 fps.
- h. All Backflow Preventer flow curves must be provided by independent laboratory testing.
- i. Provide ductile iron valve bodies and covers in accordance with ASTM A 536, Grade 65-45-12, latest revision, and to withstand a 10:1 safety factor over the water system working pressure.
- j. Provide flanged ductile iron bodies in accordance with ANSI B16-1, Class 125, latest revision, with epoxy coating internally at a rate of 10-20 mils.
- k. All Backflow Preventer assemblies must be flanged, and provided with full port resilient wedge shut-off valves and four vandal resistant ball valve test cocks that are integral to the devices.
- l. All Backflow Preventers are to be factory assembled and tested.

- m. Construct Backflow Preventers such that all internal parts, including seat rings, can be serviced from the top or side and removed while the devices are still connected to the waterline.
- n. All Backflow Preventers are to be rated 175 MWWP, and operate in with a water temperature between 32° and 140° F.
- o. Backflow Preventer assemblies must meet the requirements of ASSE Standard 1013; AWWA Standard Code C511-92, or latest revision; and USC Foundation of Cross Connection Control and Hydraulic Research, latest revision.
- p. If Backflow Preventers are installed below ground, rock and pipe drains must be

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verily that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.03 HANDLING

- A. All piping materials must be handled to ensure that the pipe reaches the trench in an undamaged condition:
 - 1. All pipe must be carried to trench for placement.
 - 2. Provide pinch bars or tongs to align or turn the pipe while installing, and only use on the bare end of the pipe.
 - 3. Take care not to damage the pipe linings.
 - 4. Be sure to not damage the pipe with chokers or lifting equipment.
- B. The interior of all piping and appurtenances must be cleaned before placing the pipe into trench, and be sure to keep the pipe clean during installation operations with the use of plugs or any other methods that have been approved by the Engineer.
- C. All piping and fittings and valves, etc. must be inspected for defects prior to installation, and if any material is found to be defective, replace with sound material meeting these specified requirements, at no additional cost to the project or Owner.
- D. All gaskets must be stored in a cool dark place until time of installation.

3.04 PIPE CUTTING

- A. Pipe must be neatly cut with a mechanical pipe cutter that is recommended by the manufacturer and approved by the Engineer. When practicable use wheel cutters and plastic pipe must be cut square and all burrs removed.

3.05 LOCATING

- A. New water mains must be installed at a minimum distance of 10' from edge of pipe to edge of pipe from any existing or proposed wastewater lines.
- B. If a 10' separation is not possible, the water lines may be laid closer with approval from SCDHEC prior to installation, provided the water lines are laid in a separate trench, within the same trench if the wastewater line is laid in a bench of undisturbed earth to one (1) side. In either of the referenced cases, the invert of the water line must be 18" above the crown of the wastewater line.
- C. In locations where the waterlines cross over the wastewater lines, an 18" vertical separation must be maintained between the outside of the waterline and the outside of the wastewater line.
- D. In locations where the waterlines cross under the wastewater lines, each line at the crossing must be either cast iron or ductile iron.
 - 1. A full pipe length of waterline shall be located over an existing or proposed wastewater line to separate the joints of each pipe system as much as possible.
 - 2. In locations where a new waterline crosses a new wastewater line, a full length of pipe shall be used for both the water and wastewater lines and the crossing must be arranged to separate the joints of each pipe system as much as possible.
- E. No waterline shall extend through or come in contact with any part of a wastewater manhole.
- F. Waterlines cannot be installed within 25' horizontally from any known wastewater tile or spray fields.
- G. Waterlines must be located outside of any contaminated areas, unless pipe materials that will protect the water supply are utilized.
- H. No water flushing devices or drains can be directly connected to any type of wastewater lines.
- I. No cross connections are allowed between a potable water system and any pipes, valves, tanks or pumps, which are not part of the potable water system.
- J. If required, waterlines may come in contact with storm drainage systems provided there are no other alternatives and ductile iron is utilized for the waterline and that no joints of the waterline are within the storm drainage system and the joints are spaced such that they are as far as possible from the storm drainage crossing.
- K. Structures containing water valves, blowoff valves, meters, air release valves, etc., cannot be connected directly to any storm drainage or wastewater system.

3.06 TRENCHING, EXCAVATION AND BACKFILLING

- A. Comply with Sections 31 23 16 and 31 23 16.13, and 31 23 23.13 for additional requirements.
- B. For PE Pipe, comply with manufacturer's recommendations.
- C. A continuous and uniform bedding material shall be provided in the trench for all buried pipe. Backfill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe. Stones other than crushed bedding, shall not come into contact with the pipe and shall not be within 6-inches of the pipe.
- D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.07 ALIGNMENT OF PIPE

- A. For all practical purposes waterlines are to be laid straight.
- B. Where pipe deflections are required, these deflections shall not exceed maximum deflection recommendations of the pipe manufacturer.
- C. If alignment requires a deflection that exceeds manufacturer recommended limits, pipe bends and shorter sections of pipe must be utilized to accommodate the deflections.

3.08 INSTALLATION - PIPE

- A. General:
 - 1. Maintain separation of water main from sewer piping in accordance with SCDHEC regulations.
 - 2. Establish elevations of buried piping to ensure not less than 3ft (0.9144 m) of cover.
 - 3. Install ductile iron piping and fittings to AWWA C600.
 - 4. Install grooved and shouldered pipe joints to AWWA C606.
 - 5. Route pipe in straight line.
 - 6. Install pipe to allow for expansion and contraction without stressing pipe or joints.
 - 7. Slope water pipe and position drains at low points.
 - 8. Install trace wire 6 inches (150 mm) above top of pipe; coordinate with Section 31 23 16.13.
 - 9. Piping and appurtenances are to be installed in the trench by means of a derrick, ropes, belt slings, or other equipment approved by the Engineer.
 - 10. Except in locations where connections to other lines are being installed, install water pipe with the bells facing in the direction of installation.
 - 11. For each section of pipe installed, rest the full length of water pipe on the pipe bed, with recesses excavated at all bells, couplings and joints to allow the water line to

lay flat.

12. If any grades or joints of the waterlines have been disturbed, remove and relay piping.
13. No waterline piping is to be installed in trenches that are unsuitable or trenches that contain water.
14. When not working on the waterlines, close all open pipes, valves and fittings.
15. If any portion of the coating or lining of a waterline is damaged, repair to the approval of the Engineer and at no additional cost to the project or Owner.
16. Installation of water mains and appurtenances shall be conducted in accordance with Section C of the AWWA standards and/or manufacturer's recommended installation procedures.
17. All pipes must have a minimum cover of 30-inches, unless the pipe material is concrete, Ductile Iron Pipe, or other approved material, and insulated to prevent freezing.

B. Ductile iron pipe:

1. Provide mechanical, push on and flanged joints, install in accordance with AWWA C600, latest revision.
2. Provide gaskets and handle, lubricate as necessary and install in accordance with manufacturer's recommendations.

C. Plastic pipe:

1. The interior of the bell, coupling and gasket areas, must be thoroughly cleaned, especially grooved area.
2. Lubricate and install gasket as recommended by manufacturer.
3. Align spigot to bell, insert spigot into bell and verify that there is uniform contact with the gasket.
4. Push pipe into the bell using a leverage bar approved by the manufacturer. The pipe should not be pushed into the bell using mechanical means.
5. The pipe must be pushed completely into the bell until the edge of the bell is aligned with the reference mark.

D. Flanged joints:

1. Provide true face flanges that are field clean and fit with one full face gasket that has bolts installed finger tight.
2. A torque wrench used in an alternating fashion to tighten bolts 180 apart until the full gasket flow and seal are safe in place.
3. Flanges that are bias cut or has unusual refacing will not be approved.

- E. Restrained joints:
 - 1. Install in accordance with manufactures recommendations.
 - 2. Install set screws as recommended by the manufacturer's rated torque using a torque wrench. If twist-off nuts are provided, tighten screws until nut breaks.
- F. HDPE pipe:
 - 1. Install in accordance with manufacturer's recommendation and ASTM 02321, latest revision.
 - 2. All fusion joint work must be provided by factory-trained personnel.
- G. Polyethylene encasement installation must be in accordance with AWWA C105, latest revision.

3.09 SEPERATION OF WATER AND WASTEWATER MAINS

- A. Special Conditions: When it is impossible to obtain the distances specified in R.61-58.4(D)(12)(a) and (b), the South Carolina Department of Health and Environmental Control (SCDHEC) may allow an alternative design. Any alternative design shall:
 - 1. Use materials which meet the requirements of R.61-58.4(D)(1) for the wastewater line; and,
 - 2. Allow enough distance to make repairs to one (1) of the lines without damage and disruption of service to the other line.

3.10 ABOVE WATER CROSSINGS

- A. The pipe shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement (R.61-58.4(D)(13)(a)).

3.11 UNDERWATER CROSSINGS

- A. A minimum of 2-feet of cover shall be provided over the pipe.
- B. When crossing water courses that are greater than 15-feet in width, the following shall be provided:
 - 1. The pipe materials and joints shall be designed appropriately.
 - 2. Valves shall be located so the section can be isolated for testing or repair; the valves (on both sides of the crossing) shall be easily accessible and not subject to flooding.
 - 3. A blow-off valve shall be provided on the side opposite the supply service sized in accordance with Section R61-58.4(D)(7). Direct blow off valve away from streams, and valve must discharge over ground. Use Ductile Iron Pipe with mechanical joints for any lines being installed in rock.

3.12 INSTALLATION - VALVES AND HYDRANTS

- A. General

1. Set valves on solid bearing.
2. Center and plumb valve box over valve. Set box cover flush with finished grade.
3. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.
4. Set hydrants to grade, with nozzles at least 20 inches (500 mm) above ground.
5. Valves and Valve Boxes:
 - a. Place valve boxes centered on the valves plumb and level.
 - b. Fully compact earth fill around each valve box to a distance of 5' on all sides, or to the trench face if less than 5'.
 - c. Install all shaft extensions plumb and without any binding.
 - d. Fully open and close each valve to assure that all parts are in good working order.
 - e. Install valve box protection ring around top of each valve box, level with top 1" above finish grade and level or no more than 1" above the valve box.
6. Fire Hydrants:
 - a. Verify that all debris is removed from the barrel.
 - b. All Fire Hydrants must be set plumb and the connecting pipe and water system main must have the same depth of cover.
 - c. Place stone drainage bedding and thrust blocking as required.
 - d. Fire Hydrant connections or hydrant drains are not allowed within 10' of an existing or new wastewater main.
 - e. Fire Hydrant extension pipe must be a minimum of 6" in diameter and include a gate valve.
 - f. A gravel pocket or dry well shall be provided at each fire hydrant unless the natural soils will provide adequate drainage.
 - g. Thrust Blocking must not block fire hydrant weep holes.
 - h. Fully open and close each Fire Hydrant and Gate Valve to verify that everything is in good working condition.
 - i. Blue reflectors must be installed on centerline of all paved roadways, marking the perpendicular location of any new Fire Hydrants.

3.13 INSTALLATION OF AIR RELEASE VALVES

- A. All Air Release Valves are to be installed in precast manholes with a ring and cover, and in accordance with the manufacturer's recommendations.
- B. Air Release Valves are to be provided at high points along the new water lines as required.

Automatic Air Relief Valves shall not be installed in situations where flooding of the manhole or chamber may occur.

3.14 INSTALLATION OF CROSS CONNECTION DEVICES

A. General

1. High hazard category cross connections shall require an air gap separation or an approved reduced pressure backflow preventer.
2. All piping up to the backflow prevention device must be suitable for potable water. The pipe must be AWWA or NSF approved, and Black Steel Pipe cannot be used on the inlet side of the backflow prevention device.

B. Installation of Reduced Pressure Principle Backflow Preventer

1. Install above ground and provide a minimum clearance of 12" and a maximum clearance of 30" between pressure release port and floor or grade.
2. Install in all locations where any discharge can be positively drained away and where any discharge will not cause any issues or concerns.
3. Provide in a location where the unit is easily accessible for testing and maintenance, and protected from freezing.
4. Avoid excessive pressure situations to avoid possible damage to the units.
5. Pressure release port must discharge onto a grassed area.
6. Reduced Pressure Principle Backflow Prevention assemblies shall not be installed in any area location subject to possible flooding. This includes pits or vaults which are not provided with a gravity drain to the ground surface that is capable of exceeding the discharge rate of the relief valve. Generally, if installed in a pit, the drain line shall be 2 times the size of the line entering the backflow prevention device. The drain cannot empty into any type of ditch, storm drain, or wastewater systems, which could flood water back into the pit.

C. Installation of Double-check Backflow Preventer

1. Provide in a location where the unit is easily accessible for testing and maintenance.

3.15 THRUST BLOCKS

A. General:

1. Provide on all waterline fittings, valves, fire hydrants and any bends in the waterline that deflects 11-1/4° or more in a vertical or horizontal position, thrust blocks, or metal tie rods and clamps or lugs as required. Thrust blocking is not required where restrained joints are utilized.
2. Utilize cast-in-place concrete with a compressive strength of 3000 psi in 28 days.
3. Thrust Block sizing will be provided by the Engineer, based on the bearing soil capacity.

4. Provide 8 mil polyethylene film between the thrust block and the waterline features where they are used.

B. Installation:

1. Thrust blocking must be installed between undisturbed ground and the unit being anchored.
2. The sides of thrust blocking that are not subject to thrust may be placed against forms.
3. All fitting joints must be accessible for repair.
4. Provide steel rods and clamps that are hot dipped galvanized.

3.16 CONNECTIONS TO DEDICATED FIRE LINES

- A. If any connections are made to a dedicated fire line, a Double-check Backflow Preventer must be installed.

3.17 FIELD QUALITY CONTROL

A. Hydrostatic Testing

1. General:
 - a. Provide all pressure and leakage testing in accordance with AWWA Standards C600, latest revision.
 - b. Clean and flush line of air, dirt and foreign material prior to testing.
 - c. No hydrostatic testing can be performed on any new water lines until after five (5) days after installation of the concrete thrust blocking.
 - d. All testing devices required for conducting tests are to be provided by the Contractor.
 - e. All high points in the waterline that do not have air release valves installed must have brass corporation stops installed to assist with testing and removal of any air out of the system. Any corporation cocks installed are to be left in place and all costs for providing such cocks are to be borne by the Contractor.
 - f. Provide testing on each segment of waterline and/or any valved section of waterline.
 - g. Pressure testing must be conducted at 150 psi or 1.5 times the working pressure of the waterline and the test pressure must be based on the elevation of the lowest point of the waterline being tested and corrected to the elevation of the location of the test gauge.
 - h. No pipe is to be tested at pressures beyond manufacturer's recommendations.
 - i. The Contractor must provide documentation identifying the results of all

pressure and leakage tests performed. At a minimum, all testing documentation must include length of lines, diameter of pipes, amount of water required to fill the waterline after test was performed, and amount of allowable leakage.

- j. Any witnesses to the testing of the waterlines must be someone other than the Contractor or the utility installing the lines.

2. Pressure tests:

- a. After the pipe is laid, the joints completed, and the trench backfilled, subject the new waterline and valved sections of piping to the test pressure specified in Part A above.
- b. Each valve located within the section piping being tested must be opened and closed several times during the test period.
- c. Replace any joints or piping showing leakage.

3. Leakage test:

- a. Once the pressure tests have been completed with favorable results provide leakage testing.
- b. Duration of each leakage test is a minimum of two (2) hours.
- c. Subject the waterlines to the test pressure specified in Part A above during the leakage tests.
- d. Leakage is defined as the volume of water supplied to the new section of waterline being tested, required to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.
 - 1) All new pipe systems must be subjected to leakage testing and the leakage must be less than the number of gallons per hour as determined by the following formulas for the specific pipe material:
 - 2) Ductile iron piping:
 - (a) $L = S \times D \times P^{1/2} / 133,200$; where:
 - (b) L = allowable leakage in gallons per hour;
 - (c) S = length of pipe tested in feet;
 - (d) D = nominal diameter of pipe in inches; and
 - (e) P = average test pressure psi gauge.
 - 3) PVC piping:
 - (a) $L = N \times D \times P^{1/2} / 7400$; where:
 - (b) L = allowable leakage in gallons per hour;
 - (c) N = number of joints in pipeline being tested;

(d) D = nominal diameter of pipe in inches; and

(e) P = average test pressure psi gauge.

- 4) If a closed metal seated valve is tested as part of the water main, an additional leakage rate per closed valve of 0.0078 gallons per hour per inch of nominal valve size can be added to the allowable leakage (L). All visible leaks and any pipe sections that do not meet the requirements above must be removed and replaced.

B. Sterilization

1. General:

- a. Once the waterline testing has been completed and accepted, the waterlines must be sterilized and meet South Carolina Department of Health and Environmental Control requirements.
- b. Newly laid valves or other appurtenances shall be operated several times while line is filled with chlorinating agent.
- c. If the first treatment fails, continue to treat water in accordance with these procedures until tests pass, at no additional cost to the project or Owner.
- d. Any equipment, taps or fittings required for testing must be provided by the Contractor.

2. Procedure:

- a. Flush line in accordance with the following:
 - 1) Hydrant openings required to produce proper flushing velocity at 40 psi are:

Pipe Size (inches)	Hydrant Openings to Provide
4"-12"	one (1) 2-1/2"
14"-18"	two (2) 2-1/2"
20"	one (1) 4-1/2" or larger
 - 2) Pipe Size (inches) Hydrant Openings to Provide
 - 3) Comply with AWWA C651, latest revision and the following:
 - 4) Provide chlorine as liquid chlorine or chlorine compound such as calcium hypochlorite with known chlorine content.
 - 5) Inject through corporation cock in top of main located no greater than ten (10) sections from the beginning of section being sterilized.
 - 6) Water Flow to be controlled as a slow flow into the line.
 - 7) Use proper feeder and flow regulator to introduce chlorinating agent.
 - 8) Chlorine application rate shall be not less than 25 ppm and no

greater than 50 ppm.

- 9) Retain chlorinated water in main not less than 24 hours.
- 10) At end of retention period, at least 10 ppm of chlorine shall remain in the water at the extreme end of section.
- 11) Dechlorinate and flush line thoroughly.

3. Acceptance:

- a. Two (2) separate bacteriological samples must be received for each section of water line being tested, and taken at 24-hour intervals free of coliform bacteria.
 - 1) The Contractor is required to take 1st and 2nd samples, deliver to South Carolina Department of Health and Environmental Control (SCDHEC) approved laboratory for testing.
 - 2) The 1st and 2nd sample results must include the results of the free chlorine residual at the time the samples were collected.
 - 3) SCDHEC must be notified to take a 3rd sample.
 - 4) Sample locations shall be as required by SCDHEC and the following:
 - (a) The tie-in locations of new and existing water lines.
 - (b) At the end of all dead ends of all waterlines.
 - (c) At intervals of no more than 1,200' for new waterlines that are longer than 1,200' in length.
 - (d) All sample locations must be noted on the record drawings and provided an identifying designation.
 - 5) If the membrane liter method of analysis is used for the coliform analysis, non-coliform growth must also be reported.
 - 6) If the non-coliform growth is greater than eighty (80) colonies per one hundred (100) milliliters, the sample result is invalid and must be repeated.

C. Dechlorination of Chlorinated Sterilization Water

1. All chlorinated water used for sterilizing water lines must be dechlorinated.
2. Use dechlorinating agent as liquid sulfur dioxide or sulfite salts.
3. Prepare a mixing chamber utilizing a 55-gallon tank and feed the discharge and dechlorinating agent at the bottom of the tank with overflow at the top.
4. Total chlorine residual for any discharge must be less than 0.5 milligrams per liter.

3.18 MEASUREMENT AND PAYMENT

- A. All work under this Section will be measured and paid for as follows:
- B. Pipe will be paid for at the unit prices per linear foot as stated in the Bid Form and shall include cost of excavation, backfilling, metallic detection tape, copper tracer wire, cleanup, testing, sterilizing, dechlorinating, etc. Measurement will be from center to center of fittings; no deduction will be made for the space occupied by valves or fittings.
- C. Ductile iron fittings: No measurement will be made and cost for these fittings shall be included in the price bid per linear foot of the pipe with which they are used. No extra payment will be made for these fittings.
- D. Fittings other than ductile iron: No measurement will be made and cost for these fittings shall be included in the price bid per linear foot of the pipe with which they are used. No extra payment will be made for these fittings.
- E. Valves will be paid for at the price for "each" as stated in the Bid Form. This payment shall include valve, stem extensions, valve box, valve box protection ring, and installation.
- F. Tapping sleeves and valves will be paid for at the unit price for "each" as stated in the Bid Form. This payment shall include the sleeve, valve, five (5) rods, and restrained joint where restrained joint is indicated or specified.
- G. Restrained joint pipe will be paid for at the unit price per linear foot as stated in the Bid Form.
- H. Polyethylene encasement will be paid for at the unit price per linear foot as stated in the Bid Form.
- I. Fire hydrants will be paid for at the unit price for "each" as stated in the Bid Form. This payment shall include hydrant, reflector and offset fitting. Cost for piping and valve to the hydrant must be included with the price of the Fire Hydrant.
- J. Thrust blocks: No measurement will be made and cost for the thrust blocks shall be included in the price bid per linear foot of the pipe with which they are used. No extra payment will be made for these fittings.
- K. Cut-ins to existing lines: Payment will be made for labor, etc. at the price per each as stated in the Bid Form, and will all fittings, valves and installation.
- L. Tie-ins to existing lines: Where connection to an existing main is made by removing an existing plug, no payment will be made for this work.
- M. Air release valves: Payment will be made at the cost per each as stated in the Bid Form. This payment will include air release valve, corporation and curb stops, piping from main to valve and manhole, including ring and cover.
- N. Ductile iron (Extra): Payment for this item will be made at the unit price per linear foot as stated on the Bid Form and shall be for the extra cost of the ductile iron material over the cost of PVC pipe if PVC is the base material used in Paragraph B above.

END OF SECTION

SECTION 33 11 13.14

DUCTILE IRON PIPE

PART 1 GENERAL

1.01 SCOPE

- A. Provide all labor, materials, equipment and incidentals necessary to construct and disinfect, if required, all ductile iron pipe and appurtenances located inside and under buildings and structures, and test as shown on the Drawings and as specified herein.

Ductile iron pipe and appurtenances covered under this Section shall include all interior pipe and accessories to the outside face of structures and buildings, except where there is no joint at the outside face. Where there is no joint at the exterior face, this Section shall include all ductile iron pipe and accessories within two feet of the exterior face of the structure or building.

This Section includes piping and fittings in utility vaults and manholes.

1.02 SUBMITTALS

- A. Complete shop drawings and product data on all piping and fittings shall be submitted to the Engineer in accordance with the requirements of Section 01 30 00 of these Specifications.
- B. Shop drawings shall indicate piping layout in plan and/or elevations and shall include a complete schedule of all pipe, fittings, specials, hangers and supports. Special castings shall be detailed showing all pertinent dimensions. Special coatings shall be clearly identified.
- C. The Contractor shall furnish the Inspector with lists of all pieces of pipe and fittings in each shipment received. These lists shall give the serial or mark number, weight, class, size and description of each item received.
- D. The Contractor shall submit written evidence to the Engineer that the products furnished under this Section will conform to the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill test results from the pipe supplier may be considered evidence of compliance provided such tests are performed in accordance with the appropriate testing standards by experienced, competent personnel. In case of doubt as to the accuracy or adequacy of mill tests, the Engineer may require that the Contractor furnish test reports from an independent testing laboratory on samples of pipe materials.

PART 2 PRODUCTS

2.01 DUCTILE IRON PIPE (DIP)

Ductile iron pipe shall be manufactured in accordance with AWWA C115. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings:

Pipe Sizes (inches)	Special Thickness Class
4 - 54 Flanged	53
4 - 16 Grooved	53
18 Grooved	54
24 - 30 Grooved	56

2.02 FITTINGS AND ACCESSORIES

- A. Fittings, 48-inches and smaller, shall be ductile iron and shall conform to AWWA C110/ANSI A21.10 with a minimum rated working pressure of 250 psi. Fittings, 54 inches and larger, shall be ductile iron and shall conform to AWWA C153/ANSI A15.30 and shall have a minimum rated working pressure of 150 psi. AWWA C153 compact ductile fittings in sizes 4" though 36" are an acceptable substitute unless otherwise specified.
- B. Flanged elbow fittings shall be ANSI pattern using short radius elbows except where noted differently on the Drawings. Special fittings, ductile iron wall pipes and sleeves shall conform to the dimensions and details as shown on the Drawings.
- C. Thrust Collars: Thrust collars shall be welded-on ductile iron body type capable of withstanding a thrust due to 250 psi internal pressure on a dead end from either direction on that pipe size. The welded-on collars shall be continuously welded to the pipe by the pipe manufacturer.
- D. Solid sleeves shall permit the connection of plain end ductile iron pipe. Solid sleeves shall meet the requirements of ANSI/AWWA C110 for long pattern and have a minimum pressure rating of 250 psi. Solid sleeves shall have mechanical or restrained joints as specified in this Section and as shown on the Drawings. Solid sleeves shall be used only in locations shown on the Drawings or at the direction of the Engineer. Solid sleeves shall be manufactured by ACIPCO, U.S. Pipe or McWane (Clow).
- E. Tapping Saddles: Tapping saddles shall be ductile iron body type with O-ring gasket and alloy steel straps. Connection shall be flanged or mechanical joint as detailed on the Drawings. Tapping saddles shall be equal to ACIPCO A-10920 (mechanical joint) or ACIPCO A-30920 (flange joint).
- F. Flange Adapter Coupling: The flange adapter coupling shall permit the connection of unthreaded, ungrooved, open-ended ductile iron pipe to ANSI/ASME B16.1, Class 125 flanges. The flange adapter coupling shall meet the test requirements of ANSI/ASME B16.1 for Class 125 flanges. The adapter shall be a ductile iron casting incorporating gripping wedges and gasket. The gasket shall provide a compression seal between the adapter, the pipe and the adjacent flange. Flange adapter couplings are to be used only in locations specifically shown on the Drawings and shall be installed in accordance with the manufacturer's recommendations. The flange adapter coupling shall be EBAA Iron Megaflange-Flange Adapter Series 2100.
- G. Grooved joint fittings shall be manufactured of ductile iron, conforming to ASTM A395 and A536 or cast iron, conforming to ASTM A48 with grooved ends in conformance with ANSI/AWWA C606. Grooved joint fittings shall conform to ANSI A21.10/AWWA C110.

2.03 JOINTS

A. General

1. Unless shown or specified otherwise, joints for buried service shall be push-on or restrained joint type for pipe and standard mechanical, push-on or restrained joints for fittings. Joints for exposed service shall be flanged for pipe and fittings, unless shown otherwise. Grooved joint fittings are allowable subject to the specified requirements in this section.
2. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.
3. In all cases, gaskets shall be made of material that will not be damaged by the fluid being transported nor by the environment in which the pipe is installed.

B. Mechanical Joints

1. Joints shall conform to AWWA C111/ANSI A21.11.
2. Bolts and nuts shall be Tee Head bolts and nuts of high strength low-alloy steel in accordance with ASTM A 242 to the dimension shown in AWWA C111/ANSI A21.11.
3. Gaskets shall be in accordance with AWWA C111/ANSI A21.11 and shall be constructed of neoprene unless otherwise shown on the Drawings.
4. Mechanical joint glands shall be ductile iron.
5. Retainer Glands: Retainer glands shall be Megalug Series 1100, as manufactured by EBAA Iron.

C. Push-On Joints: Push-on joints and gaskets shall conform to AWWA C111/ANSI A21.11. Details of the joint design shall be in accordance with the manufacturer's standard practice such as ACIPCO "Fastite", McWane (Clow) "Bell-Tite", or U.S. Pipe "Tyton" joints.

D. Flanged Joints

1. Flanged joints shall conform to AWWA C115/ANSI A21.15. Flanges shall be ductile iron and shall be furnished by the pipe manufacturer.
2. Flanged joints shall be bolted with through stud or tap bolts of required size as directed. Bolt length and diameter shall conform to ANSI/AWWA C115 for Class 125 flanges shown in ANSI/ASME B16.1.
 - a. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to ASTM B 633, Type II.
 - b. Bolts for submerged service shall be stainless steel machine bolts

conforming to ASTM A 193, Grade B8. Nuts shall be heavy hex, stainless steel conforming to ASTM A 194, Grade 8.

3. Gaskets shall be made of 1/8-inch thick, Neoprene. Gaskets may be ring type or full face type.
4. Flanged ductile iron pipe shall have flanges cast solidly or threaded to the pipe barrel. Pipe threads shall be of such length that with flanges screwed home, the end of the pipe shall project beyond the face line of the flange. Flange and pipe shall then be machined to give a flush finish to the pipe and the flange and surface shall be normal to the axis of the pipe. Ductile iron flanges shall be of such design that the flange neck completely covers the threaded portion of the pipe to protect same against corrosion. All pipe with threaded type flanges shall be assembled, faced, and drilled at the point of manufacture, unless otherwise approved by the Engineer.
5. Flange filler shall conform to AWWA C110/ANSI A21.10. Joint bolt length shall be increased by the thickness of the flange filler.
6. Where tap or stud bolts are required, flanges shall be drilled and tapped accordingly.

E. Restrained Joints

1. Restrained joints shall be ACIPCO "FLEX-RING" or U.S. Pipe "TR-FLEX" for piping larger than 36-inches.
2. For piping 36-inches and less, restraining gaskets shall be ACIPCO "Fast-Grip" or U.S. Pipe "Field-Lok Gasket".
3. Bolts, nuts, and joint accessories shall be in accordance with manufacturer's recommendation.
4. Gaskets shall be in accordance with manufacturer's recommendation.

F. Grooved Joints

1. Grooved joints may be used in lieu of flanged or threaded piping systems.
2. Grooved joint couplings shall consist of ductile iron housings, conforming to ASTM A395 and A536, complete with pressure responsive synthetic rubber gasket (grade to suit the intended service). This synthetic rubber is NSF 61 certified for contact with portable water. Victaulic Style 31 with Grade M Gasket.

2.04 WALL SLEEVES AND WALL PIPES

- A. Where piping passes through concrete structures, furnish and install wall sleeves unless wall pipes or other provisions are specifically shown on the Drawings.
- B. Wall Sleeves
 1. For pipe sizes smaller than 3-inches, wall sleeves shall be steel oversize sleeves furnished with a full circle, integral or continuously welded waterstop collar. The sleeve seal shall be the mechanically expanded, synthetic rubber type. Provide all associated bolts, seals and seal fittings, pressure clamps or plates necessary to achieve a watertight installation. Sleeves shall extend the full thickness of the concrete. All hardware shall be 316 stainless steel. Sleeves and seal shall be Link

Seal.

2. For larger pipe sizes, wall sleeves shall be statically cast ductile iron mechanical joint wall sleeves. Unless specified or shown otherwise for a specific situation, wall sleeves shall be mechanical joint bell-plain end type with waterstop/thrust collar. Sleeves shall be constructed with studs and mechanical joint retainer gland on the air side of the concrete structure.

Provide retainer gland where shown on the Drawings. Where the concrete structure is exposed to dirt on one side and is wet on the other side, construct with studs and glands on the dirt side. Wall sleeves shall be equal to ACIPCO A-10771.

C. Wall Pipes

1. Wall pipes shall be either statically cast ductile iron with integral waterstop/thrust collar or centrifugally cast ductile iron with a continuously welded waterstop/thrust collar. The welded-on collar shall be attached to the pipe by the manufacturer. The collar shall be capable of withstanding a thrust force caused by a 250 psi dead end load from either direction on that size pipe. Wall pipes shall be furnished uncoated on the outside and cement lined on the inside.
2. Where shown on the Drawings, provide wall pipes (flange by restrained joint) which shall bolt to a Type C wall thimble provided by the sluice gate manufacturer. Class 125 flanges shall be provided.
3. Wall pipes shall be cast and/or fabricated and lined in one manufacturer's facility and delivered to the job site ready for use.
4. Wall pipe flanges shall be located 9-inches from wall to face of flange unless otherwise noted on the Drawings.

2.05 COATINGS

- A. The exterior of pipe and fittings for buried service shall be factory coated with an asphaltic coating conforming to AWWA C151/ANSI 21.51 for ductile iron pipe, AWWA C115/ANSI 21.15 for flanged pipe and AWWA C110/ANSI 21.10 for fittings. Pipe and fittings which shall be exposed or submerged shall be factory coated with a general purpose rust inhibitive primer compatible with the type of paint which will be field applied in accordance with the requirements of Section 09900 of these Specifications.

2.06 PIPE LININGS

- A. Cement Linings: Unless shown or specified otherwise, ductile iron pipe and fittings shall be cement lined in accordance with AWWA C104/ ANSI A21.4, standard thickness.
- B. Interior Lining: Ductile iron piping and fittings shall be epoxy lined where shown on the drawings.
- C. Epoxy Lining:
 1. Linings shall cover all exposed surfaces of pipe and fittings. The lining of the pipe barrel shall extend from spigot end through the socket to the edge of the gasket sealing area or recess for pipe using push-on gaskets, and to the edge of the gasket seat for mechanical joints. The lining shall also cover the exterior of the spigot end

from the end of the pipe to beyond the gasket sealing area. The lining in fittings shall cover the interior surfaces including the socket areas as defined above. All linings shall be hermetically sealed at the ends.

2. Lining Material: The lining material shall be Protecto 401 Ceramic Epoxy, a two component, modified epoxy formulated for corrosion control with the following minimum requirements:
 - a. A permeability rating of 0.0 perms when measured by ASTM E 96, Procedure A. Duration of the test shall be six weeks.
 - b. A direct impact resistance of 125 inch-pounds with no cracking when measured by ASTM D 2794.
 - c. The ability to build at least 50 mils dry in one coat.
 - d. The material shall be recoatable with itself for at least seven days with no additional surface preparation when exposed to direct summer sun and a temperature of 90 degrees F.
 - e. The material shall contain at least 20 percent by volume of ceramic quartz pigment.
 - f. A test and service history demonstrating the ability of the material to withstand the service expected.
 - g. Possess a minimum solids volume content of 88 percent, \pm one percent.
 - h. Possess a maximum drying time to allow recoating as follows: 50 degrees F - 72 hours; 75 degrees F - 18 hours; 90 degrees F - 8 hours. If recoating cannot be accomplished within seven days, a light brush blast shall be performed to improve intercoat adhesion.
3. Surface Preparation: The interior of the pipe exposed to liquids and gases shall be blasted and cleaned to remove all loose laitance, scale, or other loose material. No lining shall take place over grease, oil, etc., that would be detrimental to the adhesion of the compound to the substrate.
4. Application: The lining shall be applied using a centrifugal lance applicator by workers employed by Vulcan Painters, Inc. The workers shall be experienced and competent in the surface preparation, application and inspection of the lining to be applied. The compound shall not be applied when the substrate temperature is below 40 degrees F or in adverse atmospheric conditions which will cause detrimental blistering, pinholing or porosity of the film.
5. Lining of pipe barrel and fittings shall be 40 mils nominal thickness; minimum lining thickness shall be 30 mils. Lining thickness for exterior of spigot and interior of socket shall be 8 to 10 mils.
6. All pipe and fitting linings shall be tested for pinholes in accordance with ASTM G 62, Method B and shall be holiday free.
7. All pipe linings shall be checked for thickness using a magnetic film thickness gauge.

8. Each pipe joint and fitting shall be marked with the date of application of the lining system and with the numerical sequence of application of that date.”

2.07 EXPANSION JOINTS

- A. The Expansion Joint shall have a rubber inner tube, a body constructed of multiple piles of fabric impregnated with synthetic rubber, and a protective outer cover of synthetic rubber to provide resistance to deterioration from weather and ozone. Special covers shall be applied when indicated on the drawings to resist weather, ozone, and corrosive fumes. Steel wire shall be imbedded in the body for additional strength.
- B. The elastomer and fabric materials shall be determined by the temperature and chemical compatibility requirements, as indicated on the drawings.
 1. Class I - to 108°F: PGR, Neoprene, Buna-N, or Hypalon, with Nylon or Polyester reinforcement.
 2. Class II - to 250°F: Chlorobutyl, EPDM, or Teflon® -lined, with Polyester reinforcement.
 3. Class III - to 400°F: Solid Viton®, with Kevlar® reinforcement.
- C. Flanges shall be constructed integrally with the body to resist stresses. Flanges shall be full-pattern so that gaskets are not necessary. Flanges shall be drilled to ANSI B16.5 Class 150#. Flanges shall be accompanied with Galvanized 3/8" split steel retaining rings and enough control rods installed to achieve a working pressure of 200 psi.
- D. The expansion joint shall be available with a single arch or multiple arches, in open or filled arch (s) construction, and with wide arch(es) as specified on the drawings. Joint dimensions, movement, and spring rates for all variations shall follow Fluid Sealing Association guidelines.
- E. The elastomer construction of the joint acts to absorb vibration, preventing it from being transmitted to the piping, as well as compensation for lateral deflection. The integral arch allows for axial compression and elongation of the joint, to compensate for expansion and contraction of the piping.
- F. All expansion joints shall be Redflex™ Type J-1 as manufactured by the Red Valve Company, Inc. of Carnegie, PA 15105 or approved equal.

PART 3 EXECUTION

3.01 CUTTING

- A. When new or existing pipe is required to be cut, the pipe shall be cut in such a manner as to leave a smooth end normal to the axis of the pipe.
- B. All cutting of ductile iron pipe shall be performed with a cutting saw. All burrs shall be removed from the inside and outside edges of all cut pipe. All damaged linings and coatings shall be repaired.
- C. Lining Repair: Repair linings and recoat spigot ends of cut pipe with a product equal to Protecto 401 in accordance with the manufacturer's recommendations and as specified

below:

1. Remove all burrs and areas of loose lining materials by sanding or scraping to bare metal.
2. Remove oil and lubricants used during field cutting.
3. Lining shall be stripped back a minimum of 1-inch from the spigot end into well adhered lined areas.
4. Roughen 1 to 2-inches of good lining with a rough grade (40 grit) emery paper, rasp or small chisel, to allow an overlap between new and existing lining.
5. Apply lining repair material in the number of coats required to match the thickness requirements as specified in Part 2 of this Section and in accordance with the manufacturer's recommendations.

3.02 JOINT ASSEMBLY

- A. General: Ductile iron pipe shall be assembled in accordance with ANSI/AWWA C600.
- B. Push-On Joints: The inside of the bell and the outside of the pipe from the plain end to the guide stripe shall be wiped clean immediately before assembling the pipe joint. Then the rubber gasket shall be inserted into a groove or shaped recess in the bell. Both the bell and spigot ends to be joined shall be wiped again to ensure they are thoroughly clean. A liberal coating of special lubricant furnished by the pipe manufacturer shall be applied to the outside of the pipe. The plain end shall be centered in the bell and the spigot pushed home.
- C. Mechanical Joints
 1. The surfaces with which the rubber gasket comes in contact shall be brushed thoroughly with a wire brush just prior to assembly to remove all loose rust or foreign material which may be present and to provide clean surfaces which shall be brushed with a liberal amount of soapy water or other approved lubricant just prior to slipping the gasket over the spigot end and into the bell. Lubricant shall be brushed over the gasket prior to installation to remove loose dirt and lubricate the gasket as it is forced into its retaining space.
 2. Joint bolts shall be tightened by the use of wrenches and to a tension recommended by the pipe manufacturer. When tightening bolts, the gland shall be brought up toward the pipe bell. If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after thorough cleaning. Overstressing of bolts to compensate for poor installation shall not be permitted.
 3. After installation, bolts and nuts in buried piping shall be given two heavy coats of a bituminous paint. Bolts and nuts for exposed or submerged service shall be coated in accordance with the requirements of Section 09 90 00 of these Specifications.
- D. Flanged Joints
 1. All flanges shall be true and perpendicular to the axis of the pipe. Flanges shall be cleaned of all burrs, deformations, or other imperfections before joining. Flanged joints shall be installed so as to ensure uniform gasket compression. All bolting shall be pulled up to the specified torque by crossover sequence. Where screwed flanges

are used, the finished pipe edge shall not extend beyond the face of the flange, and the flange neck shall completely cover the threaded portion of the pipe.

2. Connections to equipment shall be made in such a way that no torque is placed on the equipment flanges. Connecting flanges must be in proper position and alignment and no external force may be used to bring them together properly.
3. After installation, bolts and nuts for exposed or submerged service shall be coated in accordance with the requirements of Section 09 90 00 of these Specifications.
4. Flanged filler shall be used only where shown on the Drawings or approved by the Engineer to make up minor differences in pipe length, less than 3-inches. Joint bolts shall be increased in length by the thickness of the flange filler.

E. Grooved Joints

All grooved couplings, fittings and valves shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations and projections in the area from pipe end to groove. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically inspect the product installation. Contractor shall remove and replace any improperly installed products.

- F. Joints of Dissimilar Metals: When a flanged joint consists of a ductile iron flange mated to a steel or alloy flange, the steel flanges shall be flat faced and furnished with full-faced gaskets, insulating bushings.

3.03 DRILLING AND TAPPING

- A. Wherever required ductile iron pipe and fittings shall be drilled and tapped to receive drainage or any other piping. All holes shall be drilled accurately at right angles to the axis of any pipe or fitting. Where plugs are drilled, holes shall be at right angles to the face of the plug.
- B. Unless shown otherwise, small diameter pipes, less than 2-inches, shall be connected to ductile iron pipe using one of the following methods:
1. Direct tap.
 2. Direct tap with service saddle.
 3. Direct tap boss.
 4. Tapped plug or flange on tapping saddle.
- C. In no case shall the effective number of threads be less than 4.

3.04 CONSTRUCTING BENEATH AND BEYOND STRUCTURES

- A. Construct beyond buildings and structures in accordance with Section 31 23 16.13 of these Specifications.

- B. All ductile iron pipe installed under buildings or basins shall be encased and backfilled in accordance with Section 31 23 23.13 of these Specifications.
- C. All ductile iron pipes entering buildings or basins shall be adequately supported between the structure and undisturbed earth to prevent damage resulting from settlement of backfill around the structure.

3.05 CONSTRUCTING WITHIN STRUCTURES

- A. Proper and suitable tools and appliances for safe and convenient handling and laying of pipe and fittings shall be used. Care shall be taken to prevent the pipe coating from being damaged, particularly cement linings on the inside of the pipes and fittings. Any damage shall be remedied as directed by the Engineer.
- B. All pipe and fittings shall be carefully examined by the Contractor for defects just before installing and no pipe or fitting shall be installed if it is defective. If any defective pipe or fitting is discovered after having been installed, it shall be removed and replaced in a satisfactory manner with a sound pipe or fitting by the Contractor at Contractor's own expense.
- C. All pipes and fittings shall be thoroughly cleaned before they are installed and shall be kept clean until they are used in the completed work. Open ends of pipe shall be kept plugged with a bulkhead during construction.
- D. All elbows, tees, brackets, crosses, and reducers in pressure piping systems shall be adequately restrained against thrust.
- E. Wall pipe and wall sleeves shall be accurately located and securely fastened in place before concrete is poured. All wall pipe and sleeves shall have wall collars properly located to be in the center of the wall where the respective pipes are to be installed. Pipe passing through the sleeve shall extend no more than three feet beyond the structure without a piping joint.
- F. Wall pipe and wall sleeves shall be constructed when the wall or slab is constructed. Blocking out or breaking of the wall for later installation shall not be permitted.
- G. Cutting or weakening of structural members to facilitate pipe installation shall not be permitted. All piping shall be installed in place without springing or forcing.
- H. Exposed ductile iron piping shall be supported as shown on the Drawings and specified in Section 22 05 29 of these Specifications.

3.06 FIELD PAINTING

Field painting of exposed and submerged pipe shall be in accordance with the requirements of Section 09 90 00 of these Specifications.

3.07 INSPECTION AND TESTING

All testing shall be in accordance with the requirements of Section 01 45 29 of these Specifications.

3.08 INSULATION AND HEAT TRACING

Provide insulation and heat tracing in accordance with Sections 40 41 00 and 40 42 00 of these Specifications.

3.09 DISINFECTION

Following installation and testing, potable water lines shall be disinfected in accordance with the requirements of Section 33 11 00 of these Specifications.

3.10 CLEANING

In accordance with Section 01 74 19 of these Specifications.

END OF SECTION

SECTION 33 11 13.24

PLASTIC PIPE

PART 1 GENERAL

1.01 SCOPE

- A. This section applies to plastic pipe associated with process piping only. Domestic water and sanitary waste and vent plastic piping to be covered elsewhere in Division 33.
- B. Provide all labor, materials, equipment and incidentals necessary to construct and disinfect, if required, all PVC, CVPC, HDPE and UT pipe and appurtenances located inside and under buildings and structures, and test as shown on the Drawings and as specified herein.
- C. PVC, CVPC, HDPE and UT pipe and appurtenances covered under this Section shall include all pipe and accessories inside and under buildings and structures to the outside face of structures and buildings, except where there is no joint at the outside face. Where there is no joint at the exterior face, this Section shall include all PVC, CVPC, HDPE and UT pipe and accessories within two feet of the exterior face of the structure or building.

1.02 SUBMITTALS

- A. Complete and product data on all piping and fittings shall be submitted to the Engineer in accordance with the requirements of Section 01 30 30 of these Specifications.
- B. Shop drawings shall indicate piping layout in plan and/or elevations and shall include a complete schedule of all pipe, fittings, specials, hangers and supports.
- C. The Contractor shall furnish the Engineer with lists of all pieces of pipe and fittings in each shipment received. These lists shall give the serial or mark number, schedule or class, size and description of each item received.
- D. The Contractor shall submit written evidence to the Engineer that the products furnished under this Section will conform to the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill test results from the pipe supplier may be considered evidence of compliance provided such tests are performed in accordance with the appropriate testing standards by experienced, competent personnel. In case of doubt as to the accuracy or adequacy of mill tests, the Engineer may require that the Contractor furnish test reports from an independent testing laboratory on samples of pipe materials.

PART 2 PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PIPE

- A. Polyvinyl Chloride Pipe (AWWA C900) 4" - 12"
 - 1. All buried PVC pipe shall have belled ends for push-on type jointing and shall conform to ANSI/AWWA C900, ductile iron pipe equivalent outside diameters. All exposed pipe shall use solvent-weld couplings in accordance with ANSI/AWWA C900. Flanged joints using flange adapters shall be provided where shown on the Drawings. The pipe shall have a Dimension Ratio (DR) of 14 and shall be capable of withstanding a working pressure of 200 psi. Pipe shall be supplied in minimum lengths

of 20 feet.

2. All fittings shall be of cast or ductile iron meeting the requirements of AWWA C110/ANSI A21.10 with a minimum rated working pressure of 250 psi. Fittings shall be cement lined in accordance with AWWA C104/ANSI A21.4. Fittings shall be furnished with a bituminous outside coating.
3. Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards including the National Sanitation Foundation. Additionally, each piece of pipe shall be stamped "NSF Approved."

B. Polyvinyl Chloride Pipe (AWWA C905) 14" - 36"

1. All PVC pipe shall have belled ends for push-on type jointing and shall conform to ANSI/AWWA C905, ductile iron pipe equivalent outside diameters. The pipe shall have a Dimension Ratio (DR) of 18 and shall be capable of withstanding a working pressure of 235 psi. Pipe shall be supplied in minimum lengths of 20 feet.
2. All fittings shall be of cast or ductile iron meeting the requirements of AWWA C110/ANSI A21.10 with a minimum rated working pressure of 250 psi. Fittings shall be cement lined in accordance with AWWA C104/ANSI A21.4. Fittings shall be furnished with a bituminous outside coating.
3. Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards including the National Sanitation Foundation. Additionally, each piece of pipe shall be stamped "NSF Approved."

C. Polyvinyl Chloride Pipe (SDR Pipe) 1-1/2" - 24"

1. Pipe: PVC pipe shall conform to ASTM D 2241. The pipe shall have a Standard Dimensional Rating (SDR) of 21 and shall be capable of withstanding a working pressure of 200 psi.
2. Fittings: Fittings for pipe 8-inches and less in diameter shall be one-piece with no solvent-welded joints. Fittings for pipe 10-inches and larger may be fabricated using solvent welding; however, no field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings delivered ready for use.
3. All fittings shall be of cast or ductile iron meeting the requirements of AWWA C110/ANSI A21.10 or AWWA C153/ANSI A 21.53 with a minimum rated working pressure of 250 psi. Fittings shall be cement lined in accordance with AWWA C104/ANSI A21.4. Fittings shall be furnished with a bituminous outside coating. Special adapters shall be provided, as recommended by the manufacturer, to adapt the PVC pipe to mechanical jointing with cast or ductile iron pipe, fittings or valves.
4. PVC pressure pipe shall be supplied in 20 foot nominal lengths.
5. Joints: Pipe and fittings shall have integral bell and spigot type joints with elastomeric gaskets having the capability of absorbing expansion and contraction without leakage. Joints shall meet the requirements of ASTM D 3139; gaskets shall meet the requirements of ASTM F 477. Joint system shall be subject to the approval of the

Engineer.

6. Acceptance: Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

D. Schedule Pipe

1. Unless specified or shown on the Drawings otherwise, use schedule polyvinyl chloride pipe for all interior polyvinyl chloride pipe and for all chemical system piping.
2. Piping: PVC
 - a. Schedule 80 in accordance with ASTM D 1785.
 - b. Fittings: Solvent weld socket type, same schedule as piping, ASTM D 2466 or D 2467.
 - c. Solvent Cement: Oatey, Low VOC, Heavy duty gray, industrial grade PVC cement, ASTM D 2564 and D1412.
 - d. Service saddles shall be two-piece and constructed of schedule 80 PVC. Saddle shall be furnished with 316 stainless steel hardware and an EPDM o-ring. Service saddle shall be Spears, Clamp-On Saddle, or equal.
 - e. Gaskets: Provide gaskets for PVC pipe flanges. Gaskets shall be fabricated of PVC materials for all services except coagulant, which shall be Teflon.

2.02 HIGH DENSITY POLYETHYLENE HDPE PIPE

A. High Density Polyethylene Pipe (AWWA C 906) 4" - 36"

1. This specification covers the requirements of high density polyethylene water transmission and distribution pipe in sizes 4" to 36" joined by means of zero leak-rate heat-fusion, and approved mechanical joints, meeting the specifications and requirements of American Water Works Association Standard C906.
2. The polyethylene pipe and fittings shall be made from virgin resins exhibiting a cell classification of PE 345464C as defined in ASTM D3350-Type III, Grade PE34 with an established hydrostatic-design-basis of 1600 psi for water at 73 Degrees F. The resin shall be listed by the PPI (Plastic Pipe Institute) in its pipe-grade registry Technical Report (TR) 4, "*Listing of Plastic Pipe Compounds*".
3. Pipe and fittings must be marked as prescribed by AWWA C906 and NSF 14 & 16. Pipe markings will include nominal size, OD base (i.e. 12" ductile iron pipe sizing, DIPS), dimension ration, pressure class, WPR, AWWA C906, manufacturers name, manufacturer's production code including day, month, year extruded, and manufacturer's plant and extrusion line; and NSF logo.
4. The wall thickness shall follow the Dimension Ration (DR) system prescribed in AWWA C906. Laying lengths are 40 ft. standard. The pipe is to be joined by heat fusion, flanges or other mechanical joint systems proven for HDPE pipes. Both pipe and fittings must be NSF listed by the manufacturer with the pipe bearing the

"NSF" logo or mark. HDPE shall be the DR as shown on plans.

B Plastic SDR9 HDPE Water Service Tubing (AWWA C901) 1/2" - 3"

Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material will meet the specifications of ASTM D3350-02 with a cell classification of PE:345464C. Pipe shall have a manufacturing standard of ASTM D2737 (CTS). Pipe shall be DR 9 (200psi WPR) at 73.4 degrees F unless otherwise specified on the plans. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipes shall be suitable for use as pressure conduits, and per AWWA C901, have nominal burst values of three times the Working Pressure Rating (WPR) of the pipe. Pipe shall also have the following agency listing of NSF 61.

C. HDPE Joints

1. Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 PSI. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. All welds will be made using a Data Logger to record temperature, fusion pressure, with a graphic representation of the fusion cycle shall be part of the Quality Control records.
2. Sidewall fusions for connections to outlet piping shall be performed in accordance with HDPE pipe and fitting manufacturer's specifications. The heating irons used for sidewall fusion shall have an inside diameter equal to the outside diameter of the HDPE pipe being fused. The size of the heating iron shall be 1/4 inch larger than the size of the outlet branch being fused.
3. Mechanical joining will be used where the butt fusion method cannot be used. Mechanical joining will be accomplished by either using a HDPE flange adapter with a Ductile Iron back-up ring or HDPE Mechanical Joint adapter with a Ductile Iron back-up ring.
4. Socket fusion, hot gas fusion, threading, solvents, and epoxies will not be used to join HDPE pipe.

D. HDPE Fittings

1. Butt Fusion Fittings - Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02, and approved for AWWA use. Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans. Fabricated fittings are to be manufactured using Data Loggers. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records. All fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.

2. Electrofusion Fittings - Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans. All electrofusion fittings shall be suitable for use as pressure conduits, and per AWWA C906, have nominal burst values of three and one-half times the Working Pressure Rating (WPR) of the fitting.
3. Flanged and Mechanical Joint Adapters - Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-02. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D3261. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

2.03 CHLORINATED POLYVINYL CHLORIDE (CPVC)

- A. CPVC shall be produced to the requirements of ASTM D-2846. All tubing and fitting must bear the D2846 marking. CPVC solvent cements must conform to ASTM F493 and must carry this identification.
- B. Pipe and fittings are to be produced in copper tube sizes, 1/2" - 2", SDDR-11 and are rated at a continuous working pressure of 100 psi at 180°F. A margin of safety shall be provided, should unusual short-term condition be encountered above these levels.
- C. Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards including the National Sanitation Foundation.

2.04 URETHANE (UT) PIPE

- A. UT pipe and fittings shall be formulated of polyurethane elastomer equal to Uniroyal Vibrathane. Pipe shall be 150 psi rated in all sizes, 1/2" minimum wall thickness and suitable for use to 180° F. Flanges shall be 150 lb. and shall be chemically bonded to pipe segments in accordance with the manufacturer's instructions. Pipe and fittings shall be as manufactured by GIW Industries, 500 Wrightsboro Road, Grovetown, GA 30813 or equal. Bolts for flanges shall be 316 stainless steel.

2.05 WALL SLEEVES AND WALL PIPES

- A. Wall Sleeves
 1. For pipe sizes smaller than 3-inches, wall sleeves shall be steel oversize sleeves furnished with a full circle, integral, or continuously welded waterstop collar. The sleeve seal shall be the mechanically expanded, synthetic rubber type. Provide all associated bolts, seals and seal fittings, pressure clamps, or plates necessary to achieve a watertight installation. Sleeves shall extend the full thickness of the concrete. Sleeves and seal shall be Link Seal. Bolts shall be stainless steel.
 2. For larger pipe sizes, wall sleeves shall be ductile iron mechanical joint wall sleeves. Unless specified or shown otherwise for a specific situation, wall sleeves shall be mechanical joint bell-plain end type with waterstop/thrust collar. The waterstop collar shall be capable of withstanding a thrust force caused by a 250 psi dead end load from either direction on that size pipe. Sleeves shall be constructed with studs and mechanical joint gland on the air side of the concrete structure. Provide retainer gland

where shown on the Drawings. Where the concrete structure is exposed to dirt on one side and is wet on the other side, construct with studs and glands on the dirt side. Wall sleeves shall be equal to ACIPCO A-10771.

B. Wall Pipes

1. Wall pipes shall be either statically cast ductile iron with integral waterstop collar or centrifugally cast ductile iron with a continuously welded waterstop/ thrust collar. The welded on collar shall be attached to the pipe by the manufacturer. The collar shall be capable of withstanding a thrust force caused by a 250 psi dead end load from either direction on that size pipe. Wall pipes shall be furnished uncoated on the outside and cement lined on the inside. Unless specified or shown otherwise, wall pipes shall be flange end type.
2. Wall pipes shall be cast and/or fabricated and lined in one manufacturer's facilities and delivered to the job site ready for use.

2.06 FLANGE ADAPTERS

A. The flange adaptor shall permit the connection of unthreaded, ungrooved, open-ended polyvinyl chloride pipe to ANSI/ASME B16.1, Class 125 flanges. The flange adaptor shall meet the test requirements of ANSI/ASME B16.1 for Class 125 flanges. The adaptor shall be a ductile iron casting incorporating a flange with a serrated edge, clamping bolts, and gasket. The gasket shall provide a compression seal between the adaptor, the pipe and the adjacent flange. Flange adaptors are to be used only in locations specifically shown on the Drawings or at the direction of the Engineer, and in accordance with the manufacturer's recommendations. The flange adaptor shall be Uni-Flange or EBAA Iron.

B. Bolts and Nuts

1. All bolts and nuts shall be made in the U.S.A. Bolts and nuts shall be threaded in accordance with ANSI/ASME B1.1, Coarse Thread Series, Class 2A external and Class 2B internal fit.
2. Bolts for exposed service shall be zinc plated, cold pressed, steel machine bolts conforming to ASTM A 307, Grade B. Nuts for exposed service shall be zinc plated, heavy hex conforming to ASTM A 563. Zinc plating shall conform to ASTM B 633, Type II.
3. Bolts for submerged service shall be stainless steel machine bolts conforming to ASTM A 193, Grade B8. Nuts shall be heavy hex, stainless steel conforming to ASTM A 194, Grade 8.

2.07 RETAINER GLANDS

Retainer glands shall be ductile iron and shall be equal to EBAA Iron 1100 PV or Uni-Flange Model 1300.

PART 3 EXECUTION

3.01 CUTTING

- A. When new or existing pipe is required to be cut, the pipe shall be cut in such a manner as to leave a smooth end normal to the axis of the pipe.
- B. All cutting of polyvinyl chloride pipe shall be performed with a cutting saw. All burrs shall be removed from the inside and outside edges of all cut pipe. All damaged linings and coatings shall be repaired.

3.02 JOINT ASSEMBLY

- A. **Push-On Joints:** The inside of the bell and the outside of the pipe from the plain end to the guide stripe shall be wiped clean immediately before assembling the pipe joint. Then the rubber gasket shall be inserted into a groove or shaped recess in the bell. Both the bell and spigot ends to be joined shall be wiped again to ensure they are thoroughly clean. A liberal coating of special lubricant furnished by the pipe manufacturer shall be applied to the outside of the pipe. The plain end shall be centered in the bell and the spigot pushed home.
- B. **Mechanical Joints**
 - 1. The surfaces with which the rubber gasket comes in contact shall be brushed thoroughly with a wire brush just prior to assembly to remove all dirt or foreign material which may be present and to provide clean surfaces which shall be brushed with a liberal amount of soapy water or other approved lubricant just prior to slipping the gasket over the spigot end and into the bell. Lubricant shall be brushed over the gasket prior to installation to remove loose dirt and lubricate the gasket as it is forced into its retaining space.
 - 2. Joint bolts shall be tightened by the use of wrenches and to a tension recommended by the pipe manufacturer. When tightening bolts, the gland shall be brought up toward the pipe bell. If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after thorough cleaning. Overstressing of bolts to compensate for poor installation shall not be permitted.
 - 3. After installation, bolts and nuts in buried piping shall be given two heavy coats of a bituminous paint.
- C. **Flanged Joints**
 - 1. All flange adapters shall be installed true and perpendicular to the axis of the pipe. Flanged joints shall be installed so as to ensure uniform gasket compression. All bolting shall be pulled up to the specified torque by crossover sequence. The finished pipe edge shall not extend beyond the face of the flange.
 - 2. Connections to equipment shall be made in such a way that no torque is placed on the equipment flanges. Connecting flanges must be in proper position and alignment and no external force may be used to bring them together properly.
 - 3. Bolts and nuts for exposed or submerged service shall be coated in accordance with the requirements of Section 09 90 00 of these Specifications.

- D. Solvent-Welded Joints: All solvent-welded joints shall be in accordance with ASTM 2855.

3.03 CONSTRUCTING BENEATH AND BEYOND STRUCTURES

- A. Construct piping beyond buildings or structures in accordance with Section 31 23 16.13 of these Specifications.
- B. All polyvinyl chloride pipe installed under buildings or basins shall be encased and backfilled in accordance with Section 33 23 23.13 of these Specifications.
- C. All polyvinyl chloride pipe entering buildings or basins shall be adequately supported between the structure and undisturbed earth to prevent damage resulting from settlement of backfill around the structure.

3.04 CONSTRUCTING WITHIN STRUCTURES

- A. Proper and suitable tools and appliances for safe and convenient handling and laying of pipe and fittings shall be used. Any damage shall be remedied as directed by the Engineer.
- B. All pipe and fittings shall be carefully examined by the Contractor for defects just before installing and no pipe or fitting shall be installed if it is defective. If any defective pipe or fitting is discovered after having been installed, it shall be removed and replaced in a satisfactory manner with a sound pipe or fitting by the Contractor at Contractor's own expense.
- C. All pipes and fittings shall be thoroughly cleaned before they are installed and shall be kept clean until they are used in the completed work. Open ends of pipe shall be kept plugged with a bulkhead during construction.
- D. All elbows, tees, brackets, crosses, and reducers in pressure piping systems shall be adequately restrained against thrust.
- E. Wall pipe and wall sleeves shall be accurately located and securely fastened in place before concrete is poured. All wall pipe and sleeves shall have wall collars properly located to be in the center of the wall where the respective pipes are to be installed. Pipe passing through the sleeve shall extend no more than three feet beyond the structure with a piping joint.
- F. Wall pipe and wall sleeves shall be constructed when the wall or slab is constructed. Blocking out or breaking of the wall for later installation shall not be permitted.
- G. Cutting or weakening of structural members to facilitate pipe installation shall not be permitted. All piping shall be installed in place without springing or forcing.
- H. Exposed polyvinyl chloride piping shall be supported as shown on the Drawings and specified in Section 22 05 29 of these Specifications.

3.05 CPVC PIPE SOLVENT WELD PROCEDURE

- A. This primer and cement cannot be used for PVC pipe; since CPVC has a continuous operating temperature of 90°C (195°F) and PVC pipe has a maximum operating temperature of 57°C (135°F). CAUTION: The use of PVC pipe, or other solvents or primers can cause leaky joints and fittings, sagging pipe, or other complications. Instructions for proper joint makeup can be found on the can labels, or as follows.

1. Primer - IPS weld - on P70 Primer and IPS weld weld-on CPCV 724 cement to be used on CPVC pipe only.
2. Primer Application
 - a. Cut pipe square and deburr. It is preferable to use a PVC pipe cutter with a sharp blade to avoid plastic pipe flash from entering the pipe. Pipe flashing can get in to solenoid valves, pressure reducing valves, orifices, or other components in the system and can lead to serious equipment damage.
 - b. Check for dry fit of pipe and fittings.
 - c. Use a suitable applicator at least 1/2 size of the pipe diameter.
 - d. Apply P-70 PRIMER to the inside of the fitting equal to the socket depth. Without delay, coat the pipe end up to the socket depth until soft. Apply again to socket fitting. Avoid puddling.
 - e. To check penetration, scratch surface. Recoat if necessary. Immediately, while surfaces are still wet, apply Weld-On CPVC 724 cement.
3. Cement Application (Weld-On CPVC 724 ONLY):
 - a. Apply a full, even layer of cement on the pipe equal to the depth of the socket. Coat the fitting socket with a medium layer. Applying too much to the inside of the socket can cause the glue to form a thin membrane over the end of the pipe, particularly on smaller pipe diameters, thereby blocking flow of fluid through the fitting. If necessary, apply a second full layer on the PIPE.
 - b. Assemble while cement is wet. If not wet, recoat parts before assembly. Insure pipe bottoms in fitting socket. Twists 1/8 to 1/4 turn. To avoid pushout and allow for initial set, hold for about 30 seconds. Wipe off excess to avoid dripping on the floor, other components, and to ensure an aesthetically pleasing appearance.
 - c. Allow several minutes for good handling strength. At temperatures from 16C (60°F) to 43C (110°F) allow 24 hours cure for cold water systems, and 48 hours cure for hot water systems such as oxidant lines. At colder ambient temperatures, allow more time to cure. In general, longer cure times are needed when the pipe is used for chemicals, particularly mixed oxidant solution or sodium hypochlorite.

3.06 INSPECTION AND TESTING

All testing shall be in accordance with the requirements of Section 33 11 00 of these Specifications.

3.07 INSULATION AND HEAT TRACING

Provide insulation and heat tracing in accordance with Sections 40 41 00 and 40 42 00 of these Specifications.

END OF SECTION

PLASTIC PIPE
33 11 13.24-9