



TOWN OF MOSHEIM, TENNESSEE

Tonys Pump Station Rehabilitation

WW-PDC-1

May 2024

PROJECT MANUAL



LDA ENGINEERING

LDAENGINEERING.COM



**TOWN OF MOSHEIM
TONY'S PUMP STATION, REHAB PROJECT
PROJECT SPECIFICATIONS**

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SECTION 00100

INSTRUCTIONS TO BIDDERS

ARTICLE 1 - DEFINED TERMS

- 1.01 Terms used in these Instructions to Bidders will have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below which are applicable to both the singular and plural thereof:
- A. ***Bidder***--The individual or entity who submits a Bid directly to OWNER.
 - B. ***Issuing Office***--The office from which the Bidding Documents are to be issued. May or may not be where the bidding procedures are to be administered.
 - C. ***Successful Bidder***--The lowest responsible Bidder submitting a responsive Bid to whom OWNER (on the basis of OWNER's evaluation as hereinafter provided) makes an award.

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 the Issuing Office. See Invitation to Bid for information concerning deposits/refunds.
- 2.02 Complete sets of Bidding Documents must 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 or information obtained from an officer, agent, or employee of the Owner or any other person. Addenda will be provided to registered plan holders only. Registered plan holders are those obtaining the Contract Documents from the issuing office.
- 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.
- 2.04 OWNER and ENGINEER are not responsible for errors or omissions in preparing Bid due to use of partial or incomplete sets of Contract Documents. Complete sets of Contract Documents must be utilized to ensure that all work is identified.

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, present commitments, and such other data as may be called for by OWNER, or as outlined below.

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

4.01 Subsurface and Physical Conditions

- A. The Supplementary Conditions identify:
 - 1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Bidding Documents.
 - 2. Those 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 the reports and drawings referenced in paragraph 4.01.A will be made available by OWNER to any Bidder on request. 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 in paragraph 4.02 of the Supplementary Conditions. 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 Conditions

- A. The Supplementary Conditions identify those reports and drawings relating to a Hazardous Environmental Conditions identified at the Site, if any, that ENGINEER has used in preparing the Bidding Documents.
- B. Copies of reports and drawings referenced in paragraph 4.03.A will be made available by OWNER and to any Bidder on request. 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 in paragraph 4.06 of the Supplementary Conditions. 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 responsibility 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 at least its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall be responsible for notifications, licenses, or permits required to perform explorations, tests, etc.
- 4.06 Reference is made to Article 7 of the Supplementary 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 for which a Bid is to be submitted. 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 a Bid to:
- A. examine and carefully study the Bidding Documents, including any Addenda and the other related data identified in the Bidding Documents;
 - 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, or performance of the Work;
 - D. carefully study all 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 the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions, and carefully study all reports and drawings of a Hazardous Environmental Condition, if any, at the Site which have been identified in the Supplementary Conditions as provided in paragraph 4.06 of the General Conditions;
 - E. obtain and carefully study (or assume responsibility for 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, sequence, and procedures of construction expressly required by the Bidding Documents, and safety precautions and program 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 determinations of its Bid for performance of the Work at the price 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; and
 - 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, including written Addenda 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

- 5.01 A pre-Bid conference will be held at **10 A.M.** (local time) on **June 12, 2024** For an emailed invitation to this virtual conference, please contact Reuben Robertson at rrobertson@ldainc.com or by phone at (865) 250-9986 or use the information below to login or call in:
- Meeting ID: 257 294 857 825
 - Passcode: NyTvWy

 - Call In Option: [+1 423-417-1479,,312999483#](tel:+14234171479312999483) United States, Chattanooga. Call in conference ID: 312 999 483"

Representatives of OWNER and ENGINEER will be present to discuss the Project. Bidders are not required to attend and participate in the conference. ENGINEER will transmit to all prospective Bidders of record such Addenda as ENGINEER considers necessary in response

to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 6 - SITE AND OTHER AREAS

- 6.01 The Site is identified in the Bidding Documents. All additional lands 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. 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.

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

- 7.01 All questions about the meanings or intent of the Bidding Documents are to be submitted to 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. Questions received less than ten days prior to the date of 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 Only Bidders and plan rooms registered as receiving documents from the issuing office will be provided Addenda. Neither the Owner nor Engineer has responsibility for parties obtaining documents by other means.
- 7.03 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 (5%) percent of Bidder's maximum Bid price and in the form of a certified or bank check or a Bid Bond on the form attached.
- 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 upon request by the Bidder.
- 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 upon request by the Bidder.

ARTICLE 9 - CONTRACT TIMES

- 9.01 The number of days within, or the dates by which, the Work is to be (a) Substantially Completed and (b) also completed and ready for final payment are set forth in the Agreement.

ARTICLE 10 - LIQUIDATED DAMAGES

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

ARTICLE 11 - SUBSTITUTE AND "OR EQUAL" ITEMS

- 11.01 The Contract, if awarded, will be awarded on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or "or-equal" items. Whenever it is specified or described in the Bidding Documents that a substitute or "or-equal" item of material or equipment may be furnished or used by CONTRACTOR if acceptable to ENGINEER, application for such acceptance will not be considered by ENGINEER until after the Effective Date of the Agreement. The procedure for submission of any such application by CONTRACTOR and consideration by ENGINEER is set forth in the General Conditions and may be supplemented in the General Requirements.

ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- 12.01 If the Supplementary Conditions or the Bid Form (00300) require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to OWNER with the Bid or 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 with his Bid or if not required on the Bid, 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 an acceptable substitute, without an increase in the Bid.
- 12.02 If apparent Successful Bidder declines to make any such substitution, OWNER may award the Contract to the next lowest responsible 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.

ARTICLE 13 - PREPARATION OF BID

- 13.01 All blanks on the Bid Form shall be completed by printing in ink or by typewriter and the Bid

signed. A Bid price shall be indicated for each section, Bid item, alternative, adjustment unit price item, or unit price item listed therein, or the words "No Bid," "No Change," or "Not Applicable" entered.

- 13.02 A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate address and state of incorporation shall be shown below the signature.
- 13.03 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.
- 13.04 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 must be shown below the signature.
- 13.05 A Bid by an individual shall show the Bidder's name and official address.
- 13.06 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 must be shown below the signature.
- 13.07 All names shall be typed or printed in ink below the signatures.
- 13.08 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form. Failure to acknowledge receipt of all Addenda will constitute grounds for disqualifying the Bid.
- 13.09 The address and telephone number for communications regarding the Bid shall be shown.
- 13.10 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 for the state of the Project, if any, shall also be shown on the Bid Form. Bidder shall include the Drug Free Work Place Affidavit (Section 00910) with his/her Bid.

ARTICLE 14 - BASIS OF BID; EVALUATION OF BIDS

- 14.01 Lump Sum Bids
 - A. Bidders shall submit a Bid on a lump sum basis as set forth in the Bid Form for the Contracts.
- 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 price shall include a price for any allowances and alternates specified in the contract documents.
- 14.04 In addition to the bid amount, additional factors will be considered as an integral part of the bid evaluation process, including, but not limited to:
 - A. The bidder's experience, reputation, efficiency, judgment, and integrity.

- B. The quality, availability and adaptability of the requested products or services.
- C. The bidder's ability to provide future maintenance and/or services.

- D. Any other applicable factors as the City determines necessary and appropriate (which may be requested by the city prior to award).

ARTICLE 15 - SUBMITTAL OF BID

15.01 Each prospective Bidder is furnished one copy of the Bidding Documents with one copy each of the Bid Form and the Bid Bond. The Bid Form is to be completed and submitted with the Bid security in the following format:

- A. Each Bid must be submitted in a sealed envelope, addressed to **Town of Mosheim** at:

**Mailing Address:
Town of Mosheim
Attn. Stephanie Wallin
1000 Main St
Mosheim, TN 37818**

- B. Each sealed envelope containing a Bid must have attached on the outside, the bid envelope information sheet provided by the City of Alcoa. The information includes, but is not limited to:
 - Bidder's Name.
 - Bidder's Address.
 - Contractor's Tennessee License Number and Expiration Date, and that part of classification applying to the Bid.
 - Subcontractor information as required by the City of Alcoa and the Contractor's Licensing Act - Latest Amendment.
- C. A copy of the Bid submittal form is included in the Contract Documents. Bids not having the form attached to the outside of the bid envelope will not be opened.

15.02 A Bid shall be submitted no later than the date and time prescribed in Section 00020 and at the place indicated in Section 15.01 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.

15.03 The "Drug-Free Workplace Affidavit" must be completed, signed, and notarized and submitted in the Bid package. This form is included in Section 00910.

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 Bids.
- 16.02 If within twenty-four (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, that Bidder will be disqualified from further bidding on the work.

ARTICLE 17 - OPENING OF BID

- 17.01 Bids will be opened at the time and place indicated in the Advertisement or Invitation to Bid and the Information for Bidders, and unless obviously non-responsive, read aloud publicly. An abstract of the amount of the base Bids and major alternates, if any, will be made available to Bidders after the opening Bids upon their request.

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 - AWARD OF CONTRACT

- 19.01 OWNER reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, conditional, or qualified Bids. OWNER further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to be non-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 or minor defects in any Bid.
- 19.02 More than one (1) 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 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 these Instructions or the Supplementary Conditions.
- 19.05 OWNER may conduct such investigations as OWNER deems necessary to establish the responsibility, qualifications, and financial ability of the 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 Bidder whose Bid is

in the best interest of the Project. Award will be made to the lowest responsive, responsible Bidder as determined by the City of Alcoa in the best interest of the project. Bidder must Bid on all items of work contained in the Bid Form.

- 19.07 No bid shall be withdrawn for a period of sixty (60) days subsequent to the opening of bids without the consent of the City of Alcoa.

ARTICLE 20 - CONTRACT SECURITY AND INSURANCE

- 20.01 Article 5 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth OWNERS's requirements as to performance and payment Bonds and insurance. When the Successful Bidder delivers the executed Agreement to OWNER, it must 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 fifteen (15) days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to OWNER. Within ten (10) days thereafter, OWNER shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.
- 21.02 The NOTICE TO PROCEED shall be issued within ten (10) days of the execution of the Agreement by the OWNER. Should there be reasons why the NOTICE TO PROCEED cannot be issued within such period; the time may be extended by mutual agreement between the OWNER and the CONTRACTOR. If the NOTICE TO PROCEED has not been issued within the ten (10) day period or within the period mutually agreed upon, the CONTRACTOR may terminate the Agreement without further liability on the part of either party.

ARTICLE 22 – LAWS, PERMITS, AND REGULATIONS

- 22.01 The Contractor shall comply with all State and Local laws, ordinances, regulations and requirements applicable to work hereunder. If the Contractor ascertains at any time that any requirement of this Contract is at variance with applicable laws, ordinances, regulations, or other requirements, she/he shall promptly notify the City of Alcoa in writing.

ARTICLE 23 – CANCELLATION OF AWARD

- 23.01 The City reserves the right to cancel the award of any contract at any time before the execution of such contract by all parties without any liability against the City. The Vendor is advised that if in the event appropriated funds are legitimately unavailable for this product in successive fiscal years, such purchase orders resulting from this bid are null and void.

ARTICLE 24 – COOPERATIVE PURCHASING

- 24.01 Unless stated otherwise, vendor agrees that it shall be permissible for other governments in Tennessee to purchase these items or services at the same price. Freight charges can be adjusted to reflect differences in delivery costs.

ARTICLE 25 – IRAN DIVESTMENT ACT

25.01 By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief that each bidder is not on the list created pursuant to § 12-12-106.

ARTICLE 26 – MISCELLANEOUS

26.01 This project will be funded by ARPA.

END OF SECTION

SECTION 00020

ADVERTISEMENT FOR BIDS

Separate sealed Bids for the **TONYS PUMP STATION IMPROVEMENTS PROJECT** will be received by the **Town of Mosheim at City Hall , 1000 Main Street, Mosheim, Tennessee** until **July 2, 2024** at **11:00 A.M. (Local Time)** at which time they will be publicly opened and read aloud. Late bids are not accepted and will not be opened. An **optional pre-bid virtual meeting will occur on June 12, 2024 on Microsoft Teams.** See Article 5 in Instructions to bidders for invitation details. This project will be funded by ARPA.

The CONTRACT DOCUMENTS may be examined at the following locations:

1. LDA Engineering, - 110 Tyson Boulevard, Suite 200, Alcoa, Tennessee 37701, (865) 573-7672;
2. Knoxville Builders Exchange - 300 Clark Street, Knoxville, Tennessee 37921, (865) 525-0443;

Prospective Bidders must obtain the contract documents directly from LDA Engineering (rrobertson@ldainc.com) to be considered an official bidder and submit a bid on the project. This requirement does not apply to subcontractors and material suppliers. Documents in .pdf format will be electronically transferred.

Bid Security in the amount of five (5%) percent of the Bid must accompany each Bid. No bid may be withdrawn within ninety (90) days after the scheduled closing time for receipt of Bids.

The Owner reserves the right to reject any and all Bids; to waive irregularities in the Bids; to award bids based on individual items, groups of items, or on the entire list of items; and to accept the bid that is in the best interest of the City.

Questions concerning the CONTRACT DOCUMENTS will be directed in writing to the ENGINEER: Reuben Robertson, P.E., rrobertson@ldainc.com; LDA Engineering, 110 Tyson Boulevard, Suite 200, Alcoa, TN 37701, Telephone: (865) 306-5072. All questions will be answered by issue of an addendum. The cutoff time for all questions is **5:00 p.m. June 27, 2024.** Any questions submitted after this time may be unanswered.

All Bidders must be licensed Contractors as required by the Contractor's Licensing Act of 1994. Bidder's name, address, license number, expiration date and that part of classification which applies to the Project(s) and the name, address and licensing information for Masonry, Plumbing, HVAC and Electrical Contractors must be on the sealed envelope containing the executed Bid Proposal. All required items must be listed, with any item(s) that are not applicable to the Project in accordance with the Regulations to be marked "not applicable to this project". In compliance with the act, sealed envelopes will not be opened unless all required information is properly displayed. Contractor must comply with all "Drug Free Requirements" and the "Iran Divestment Act." All Bidders must comply with Title VI of the Civil Rights Act of 1964, as amended.

This work in general consists of construction of the following, but not limited to:

1. Rehabilitation of the existing wet well, including spray lining to protect against H2S
2. Two new 40 HP submersible waste water pumps, guide rails, and discharge piping within the wet well.
3. New electrical controls and equipment
4. Bypass pumping
5. Cleanup and site restoration.

May 24, 2024

Reuben Robertson

Engineer, LDA Engineering

SECTION 00300
BID FORM

Bid of _____ (hereinafter called BIDDER), organized and existing under the laws of the State of _____ doing business as _____* to the **Town of Mosheim**, (hereinafter called OWNER).

In compliance with your Advertisement for Bids, BIDDER hereby proposes to perform all work for the **Tonys Pump Station Improvements Project** in strict accordance with the CONTRACT DOCUMENTS, within the time set forth therein, and at the prices stated below:

By submission of this BID, each BIDDER certifies, and in the case of a joint BID each party thereto certifies as to his own organization, that this BID has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this BID with any other BIDDER or with any competitor.

BIDDER hereby agrees to commence work under this contract on or before a date to be specified in the NOTICE TO PROCEED and to substantially complete the project within **60** consecutive calendar days thereafter, and fully complete and ready for final payment within five (5) days thereafter. BIDDER further agrees to pay as liquidated damages, the amount of \$500.00 per consecutive calendar day after the specified time for substantial completion until the work is substantially complete.

BIDDER acknowledges receipt of the following ADDENDA:

BIDDER understands that the Owner reserves the right to reject any or all bids and to waive any information in the bidding.

* Insert "a corporation", "a partnership", or "an individual" as applicable.

BIDDER Agrees that this bid shall be good and may not be withdrawn for a period of sixty (60) calendar days after the scheduled closing time for receiving bids.

Upon receipt of written NOTICE OF AWARD of this Bid, BIDDER will execute formal contract attached within ten (10) days and deliver Bonds as required by the General Conditions.

Statement of Compliance with the Iran Divestment Act: By submission of this bid, each bidder and each person signing on behalf of any bidder certificates, and in the case of a joint bid each party thereto certifies as its own organization, under penalty of perjury, that to the best of its knowledge and belief that each bidder is not on the list created pursuant to Tennessee Code Annotated § 12-12-106.

The Bid Security attached at five (5%) percent of the Base Bid Price contained herein or in the sum of _____ (\$_____) is to become the property of the OWNER in the event the contract and bond are not executed within the time above set forth, as liquidated damages for the delay and additional expense to the OWNER caused thereby.

BIDDER agrees to perform all the work described in the CONTRACT DOCUMENTS for the **Tonys Pump Station Improvements Project** for the following Lump Sum Price:

TOTAL BID: _____
_____ & /100 Dollars (\$_____).

Respectfully Submitted:

(Bidder)

BY: _____
(Signature)

(Title)

(Business Address and Zip Code)

(Tennessee License Number)

(SEAL - if bid is by a Corporation)

**NOTE: BID MUST BE SIGNED TO BE CONSIDERED.
*SEE SECTION 00100 - ARTICLE 15 FOR BID SUBMITTAL REQUIREMENTS.**

BID ENVELOPE COVER

TOWN OF MOSHEIM, TENNESSEE

CONTRACT NUMBER: MHM301 TONY'S PUMP STATION

SEALED BID FOR

TONY'S PUMP STATION IMPROVEMENTS PROJECT

DELIVERY INSTRUCTIONS:

PLACE: Town of Mosheim Town Hall

1000 Main St, Mosheim, TN 37818

DATE: _____

TIME: _____

***** ANY BLANK SPACES MAY CAUSE BID TO BE UNACCEPTABLE AND REJECTED. *****

BIDDER IDENTIFICATION:

COMPANY NAME: _____

COMPANY ADDRESS: _____

TENNESSEE CONTRACTOR LICENSE INFORMATION:

LICENSE NUMBER: _____

Provide complete information if licensed, or circle the following: **BIDDER UNLICENSED**

LICENSE EXPIRATION DATE: _____

LICENSE DOLLAR LIMIT: _____

LICENSE CLASSIFICATION(S) APPLICABLE TO PROJECT: _____

- * If **any** work, regardless of dollar value, is required for Plumbing, HVAC or Electrical, list subcontractor(s) below that will perform that work. If value of subcontractor's work is such that no license is required, and subcontractor is unlicensed, fill in "**N/A**" in the **license number column**, but still fill in the name. If Bidder will perform that work with Bidder's own forces, fill in Bidder's name below as subcontractor.
- * If there is **no** work in a category, write "**None Required**" or "**N/A**" in the space provided below for subcontractors.
- * If acceptance of alternate or combination of alternates changes subcontractor, so indicate.
- * Provide state contractor license number, expiration date, and applicable classification(s) for bidder and listed subcontractors.
- * Please provide all names in the same style as used for licensing and other legal transactions, without embellishment.

SUBCONTRACTOR COMPANY NAMES:

PLUMBING: _____

HVAC: _____

ELECTRICAL: _____

MASONRY: _____

NOTE: These names **MUST** be completed in accordance with the above or the bid will not be opened.

SUBCONTRACTOR LICENSE INFORMATION:

SUBCONTRACTOR	LICENSE NUMBER	EXPIRES	CLASSIFICATION
PLUMBING			
HVAC			
ELECTRICAL			
MASONRY			

BID BOND

BIDDER (Name and Address):

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

OWNER (Name and Address):

BID

BID DUE DATE: _____

PROJECT (Brief Description Including Location):

BOND

BOND NUMBER: _____

DATE: (Not later than Bid Due Date): _____

PENAL SUM: _____

IN WITNESS WHEREOF, 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 office, agent, or representative.

BIDDER

SURETY

_____(Seal)

_____(Seal)

Bidder's Name and Corporate Seal

Surety's Name and Corporate Seal

By: _____

By: _____

Signature and Title

Signature and Title
(Attach Power of Attorney)

Attest: _____

Attest: _____

Signature and Title

Signature and Title

Note: (1) Above addresses are to be used for giving required notice.
(2) Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable

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.
2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents and Contract 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 and Contract 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 of 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 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. Notice 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 the Bond conflicts with any applicable provision of 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.

**EJCDC
STANDARD FORM OF AGREEMENT
BETWEEN OWNER AND CONTRACTOR
ON THE BASIS OF A STIPULATED PRICE**

THIS AGREEMENT is by and between The Town of Mosheim (hereinafter called OWNER) and _____ (hereinafter called CONTRACTOR). OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, 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: **Rehabilitation of Tonys Pump Station, including lining the wet well to protect against H₂S, providing new wet well top and safety hath, replacement of pumps and rails, and replacing electrical and controls equipment.**

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: **Tonys Pump Station Improvements Project**

ARTICLE 3 - ENGINEER

3.01 The Project has been designed by **LDA Engineering** who is hereinafter called ENGINEER and 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, if any, Substantial Completion, and completion and readiness 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*

- A. **The Work will be substantially completed within 60 days after the date when the Contract Times commence to run as provided in paragraph 2.03 of the General Conditions, and completed and ready for final payment in accordance with paragraph 14.07 of the General Conditions within 20 days after the date when the Contract Times commence to run.**

4.03 *Liquidated Damages*

- A. CONTRACTOR and OWNER recognize that time is of the essence of this Agreement 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 complete 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 **\$500.00** for each day that expires after the time specified in paragraph 4.02 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 **\$500.00** for each day that expires after the time specified in paragraph 4.02 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.

A. **For all Work, at the prices stated in CONTRACTOR's Bid (Section 00300), attached hereto as an exhibit.**

The Total Contract Amount is _____ Dollars (\$ _____).

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 during performance of the Work as provided in paragraphs 6.02.A.1 and 6.02.A.2 below. All such payments will be measured by the schedule of values established in paragraph 2.07.A of the General Conditions (and in the case of the 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, in accordance with paragraph 14.02 of the General Conditions:

- a. **95%** of the Work completed (with the balance being retainage); and
- b. **95%** of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

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

Not Applicable

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 obtained and carefully studied (or assumes responsibility for having done so) all 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 CONTRACTOR, including applying the specific means, methods, techniques, sequences, and procedures of construction, if any, expressly required by the Contract Documents to be employed by CONTRACTOR, and safety precautions and program incident thereto.

E. CONTRACTOR does not consider that any 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.

F. 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.

G. CONTRACTOR has correlated the information known to CONTRACTOR, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, report, studies, and data with 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 which consists of the following:
1. This Agreement (pages 1 to 6, inclusive);
 2. Performance Bond (pages 1 to 2, inclusive);

3. Payment Bond (pages 1 to 2, inclusive);
4. Other Bonds (pages ___ to ____, inclusive);
 - a. _____ (pages ___ to ____, inclusive);
 - b. _____ (pages ___ to ____, inclusive);
5. General Conditions (pages 1 to 40, inclusive);
6. Supplementary Conditions (pages 1 to 5, inclusive);
7. Supplemental Special Conditions (pages 1 to 5, inclusive);
8. Specifications as listed in the table of contents of the Project Manual;
9. Drawings consisting of a cover sheet and sheets numbered 1 through 14, inclusive, with each sheet bearing the following general title: **Tonys Pump Station Improvements Project**
11. Addenda (numbers -to -, inclusive);
12. Exhibits to this Agreement (enumerated as follows):
 - a. Notice to Proceed (by letter from the Town of Mosheim);
 - b. CONTRACTOR's Bid (pages 1 to 4, inclusive);
 - c. Documentation submitted by CONTRACTOR prior to Notice of Award (pages _ to _, inclusive);
 - d. Drug Free Workplace Affidavit;
13. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
 - a. Written Amendments;
 - b. Work Change Directive;
 - c. Change Order(s).

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 paragraphs 3.05 of the General Conditions.

ARTICLE 10 - MISCELLANEOUS

10.01 Terms

A. Terms used in this Agreement will have the meanings indicated in the General Conditions.

10.02 Assignment of Contract

A. No assignment by a party hereto of any rights under or interest 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 *Successor 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 of all covenants, agreements and obligations contained in the Contract Documents.

10.04 *Severability*

A. Any provisions 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 *Other Provisions*

Not Applicable

This Agreement will be effective on _____, 2024 (which is the Effective Date of the Agreement).

IN WITNESS WHEREOF, the parties hereto have executed this Contract as of the day and year first above written, the Town of Mosheim, by its Mayor, by authority duly given.

OWNER:

CONTRACTOR:

TOWN OF MOSHEIM

By _____
MAYOR

By _____

Address for giving notices
1000 MAIN ST

Address for giving notices

MOSHEIM, TENNESSEE 37818

Approved as to Form and Legality

License No. _____

Designated Representative:

City Attorney

Name: _____

Title: _____

Address: _____

Phone: _____

Facsimile: _____

CONSTRUCTION PERFORMANCE BOND

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

CONTRACTOR (Name and Address):

SURETY (Name and Principal Place of Business):

OWNER (Name and Address):

CONSTRUCTION CONTRACT

Date:

Amount:

Description (Name and Location)

BOND

Date (Not earlier than Construction Contract Date):

Amount:

Modifications to this Bond Form:

CONTRACTOR AS PRINCIPAL

Company: (Corp. Seal)

Signature: _____
Name and Title:

SURETY

Company: (Corp. Seal)

Signature: _____
Name and Title:

CONTRACTOR AS PRINCIPAL

Company: (Corp. Seal)

Signature: _____
Name and Title:

SURETY

Company: (Corp. Seal)

Signature: _____
Name and Title:

1. The Contractor and the 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 to participate in conferences as provided in Subparagraph 3.1
3. If there is no Owner Default, the Surety's obligation under this Bond shall arise after:
 - 3.1 The Owner has notified the Contractor and the Surety at its address described in Paragraph 10 below, that the Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with the Contractor and the Surety to be held not later than fifteen days after receipt of such notice to discuss methods of performing the Construction Contract. 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; and
 - 3.2 The Owner has declared a Contractor Default and formally terminated the Contractor's right to complete the contract. Such Contractor Default shall not be declared earlier than twenty days after the Contractor and the Surety have received notice as provided in Subparagraph 3.1; and
 - 3.3 The Owner has agreed to pay the Balance of the Contract Price to the Surety in accordance with the terms of the Construction Contract or to a contractor selected to perform the Construction Contract in accordance with the terms of the contract with the Owner.
4. 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:
 - 4.1 Arrange for the Contractor, with consent of the Owner, to perform and complete the Construction Contract; or
 - 4.2 Undertake to perform and complete the Construction Contract itself, through its agents or through independent contractors; or
 - 4.3 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 the contractor selected with the Owner's 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 6 in excess of the Balance of the Contract Price incurred by the Owner resulting from the Contractor's default; or
 - 4.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:
 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, tender payment therefore to the Owner; or
 2. Deny liability in whole or in part and notify the Owner citing reasons therefore.
5. If the Surety does not proceed as provided in Paragraph 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond fifteen 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 Subparagraph 4.4, and the Owner refuses the payment tendered 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.
6. After the Owner has terminated the Contractor's right to complete the Construction Contract, and if the Surety elects to act under Subparagraph 4.1, 4.2, or 4.3 above, 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. To the limit of the amount of this bond, but subject to commitment by the Owner of the Balance of the Contract price to mitigation of costs and damages on the Construction Contract, the Surety is obligated without duplication for:
 - 6.1 The responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
 - 6.2 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 4; and
 - 6.3 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.
7. 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, or successors.
8. 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.
9. 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 Contractor Default or within two years after the Contractor ceased working or with 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 period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.
10. Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page.
11. 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. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.
12. Definitions.
 - 12.1 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 to the Contractor of 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.
 - 12.2 Construction Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.
 - 12.3 Contractor Default: Failure of the Contractor which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Construction Contract.
 - 12.4 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Construction Contract or to perform and complete or comply with the other terms thereof.

(FOR INFORMATION ONLY – Name, Address and Telephone)
 AGENT or BROKER: OWNER'S REPRESENTATIVE (Architect, Engineer or other party):

CONSTRUCTION PAYMENT BOND

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

CONTRACTOR (Name and Address):

SURETY (Name and Principal Place of Business):

OWNER (Name and Address):

CONSTRUCTION CONTRACT

Date:

Amount:

Description (Name and Location)

BOND

Date (Not earlier than Construction Contract Date):

Amount:

Modifications to this Bond Form:

CONTRACTOR AS PRINCIPAL

Company: (Corp. Seal)

SURETY

Company: (Corp. Seal)

Signature: _____
Name and Title:

Signature: _____
Name and Title:

CONTRACTOR AS PRINCIPAL

Company: (Corp. Seal)

SURETY

Company: (Corp. Seal)

Signature: _____
Name and Title:

Signature: _____
Name and Title:

1. The Contractor and the 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.

2. With respect to the Owner, this obligation shall be null and void if the Contractor:

2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants, and

2.2 Defends, indemnifies and holds harmless the Owner from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Construction Contract, provided the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 12) of any claims, demands, liens or suits and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety, and provided there is not Owner Default.

3. With respect to Claimants, this obligation shall be null and void if the Contractor promptly makes payment, directly or indirectly, for all sums due.

4. The Surety shall have no obligation to Claimants under this Bond until:

4.1 Claimants who are employed by or have a direct contract with the Contractor have given notice to the Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

4.2 Claimants who do not have a direct contract with the Contractor:

1. Have furnished written notice to the Contractor and sent a copy, or notice thereof, to the Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied or for whom the labor was done or performed; and

2. have either received a rejection in whole or in part from the Contractor, or not received within 30 days of furnishing the above notice any communication from the Contractor by which the Contractor has indicated the claim will be paid directly or indirectly; and

3. Not having been paid within the above 30 days, have sent a written notice to the Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to the Contractor.

5. If a notice required by Paragraph 4 is given by the Owner to the Contractor or to the Surety, that is sufficient compliance.

6. When the Claimant has satisfied the conditions of Paragraph 4, the Surety shall promptly and at the Surety's expense take the following actions:

6.1 Send an answer to the Claimant, with a copy to the Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

6.2 Pay or arrange for payment of any undisputed amounts.

7. The Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

8. 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 the Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

9. 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 payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

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. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the work or part of the work is located or after the expiration of one year from the date 91) on which the Claimant gave the notice required by Subparagraph 4.1 or Clause 4.2 (iii), 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.

12. Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page. Actual receipt of notice by Surety, the Owner or the Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

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. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

14. Upon request by any person or entity appearing to be a potential beneficiary of this bond, the Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15. DEFINITIONS

15.1 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 Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of 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.

15.2 Construction Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

15.3 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Construction Contract or to perform and complete or comply with the other terms thereof.

(FOR INFORMATION ONLY – Name, Address and Telephone)

AGENT or BROKER: OWNER'S REPRESENTATIVE (Architect, Engineer or other party):

NOTICE OF AWARD

Dated _____, 2024

TO: _____
(BIDDER)

ADDRESS: _____

Contract: Town of Mosheim – Tonys Pump Station Improvements Project

You are notified that your Bid dated _____ for the above Contract has been considered. You are the apparent Successful Bidder and have been awarded a contract for **Tonys Pump Station Improvements Project**.

The Contract Price of your Contract is _____ **Dollars (\$** _____ **)**.

4 copies of each of the proposed Contract Documents (except Drawings accompany this Notice of Award

You must comply with the following conditions precedent within fifteen (15) days of the date of this Notice of Award, that is by _____.

1. Deliver to the OWNER 4 fully executed counterparts of the Contract Documents. Each of the Contract Documents must bear your signature on all required documents.
2. Deliver with the executed Contract Documents the Contract Security (Bonds) as specified in the Instructions to Bidders (Article 20), General Conditions (paragraph 5.01) Supplementary Conditions (paragraph SC-5.01).]
3. (List other conditions precedent). NOT APPLICABLE

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

*EJCDC No. 1910-22 (1996 Edition)
Prepared by the Engineers Joint Contract Documents Committee and endorsed by The Associated General Contractors of America and the Construction Specifications Institute.*

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.

TOWN OF MOSHEIM -
(OWNER)

BY _____
(AUTHORIZED SIGNATURE)

(TITLE)

Copy to ENGINEER
(Use Certified Mail,
Return Receipt Requested)

NOTICE TO PROCEED

Dated _____, 2024

TO: _____
(BIDDER)

ADDRESS: _____

Contract: _____

You are notified that the Contract Times under the above contract will commence to run on _____. By 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 _____ and the date of readiness for final payment is _____.

Before you may start any Work at the Site, paragraph 2.05.C of the General Conditions provides that you and Owner must each deliver to the other (with copies to Engineer and other identified additional insureds) certificates of insurance which each is required to purchase and maintain in accordance with the Contract Documents.

- Also, before you may start any Work at the Site, you must:
1. Submit shop drawings in accordance with Section 01340.
 2. Submit a Project Schedule.

TOWN OF MOSHEIM
(OWNER)

BY: _____
(AUTHORIZED SIGNATURE)

(TITLE)

Copy to ENGINEER

¹(Use Certified Mail, Return Receipt Requested)

CHANGE ORDER

No. _____

DATE OF ISSUANCE _____

EFFECTIVE DATE _____

OWNER _____

CONTRACTOR _____

Contract: _____

Project: _____

OWNER's Contract No. _____ ENGINEER's Contract No. _____

ENGINEER _____

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

Description:

Reason for Change Order:

Attachments: (List documents supporting change)

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

CHANGE IN CONTRACT TIMES:
Original Contract Times: _____ Substantial Completion: _____ Ready for final payment: _____ <p align="right">(days or dates)</p>
Net changes from previous Change Orders No. _____ to No. _____: Substantial Completion: _____ Ready for final payment: _____ <p align="right">(days)</p>
Contract Times prior to this Change Order Substantial Completion: _____ Ready for final payment: _____ <p align="right">(days or dates)</p>
Net Increase (decrease) of this Change Order Substantial Completion: _____ Ready for final payment: _____ <p align="right">(days)</p>
Contract Times prior to this Change Order Substantial Completion: _____ Ready for final payment: _____ <p align="right">(days or dates)</p>

RECOMMENDED: _____

APPROVED: _____

ACCEPTED: _____

BY: _____
ENGINEER (Authorized Signature)

BY: _____
OWNER (Authorized Signature)

BY: _____

DATE: _____

DATE: _____

DATE: _____

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the Controlling Law.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly By



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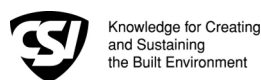
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Construction Specifications Institute

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American Society of Civil Engineers
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These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor Nos. C-520 or C-525 (2002 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the EJCDC Construction Documents, General and Instructions (No. C-001) (2002 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (No. C-800) (2002 Edition).

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GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. 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 which is evidence of the agreement between Owner and Contractor covering the Work.

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. *Asbestos*--Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. *Bid*--The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidder*--The individual or entity who submits a Bid directly to Owner.

7. *Bidding Documents*--The Bidding Requirements and the proposed Contract Documents (including all Addenda).

8. *Bidding Requirements*--The Advertisement or Invitation to Bid, Instructions to Bidders, bid security of acceptable form, if any, and the Bid Form with any supplements.

9. *Change Order*--A document recommended by Engineer 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, issued on or after the Effective Date of the Agreement.

10. *Claim*--A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Contract*--The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*-- Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor's submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

13. *Contract Price*--The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).

14. *Contract Times*--The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any, (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.

15. *Contractor*--The individual or entity with whom Owner has entered into the Agreement.

16. *Cost of the Work*--See Paragraph 11.01.A for definition.

17. *Drawings*--That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

18. *Effective Date of the Agreement*--The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

19. *Engineer*--The individual or entity named as such in the Agreement.

20. *Field Order*--A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

21. *General Requirements*--Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.

22. *Hazardous Environmental Condition*--The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.

23. *Hazardous Waste*--The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

24. *Laws and Regulations; Laws or Regulations*--Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

25. *Liens*--Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

26. *Milestone*--A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

27. *Notice of Award*--The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.

28. *Notice to Proceed*--A written notice given 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 under the Contract Documents.

29. *Owner*--The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

30. *PCBs*--Polychlorinated biphenyls.

31. *Petroleum*--Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

32. *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.

33. *Project*--The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

34. *Project Manual*--The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

35. *Radioactive Material*--Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

36. *Related Entity* -- An officer, director, partner, employee, agent, consultant, or subcontractor.

37. *Resident Project Representative*--The authorized representative of Engineer who may be assigned to the Site or any part thereof.

38. *Samples*--Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

39. *Schedule of Submittals*--A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

40. *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.

41. *Shop Drawings*--All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

42. *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 for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

43. *Specifications*--That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain

administrative requirements and procedural matters applicable thereto.

44. *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 at the Site.

45. *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.

46. *Successful Bidder*--The Bidder submitting a responsive Bid to whom Owner makes an award.

47. *Supplementary Conditions*--That part of the Contract Documents which amends or supplements these General Conditions.

48. *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 any Subcontractor.

49. *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 those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

50. *Unit Price Work*--Work to be paid for on the basis of unit prices.

51. *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, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

52. *Work Change Directive*--A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times

but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 Terminology

A. The following words or terms are not defined but, when used in the Bidding Requirements or Contract Documents, have the following 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 requirements of and information in the Contract Documents and conformance with the design concept of the completed 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 Paragraph 9.09 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 14.04 or 14.05).

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. When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, “provide” is implied.

F. Unless stated otherwise in the Contract Documents, words or phrases which 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. 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 Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *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 Agreement

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 Agreement. 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 Agreement, whichever date is earlier.

2.04 *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 the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), 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 Documents;

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.

2.06 *Preconstruction Conference*

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 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2.07 *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 2.05.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 component parts of the Work.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, 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. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to Owner.

C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, 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, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement 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 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 Contract Documents. No such provision or instruction shall be effective to assign to Owner, or Engineer, or any of, their Related Entities, 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 Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. Reporting Discrepancies

1. *Contractor's Review of Contract Documents Before Starting Work:* Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor may discover and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.

2. *Contractor's Review of Contract Documents During Performance of Work:* If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, 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 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

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 knew or reasonably should have known thereof.

B. Resolving Discrepancies

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

a. the provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); 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 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample; (Subject to the provisions of Paragraph 6.17.D.3); or

3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier or other individual or entity performing or furnishing all of the Work under a direct or indirect contract with Contractor, 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 Engineer's consultants, including electronic media editions; or

2. reuse any of 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 adaption by Engineer.

B. The prohibition 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.

3.06 *Electronic Data*

A. Copies of data furnished by Owner or Engineer to Contractor or Contractor to Owner or Engineer that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's

sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party..

C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *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. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

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 the Work is to be performed 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.

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports of explorations and tests of subsurface conditions at or contiguous to the Site that Engineer has used in preparing the Contract Documents; and

2. those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that Engineer has used in preparing the Contract Documents.

B. *Limited Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their Related Entities 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.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice*: If Contractor believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed 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 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; 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 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review*: After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. Possible Price and Times Adjustments

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition 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 meet any one or more of the categories described in Paragraph 4.03.A; and

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 Paragraphs 9.07 and 11.03.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:

a. Contractor knew of the existence of such conditions at the time Contractor made a final 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

b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

c. Contractor failed to give the written notice as required by Paragraph 4.03.A.

3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, Owner and Engineer, and any of their Related Entities shall not be liable to Contractor for any claims, costs, losses, or 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) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to 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 shall not be responsible for the accuracy or completeness of any such information or data; 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 such information and data,
- b. locating all Underground Facilities shown or indicated in the Contract Documents,
- c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction, and
- d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, 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 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will

promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *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.

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* Reference is made to the Supplementary Conditions for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the Engineer in the preparation of the Contract Documents.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their Related Entities 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 any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) 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.

E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered to Contractor written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. 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, either party may make a Claim therefor as provided in Paragraph 10.05.

F. 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. If Owner and Contractor cannot agree as to

entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, 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: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06. G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, 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 created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 - BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish performance and payment bonds, 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 Documents. 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 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent must be accompanied by a certified copy of the agent's authority to act.

C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, 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 requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

A. Contractor shall deliver to Owner, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.

B. Owner shall deliver to Contractor, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.

5.04 *Contractor's Liability Insurance*

A. Contractor shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and as will provide protection

from claims set forth below which 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:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

b. by any other person for any other reason;

5. 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; and

6. 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.

B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, include as additional insured (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, 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;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;

3. include completed operations insurance;

4. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;

5. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);

6. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and

7. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two years after final payment.

a. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

5.05 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, 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.

5.06 *Property Insurance*

A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full 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 interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured;

2. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, false work, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, (other than caused by flood) and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;

3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;

5. allow for partial utilization of the Work by Owner;

6. include testing and startup; and

7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other additional insured to whom a certificate of insurance has been issued.

B. Owner shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.

C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.

D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any

deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

E. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

5.07 *Waiver of Rights*

A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies 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 of the insureds or additional insureds thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, 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 Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insured or additional insured (and the officers, directors, 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 as trustee or otherwise payable under any policy so issued.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, 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 utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.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, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order .

B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract

Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, 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. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.01 *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. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

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. The superintendent will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or

received from the superintendent shall be binding on Contractor.

6.02 *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. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *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.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, 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.

6.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 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 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and "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 specification or description 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 or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.

1. *"Or-Equal" Items:* If in Engineer's sole discretion 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, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, 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

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.

2. Substitute Items

a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. Contractor shall submit sufficient information as provided below to allow Engineer to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented in the General Requirements and as Engineer may decide is appropriate under the circumstances.

d. 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:

1) shall certify that the proposed substitute item will:

a) perform adequately the functions and achieve the results called for by the general design,

b) be similar in substance to that specified, and

c) be suited to the same use as that specified;

2) will state:

a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time;

b) whether or not 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

c) whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

3) will identify:

a) all variations of the proposed substitute item from that specified, and

b) available engineering, sales, maintenance, repair, and replacement services;

4) and shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change,

B. Substitute Construction Methods or Procedures: If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.

C. Engineer's Evaluation: Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.

D. Special Guarantee: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

E. Engineer's Cost Reimbursement: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute item so proposed or submitted by Contractor, Contractor shall reimburse Owner for the charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the 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.

F. Contractor's Expense: Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 Concerning Subcontractors, Suppliers, and Others

A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. 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 any right of Owner or Engineer to reject defective Work.

C. 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. 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 anything in the Contract Documents create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual

or entity except as may otherwise be required by Laws and Regulations.

D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.

F. 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.

G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, and Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, 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 such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *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, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, 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.

6.08 *Permits*

A. Unless otherwise provided in the Supplementary Conditions, 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 opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *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 knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear 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. However, it shall not be Contractor's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 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.

6.11 Use of Site and Other Areas

A. Limitation on Use of Site and Other Areas

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, 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 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 by or based upon Contractor's performance of the Work.

B. Removal of Debris During Performance of the Work: During the progress of the Work Contractor shall keep the Site and other 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 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 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 property to stresses or pressures that will endanger it.

6.12 Record Documents

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

6.13 Safety and Protection

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. 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, 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 owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.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 (except damage or loss attributable to the fault of Draw-

ings or Specifications or to the acts or omissions of Owner or Engineer or , 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).

D. Contractor's duties and responsibilities for safety and for protection of the Work 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 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *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.

6.15 *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.

6.16 *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.

6.17 *Shop Drawings and Samples*

A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the acceptable Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. Shop Drawings

a. Submit number of copies specified in the General Requirements.

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 6.17.D.

2. *Samples*: Contractor shall also submit Samples to Engineer for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals.

a. Submit number of Samples specified in the Specifications.

b. 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 6.17.D.

B. 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. Submittal Procedures

1. Before submitting each Shop Drawing or Sample, Contractor shall have determined and verified:

a. all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

b. the suitability of all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;

c. all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto; and

d. shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

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 and approval of that 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 both a written communication separate from the Shop Drawing's or Sample Submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

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 (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. Engineer's review and approval 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 6.17.C.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's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

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.

6.18 Continuing the Work

A. 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, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 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 Related Entities shall be entitled to rely on representation of 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 or the issuance of a notice of acceptability by Engineer;

6. any inspection, test, or approval by others; or

7. any correction of defective Work by Owner.

6.20 Indemnification

A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, 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 respective consultants, agents, officers, directors, partners, or employees 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 6.20.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 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, 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.

6.21 *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 law.

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, Shop Drawings 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 6.21, 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 6.17.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 - OTHER WORK AT THE SITE

7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or via other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to Contractor prior to starting any such other work; and
2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.

B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and shall properly coordinate the Work with theirs. 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 their work and will only cut or alter their work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, 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.

7.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's actions or inactions.

C. Contractor shall be liable to Owner and any other contractor for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's action or inactions.

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

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

8.02 *Replacement of Engineer*

A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

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

8.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

A. Owner's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been utilized by Engineer in preparing the Contract Documents.

8.06 *Insurance*

A. Owner's responsibilities, if any, in respect of purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility in respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *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.

8.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

A. If and to the extent Owner has agreed to furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents, Owner's responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *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 Documents and will not be changed without written consent of Owner and Engineer.

9.02 *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 9.09. 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.

9.03 *Project Representative*

A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. 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.

9.04 *Authorized Variations in Work*

A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which 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. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

B. In connection with 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, see Paragraph 6.21.

C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

A. 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 Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question

B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believe that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.

D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show

partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents 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 14.07.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 9.09 shall also apply to, the Resident Project Representative, if any, and assistants, if any.

ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

10.01 *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 by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall

promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *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 as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.B.

10.03 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

2. 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; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

A. If notice 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) is required by the provisions of any bond to be given to a surety, 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.

10.05 *Claims*

A. *Engineer's Decision Required:* All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.

B. *Notice:* Written notice stating the general nature of each Claim, shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

C. *Engineer's Action:* Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

1. deny the Claim in whole or in part,

2. approve the Claim, or

3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 - COST OF THE WORK;
ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items, and shall not include any of the costs itemized in Paragraph 11.01.B.

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 at the Site. 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, 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 11.01.

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, 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 5.06.D), 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 telegrams, long distance telephone calls, telephone service at the Site, expresses, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. 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 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which 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 Paragraphs 11.01.A and 11.01.B.

C. Contractor's Fee: When all the Work 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 or when a Claim for an 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 12.01.C.

D. Documentation: Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, 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.

11.02 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

1. Contractor agrees that:

a. 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

b. 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

1. 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.

11.03 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. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.

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. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 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; and

2. there is no corresponding adjustment with respect any other item of Work; and

3. Contractor believes that Contractor 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 12 - CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. The value of any Work covered by a Change Order or of any Claim for 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, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an

allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

C. *Contractor's Fee:* 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 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 11.01.A.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 Paragraph 12.01.C.2.a is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

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 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted

by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, 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 Price or the Contract Times, or both. 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.

C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is 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 described in this Paragraph 12.03.C.

D. Owner, Engineer and the Related Entities of each of them shall not be liable to Contractor for any claims, costs, losses, or 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) sustained by Contractor on or in connection with any other project or anticipated project.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. All defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 *Access to Work*

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

13.03 *Tests and Inspections*

A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;
2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in said Paragraph 13.04.C; and
3. as otherwise specifically provided in the Contract Documents.

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 and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to

be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

E. 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, it must, if requested by Engineer, be uncovered for observation.

F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, 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, furnishing all necessary labor, material, and equipment.

C. If it is found that the uncovered Work is defective, 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 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 Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.

D. 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, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *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, 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.

13.06 *Correction or Removal of Defective Work*

A. Promptly after receipt of notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. 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 removal (including but not limited to all costs of repair or replacement of work of others).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *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 land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas; or
2. correct such defective Work; or
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 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. 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) will be paid by Contractor.

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 13.07, 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 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. 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) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *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 in accordance with Paragraph 13.06.A, 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, 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 13.09, 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, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, 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 (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) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. 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 13.09.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

A. The Schedule of Values established as provided in Paragraph 2.07.A 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.

14.02 *Progress Payments*

A. 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 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.

B. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, 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 on the Site 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, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and to 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 Documents; or

b. that 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 moneys 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 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent

inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

- a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;
- b. the Contract Price has been reduced by Change Orders;
- c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or
- d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. Payment Becomes Due

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. Reduction in Payment

1. Owner may refuse to make payment of the full amount recommended by Engineer because:

- a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;
- b. 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;
- c. there are other items entitling Owner to a set-off against the amount recommended; or
- d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action 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, when Contractor corrects to Owner's satisfaction the reasons for such action.

3. If it is subsequently determined that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1.

14.03 Contractor's Warranty of Title

A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 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 (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.

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 tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will within 14 days after submission of the tentative certificate to Owner notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will within said 14 days execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial

Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to complete or correct items on the tentative list.

14.05 *Partial Utilization*

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. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner and Engineer that such part of the Work is substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and 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 14.04 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 5.10 regarding property insurance.

14.06 *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 is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *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, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.7;

b. consent of the surety, if any, to final payment;

c. a list of all Claims against Owner that Contractor believes are unsettled; and

d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner or Owner's property might in any way be responsible 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.

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 Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. 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 14.09. 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. Payment Becomes Due

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and , will be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance

with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.01 *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 notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will 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 established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);

2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;

3. Contractor's disregard of the authority of Engineer; or

4. Contractor's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion),

2. 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

3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.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 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) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed 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.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

E. 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. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.

F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B, and 15.02.C.

15.03 *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;

3. 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) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. reasonable expenses directly attributable to termination.

B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 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 15.03.

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 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 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 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 16 - DISPUTE RESOLUTION

16.01 *Methods and Procedures*

A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be

governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions, or

2. agrees with the other party to submit the Claim to another dispute resolution process, or

3. gives written notice to the other party of their intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 - MISCELLANEOUS

17.01 *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 to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

A. When any period of time is referred to in the Contract Documents 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.

17.03 *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 Documents. 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.

17.04 *Survival of Obligations*

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

17.05 *Controlling Law*

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

17.06 *Headings*

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

ARTICLE 19 - ARP GUIDELINES

Consistent with the obligations set out General Requirements, the contractor certifies to the Town of Mosheim that Service Provider is, and shall continue to be, in compliance with the applicable requirements of federal Executive Order 11246 (as amended), 41 CFR 60-1.40, 60-300.5(a), 60741.5(a) and all other relevant employment regulations issued by the Office of Federal Contactor Compliance Programs ("OFCCP") (the "Regulatory Requirements"). These Regulatory Requirements prohibit discrimination against qualified individuals based on their status as protected veterans or individuals with disabilities and prohibit discrimination against all individuals based on their race, color, religion, sex, sexual orientation, gender identity, national origin, and for inquiring about, discussing or disclosing compensation. Moreover, the Regulatory Requirements require that covered prime contractors and subcontractors take affirmative action to employ and advance in employment individuals without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, disability, or veteran status.

19.01 *Equal Employment Opportunity*

During the performance of this contract, the contractor agrees as follows:

- A. The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.
- B. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.
- C. The contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation,

proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.

- D. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- E. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- F. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
- G. In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
- H. The contractor will include the requirements in paragraphs (A) through (H) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance:

Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

19.02 *Reserved.*

19.03 *Copeland Anti-Kickback Act*

During the performance of this contract, the contractor agrees as follows:

- A. Contractor. The contractor shall comply with 18 U.S.C. § 874, 40 U.S.C. § 3145, and the requirements of 29 C.F.R. pt. 3 as may be applicable, which are incorporated by reference into this contract.
- B. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clause above and a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all of these contract clauses.
- C. Breach. A breach of the contract clauses above may be grounds for termination of the contract, and for debarment as a contractor and subcontractor as provided in 29 C.F.R. § 5.12.”

19.04 *Contract Work Hours and Safety Standards Act*

During the performance of this contract, the contractor agrees as follows:

- A. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- B. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the t \$27 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.
- C. Withholding for unpaid wages and liquidated damages. The (write in the name of the Federal agency or the loan or grant recipient) shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

- D. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (b)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (b)(1) through (4) of this section.

19.05 *Clean Air Act and Federal Water Pollution Control Act*

During the performance of this contract, the contractor agrees as follows:

Clean Air Act

- A. The contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401 et seq
- B. The contractor agrees to report each violation to the (name of subrecipient entering into the contract) and understands and agrees that the (name of the subrecipient entering into the contract) will, in turn, report each violation as required to assure notification to Treasury, and the appropriate Environmental Protection Agency Regional Office.
- C. The contractor agrees to include these requirements in each subcontract exceeding \$150,000.

Federal Water Pollution Control Act

- D. The contractor agrees to comply with all applicable standards, orders, or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 ets eq.
- E. The contractor agrees to report each violation to the (name of the subrecipient entering into the contract) and understands and agrees that the (name of the subrecipient entering into the contract) will, in turn, report each violation as required to assure notification to the Treasury, and the appropriate Environmental Protection Agency Regional Office.
- F. The contractor agrees to include these requirements in each subcontract exceeding \$150,000.

19.06 *Debarment and Suspension*

During the performance of this contract, the contractor agrees as follows:

- A. This contract is a covered transaction for purposes of 2 C.F.R. pt. 180 and 2 C.F.R. pt. 3000. As such, the contractor is required to verify that none of the contractor's principals (defined at 2 C.F.R. § 180.995) or its affiliates (defined at 2 C.F.R. § 180.905) are excluded (defined at 2 C.F.R. § 180.940) or disqualified (defined at 2 C.F.R. § 180.935).
- B. The contractor must comply with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C, and must include a requirement to comply with these regulations in any lower tier covered transaction it enters into.
- C. This certification is a material representation of fact relied upon by (insert name of recipient/subrecipient/applicant). If it is later determined that the contractor did not comply

Supplement to the Supplementary Conditions.

EJCDC® 00800, Supplementary Conditions of the Construction Contract.

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with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C, in addition to remedies available to (insert name of recipient/subrecipient/applicant), the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment.

- D. The bidder or proposer agrees to comply with the requirements of 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C while this offer is valid and throughout the period of any contract that may arise from this offer. The bidder or proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions.

19.07 *Byrd Anti-Lobbying Amendment*

During the performance of this contract, the contractor agrees as follows:

- A. Byrd Anti-Lobbying Amendment, 31 U.S.C. § 1352

Contractors who apply or bid for an award of \$100,000 or more shall file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, officer or employee of Congress, or an employee of a Member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 U.S.C. § 1352. Each tier shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the recipient who in turn will forward the certification(s) to the awarding agency.

19.08 *Procurement of Recovered Materials*

During the performance of this contract, the contractor agrees as follows:

- A. In the performance of this contract, the Contractor shall make maximum use of products containing recovered materials that are EPA-designated items unless the product cannot be acquired competitively within a timeframe providing for compliance with the contract performance schedule; meeting contract performance requirements; or at a reasonable price. Information about this requirement, along with the list of EPA-designated items, is available at EPA's Comprehensive Procurement Guidelines webpage.

The Contractor also agrees to comply with all other applicable requirements of Section 6002 of the Solid Waste Disposal Act.

19.09 *Domestic Preference for Procurement*

During the performance of this contract, the contractor agrees as follows:

- A. As appropriate, and to the extent consistent with law, the contractor should, to the greatest extent practicable, provide a preference for the purchase, acquisition, or use of goods,

products, or materials produced in the United States. This includes, but is not limited to iron, aluminum, steel, cement, and other manufactured products.

For purposes of this clause:

Produced in the United States means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States. Manufactured products mean items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

19.10 *Access to Records*

- A. The Contractor agrees to provide (insert name of state agency or local or Indian tribal government), (insert name of recipient), Treasury, the Comptroller General of the United States, or any of their authorized representatives access to any books, documents, papers, and records of the Contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts, and transcriptions.
- B. The Contractor agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.
- C. The Contractor agrees to provide the Treasury or authorized representatives access to construction or other work sites pertaining to the work being completed under the contract.

19.11 *Compliance with Federal Law, Regulations and Executive Orders*

- A. This is an acknowledgement that Treasury ARP SLFRF financial assistance will be used to fund all or a portion of the contract. The contractor will comply with all applicable Federal law regulations, executive orders, Treasury policies, procedures, and directives.

19.12 *Program Fraud and False or Fraudulent Statements or Related Acts*

- A. The Contractor acknowledges that 31 U.S.C. Chap. 38 (Administrative Remedies for False Claims and Statements) applies to the Contractor's actions pertaining to this contract."

19.13 *Non-Boycott of Israel Certification*

- A. Service Provider certifies that it is not currently engaged in, and will not for the duration of the Original Agreement, engage in, a boycott of Israel, as defined by Tenn. Code. Ann. 12-4-119. This provision shall not apply to contracts with a total value of less than two hundred fifty thousand dollars (\$250,000.00), or to contractors with less than ten (10) employees. Under the law, a boycott of Israel means engaging in refusals to deal, terminating business activities, or other commercial actions that are intended to limit commercial relations with Israel, or companies doing business in or with Israel or authorized by, licensed by, or organized under the laws of the State of Israel to do business, or persons or entities doing

business in Israel, when such actions are taken: (i) in compliance with, or adherence to, calls for a boycott of Israel; or (ii) in a manner that discriminates on the basis of nationality, national origin, religion, or other unreasonable basis, and is not based on a valid business reason.

19.14 *Iran Divestment Act Compliance Certification*

- A. In accordance with Tennessee Code Annotated (TCA) Chapter 12, by submission of this bid, each bidder and each person signing on behalf of any bidders certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief that each bidder is not on the list created pursuant to TCA §12-12-106.
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SECTION 00800

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (No. 1910-8, 2002 Edition) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions will have the meanings indicated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings indicated below, which are applicable to both the singular and plural thereof.

I. SC-4.06 Delete Paragraphs 4.06.A and 4.06.B in their entirety and insert the following:

A. No reports or explorations or tests of hazardous environmental conditions at or contiguous to the Site are known to the Owner or Engineer.

II. SC-4.06-Delete Paragraph G in its entirety with no replacement.

III. SC-5.04 Add the following new paragraph immediately after paragraph 5.04.B:

C. The limits of liability for the insurance required by paragraph 5.04 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers' Compensation and related coverages under paragraphs 5.04.A.1 and A.2 of the General Conditions:
 - a. State: Statutory
 - b. Applicable Federal (e.g., Longshoreman's) Statutory
 - c. Employer's Liability \$1,000,000
2. Contractor's General Liability under paragraphs 5.04.A.3 through A.6 of the General Conditions which shall include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody and control of Contractor:
 - a. General Aggregate \$2,000,000
 - b. Products - Completed Operations Aggregate \$2,000,000
 - c. Personal and Advertising Injury \$1,000,000
 - d. Each Occurrence
 - (1) (Bodily Injury and Property Damage) \$1,000,000
 - e. Property Damage liability insurance will provide Explosion, Collapse, and Underground coverages where applicable.
 - f. Excess or Umbrella Liability
 - (1) General Aggregate \$1,000,000
 - (2) Each Occurrence \$1,000,000
3. Automobile Liability under paragraph 5.04.A.6 of the General Conditions:
 - a. Bodily Injury:

- (1) Each Person \$ 500,000
 - (2) Each Accident \$ 500,000
 - b. Property Damage:
 - (1) Each Accident \$ 500,000
 - c. Combined Single Limit of: \$1,000,000
- 4. The Contractual Liability coverage required by paragraph 5.04.B.4 of the General Conditions shall provide coverage for not less than the following amounts:
 - a. Bodily Injury:
 - (1) Each Accident \$1,000,000
 - (2) Annual Aggregate \$1,000,000
 - b. Property Damage:
 - (1) Each Accident \$1,000,000
 - (2) Annual Aggregate \$1,000,000
- 5. The Contractor shall furnish the Owner with a Certificate of Insurance naming Owner as an additional insured on all casualty policies.

IV. SC-5.06.A. Delete paragraph 5.06.A in its entirety and insert the following in its place:

- A. CONTRACTOR shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof. This insurance shall:
 - 1. Include the interests of OWNER, CONTRACTOR, Subcontractors, ENGINEER, ENGINEER's Consultants and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents and other consultants and subcontractors of any of them each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured;
 - 2. Be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss and 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, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and such other perils or causes of loss as may be specifically required by the Supplementary Conditions.
 - 3. Include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
 - 4. Cover materials and equipment stored at the Site or at another location that was agreed to in writing by OWNER prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by ENGINEER; and
 - 5. Allow for partial utilization of the Work by OWNER;
 - 6. Include testing and startup; and

7. Be maintained in effect until final payment is made unless otherwise agreed to in writing by OWNER, CONTRACTOR and ENGINEER with 30 days written notice to each other additional insured to whom a certificate of insurance has been issued.
- B. CONTRACTOR shall be responsible for any deductible or self-insured retention.
 - C. The policies of insurance required to be purchased and maintained by CONTRACTOR in accordance with this paragraph SC-5.06 shall comply with the requirements of paragraph 5.06.C of the General Conditions.
- V. **SC-5.07-Delete section in its entirety with no replacement.**
- VI. **SC-6.08 Add the following new paragraph immediately after paragraph 6.08.A:**
- B. Contractor shall abide by all conditions of permits obtained including any additional insurance requirements requested by the permitting agency(s).
- VII. **SC-10.01- Add the following new paragraph immediately after paragraph 10.01.B**
- C. SCOPE OF WORK:
 1. The Contract Documents outline a Scope of Work that reflects the intended size of the Project based on the best information available at the time of document preparation and Advertisement for Bids.
 2. The actual Scope of Work may vary once actual field conditions are encountered and addressed as the Work progresses.
 3. The Owner reserves the right to increase up to ten (10%) percent or decrease up to twenty-five (25%) percent the Scope of Work without obligation to receive or to pay additional compensation from or to the Contractor, or to adjust the Contract Time as a penalty for the change in the Scope of Work.
 4. All terms, conditions, Unit Prices and Schedule of Values in the Contract for Work within the original Scope of Work shall apply to all Work and to determine the value of all Work added to or deleted from the original Scope of Work.
 5. Changes outside the stated limits for the revised Scope of Work shall be subject to applicable revisions of Article 10, 11, and 12 of Section 00700, General Conditions of the Construction Contract.
- VIII. **SC-13 Delete paragraph 13.04 D in its entirety with no replacement.**

IX. SC-14 Delete paragraph 14.02 C.1. in its entirety and insert the following in its place:

1. Payment Becomes Due
 - a. Thirty days after presentation of the Application for Payment to OWNER with ENGINEER'S recommendation, the amount recommended will (subject to the provisions of paragraph 14.02.D) become due, and when due will be paid by OWNER to CONTRACTOR.

X. SC-16 Delete section in its entirety with no replacement

XI. SC-17- Miscellaneous- Add the following paragraph 17.07 immediately following paragraph 17.06:

17.07 ANTI-DISCRIMINATION:

The Contractor, in performing the work or furnishing the services covered by this Contract, shall not discriminate against any person because of race, creed, color, national origin, age, sex, sexual orientation, disability, religion, or other legally protected status. The city of Alcoa encourages the utilization of minority and women-owned businesses in its contracting and subcontracting projects and the Contractor is encouraged to actively solicit the participation of these businesses. The Contractor shall inform all of its subcontractors and vendors providing work or services under this Contract of this requirement and shall ensure compliance therewith.

XIII. T.C.A. 66-11-144, Portion of Contract Price Held in Escrow

- A. Whenever, in any contract for the improvement of real property, a certain amount or percentage of the contract price is held back by the owner or contractor, that retained amount shall be deposited in a separate escrow account with a third party giving proper security for the performance of the obligation of the owner or contractor.
- B. As of the time of the deposit of the retained funds, such funds shall become the sole and separate property of the contractor, subcontractor, materialman, or laborer to whom they are owed.
- C. Upon satisfactory completion of the contract, to be evidenced by a written release by the owner or contractor, all funds accumulated in the escrow account together with any interest thereon shall be paid immediately to the contractor, subcontractor, materialman, or laborer to whom such funds and interest are owed.

- D. In the event the owner or contractor fails or refuses to execute the release provided for in subsection (c), then the contractor, subcontractor, materialman, or laborer shall seek any remedy in a court of proper jurisdiction and the person holding the fund as escrow agent shall bear no liability for the nonpayment thereof to the contractor, subcontractor, materialman, or laborer.
- E. In contracts to which the State of Tennessee or any department, board or agency thereof, including the University of Tennessee, is a party, interest shall be paid on such retained amounts at the same rate interest is paid on the funds of local governments participating in the local government investment pool established pursuant to § 9-4-704, for the contract period.
- F. The provisions of this section shall be applicable to the State of Tennessee, any department, board or agency thereof, including the University of Tennessee, and all counties and municipalities and all departments, boards or agencies thereof, including all school and education boards, and any other subdivision of the state.
- G. The provisions of this section shall be applicable to all contracts for the contract price is five hundred thousand dollars (\$500,000.00) or greater.
- H. Compliance with this section shall be mandatory, and may not be waived by contract.

XIII. Service Interruption

- A. Water service may not be interrupted during the work.

END OF SECTION

Printed Name

Printed Name

Printed Title

Printed Title

Date

Date

No further monies or benefits may be paid out unless this Assurance is completed and filed as required by existing laws.

SECTION 00900

SUPPLEMENTAL SPECIAL CONDITIONS

I. PERMITS, LICENSES, EASEMENTS, AND REGULATIONS

A. GENERAL

1. Permits and licenses shall be obtained from the appropriate authorities having jurisdiction prior to beginning any Work on the project.
2. Contractor shall have copies of each specific permit and license at the job site prior to initiating construction of Work associated with the permit or license.
3. Copies of all permits and licenses obtained by the Contractor shall be supplied to the Owner prior to beginning any Work on the project.
4. Copies of permits and easements obtained by the Owner shall be supplied to the Contractor prior to beginning any Work on the project.
5. Contractor shall strictly adhere to all requirements, stipulations and conditions of each permit, license and/or easement.
6. Contractor shall comply with all permits, regulations and ordinances governing employee safety and health, hazardous materials and environmental protection.
7. Any problem noted in compliance with the permits, license and/or easement, or any proposed amendments by the Contractor shall be reported to the Engineer in writing before initiating or continuing with the Work.

B. REGULATIONS AND ORDINANCES

1. Contractor shall strictly adhere to all regulations and ordinances governing Work included in the construction of this Project, employee safety and health, hazardous materials and environmental protection for all activities associated with the project.
2. The enclosed list of applicable regulations and ordinances is included for general reference and should not be considered complete until verified by the Contractor to assure strict compliance.
3. The regulations and ordinances governing this Project shall include, but not necessarily be limited to:
 - a. Tennessee Department of Environment and Conservation, Division of Water Supply;
 - b. Tennessee Department of Environment and Conservation, Division of Water Pollution Control, Wastewater and Stormwater Regulations;
 - c. Tennessee Department of Environment and Conservation, Division of Air Pollution Control, all Air Quality Regulations, with specific reference to all Sections dealing with lead based coatings removal, painting operations and to Chapter 1200-3/Section 1-26, with general attention to Section 8 - "Fugitive Dust";
 - d. Tennessee Department of Environment and Conservation, Division of

Solid Waste Management, all solid waste and hazardous materials regulations;

- e. The Tennessee Valley Authority;
- f. Tennessee Occupational Safety and Health Act, (TOSHA), Regulations;
- g. The U.S. Corps of Engineers; and
- h. The Resident County, City and/or Utility District for the Project, regulations and ordinances governing Air Quality, Wastewater, Stormwater and Solid Waste, Employee Safety and Health, Hazardous Materials and Environmental Protection.

C. PERMITS AND EASEMENTS SECURED BY THE OWNER (Only permits specifically applicable to the project will be supplied)

- 1. Tennessee Department of Environment and Conservation - Water System Construction Permit;
- 2. Tennessee Department of Environment and Conservation - Wastewater System Construction Permit;
- 3. Tennessee Department of Environment and Conservation - Stormwater Construction Permit;
- 4. U.S. Army Corps of Engineers - 404 Permit;
- 5. Tennessee Valley Authority, 26A Permit;
- 6. Resident County, City and/or Utility District Permits governing Air Pollution, Potable Water, Wastewater, Stormwater and Erosion Control, Solid Waste, and Roadway - Encroachment and Crossings;
- 7. Tennessee Department of Transportation - Roadway Encroachment and Crossings;
- 8. Rail Road Right-of-way Encroachments and Crossings;
- 9. Boiler and Machinery Insurance and other such coverage as may be required to be maintained by the Owner.
- 10. Easements for Encroachments on Private Property; and
- 11. Other Permits and Easements specifically required and listed for this Project.

D. PERMITS AND LICENSES TO BE SECURED AND PAID FOR BY THE CONTRACTOR (Only Permits specifically applicable to the Project are required)

- 1. Tennessee Department of Commerce and Insurance Licenses for working as a Contractor in the State with applicable classification(s) for the specific work task(s) associated with this Project;
- 2. Resident County, City and/or Utility District, Business and/or Contractors Licenses;
- 3. U.S. Government; State of Tennessee; Resident County, City and/or Utility District Permit to transport or dispose of solid waste;
- 4. State of Tennessee; Resident County, City and/or Utility District Permits and Licenses for Contractor's job site office, yard and utilities;

5. Easements and other Agreements between the Contractor and other parties for use of property or utilities for the job site office, yard and other materials or equipment lay down or storage areas;
6. Labor Unions, all applicable agreements;
7. Tennessee Department of Transportation Permits and Licenses to transport materials and equipment to and from the job site(s); and
8. Any and all other permits and/or licenses required of the Contractor for the complete and successful construction of the Project.

END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

- A. The work covered by this Contract comprises the procurement, complete and functional installation of the following major components:
 - 1. Rehabilitation of the existing wet well through a multi-layer lining system to protect against H₂S.
 - 2. Two new 40 HP submersible EBARA waste water pumps, rails, bases, lifting chain, connections, floats, and all appurtenances.
 - 3. New electrical controls and equipment
 - 4. Bypass pumping
 - 5. Cleanup and site restoration.

- B. All regulations and requirements of the Tennessee Department of Environment and Conservation and the City of Alcoa must be followed in construction of the various components of the project.

1.02 RELATED REQUIREMENTS

- A. Section 00700: General Conditions.
- B. Section 00800: Supplementary Conditions.
- C. Section 00900: Supplemental Special Conditions.
- D. Section 01150: Measurement and Payment.
- E. Section 01310: Construction Schedules.
- F. Section 01320: Pre and Post Video and Photographic Records.
- G. Section 02260: Finish Grading.
- H. Section 02485: Seeding.

1.03 CONTRACTS

- A. Construct the Work under a lump sum contract as shown on the Bid Form

1.04 WORK SEQUENCE

- A. Coordinate the construction schedules and operations with the Owner's

Representative, the Contractors of Work described above, and the independent testing laboratory.

- B. Fulfill the Contractor's Responsibilities of Section 01410 pertaining to testing laboratory services, particularly with respect to proper advance notification.
- C. Coordinate all Work with the Owner and Engineer to ensure a successful Project. The schedule and actual construction operations must be approved by the Owner as described in, and/or referenced to Section 01310, including:
 - 1. All Contracts
 - a. Coordinate all operations in/and near active streets and roads.
 - b. Rigidly adhere to Project Schedule.
- D. INITIAL RESTORATION
 - 1. Initial restoration for all surface disturbances shall take place **IMMEDIATELY** and shall include **ALL** of the following:
 - a. Rough grading and removal of surplus soil as specified in Section 02260.
 - b. Re-vegetation of all disturbed areas in accordance with the Plans.
 - 2. Contractor shall be responsible for repeating steps a. and b. from Part 1 after each phase is completed, including placement of topsoil. This 'final restoration' shall be as directed by Engineer, or as soon as weather conditions permit.

1.05 CONTRACTOR'S USE OF PREMISES

- A. Coordinate use of premises under direction of Owner.
- B. Assume full responsibility for the protection and safekeeping of products under this Contract, stored on the site.
- C. Move any stored Products, under Contractor's control, which interfere with operations of the Owner or other personnel.
- D. Obtain and pay for the use of additional storage or work areas needed for operations.
- E. Maintain the operation of the Owner's facilities at all times during construction.

PART 2 - PRODUCTS

(Not used)

PART 3 - EXECUTION

(Not used)

END OF SECTION

SECTION 01045
CUTTING AND PATCHING

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Contractor shall be responsible for all cutting, fitting, and patching, including attendant excavation and backfill required to complete the Work or to:
 - 1. Make its several parts fit together properly.
 - 2. Uncover portions of the Work to provide for installation and ill-timed work.
 - 3. Remove and replace defective work.
 - 4. Remove and replace work not conforming to requirements of Contract Documents.
 - 5. Remove samples of installed work as specified for testing.
 - 6. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.

1.02 RELATED DOCUMENTS

- A. Section 01010: Summary of Work
- B. Section 02210: Site Grading and Filling

1.03 SUBMITTALS

- A. Submit a written request to Engineer well in advance of executing any cutting or alteration which affects:
 - 1. Work of the Owner or any separate contractor.
 - 2. Structural value or integrity of any element of the Project.
 - 3. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
 - 4. Efficiency, operational life, maintenance, or safety of operational elements.
 - 5. Visual qualities of sight-exposed elements.
- B. Request shall include:
 - 1. Identification of the Project.
 - 2. Description of affected work.
 - 3. Necessity of cutting, alteration, or excavation.
 - 4. Effect on work of Owner or any separate contractor, or on structural or weatherproof integrity of Project.
 - 5. Description of proposed work.
 - a. Scope of cutting, patching, alteration, or excavation.
 - b. Trades who will execute the work.
 - c. Products proposed to be used.
 - d. Extent of refinishing to be done.
 - 6. Alternatives to cutting and patching.

7. Cost proposal, when applicable.
 8. Written permission of any separate contractor whose work will be affected.
- C. Should conditions of Work or the schedule indicate a change of products from original installation, Contractor shall submit request for substitution.
 - D. Submit written notice to Engineer designating the date and the time the work will be uncovered.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Comply with specifications and standards for each specific product involved.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Inspect existing conditions of Project, including elements subject to damage or to movement during cutting and patching.
- B. After uncovering work, inspect conditions affecting installation of Products, or performance of work.
- C. Report unsatisfactory or questionable conditions to Engineer in writing; do not proceed with work until Engineer has provided further instructions.

3.02 PREPARATION

- A. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of Project from damage.
- C. Provide protection from elements for the portion of the Project which may be exposed by cutting and patching work, and maintain excavations free from water.

3.03 PERFORMANCE

- A. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs.
- B. Execute cutting and backfilling by methods which will prevent settlement or damage to other work.
- C. Employ original Installer or Fabricator, to perform cutting and patching for:
 1. Weather-exposed or moisture-resistant elements.
 2. Sight-exposed finished surfaces.
- D. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.

- E. Restore work which has been cut or removed; install new products to provide complete Work in accord with requirements of Contract Documents.
- F. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.
- G. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:
 - 1. For continuous surfaces, refinish to nearest intersection.
 - 2. For an assembly, refinish entire unit.

END OF SECTION

SECTION 01050

FIELD ENGINEERING

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Provide and pay for field engineering services required for the Project.
 - 1. Survey work required in execution of Project.
 - 2. Civil, structural, or other professional engineering services specified, or required to execute contractor's construction methods.
- B. Owner's Representative will identify existing control points and property line corner stakes indicated on the drawings, as required.

1.02 RELATED REQUIREMENTS

- A. Section 00700: General Conditions
- B. Section 00800: Supplementary Conditions
- C. Section 01010: Summary of Work
- D. Section 01720: Project Record Documents

1.03 QUALIFICATIONS OF SURVEYOR OR ENGINEER

- A. Qualified engineer or registered land surveyor, acceptable to Contractor and Owner.
- B. Registered Professional Engineer of the discipline required for the specific service on the Project, if required, licensed in the State in which the project is located.

1.04 SURVEY REFERENCE POINTS

- A. Existing basic horizontal and vertical control points for the Project are those designated on drawings.
- B. Locate and protect control points prior to starting site work, and reserve all permanent reference points during construction.
 - 1. Make no changes or relocations without proper written notice to Engineer.
 - 2. Report to Engineer when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
 - 3. Require surveyor to replace project control points which may be lost or destroyed.
 - a. Establish replacements based on original survey control.

1.05 PROJECT SURVEY REQUIREMENTS

- A. Establish a minimum of two (2) permanent benchmarks on site, when not present, referenced to data established by survey control points.
 - 1. Record locations with horizontal and vertical data, on Project Record Documents.
- B. Establish lines and levels, locate and lay out, by instrumentation and similar appropriate means:
 - 1. Site improvements;
 - a. Stakes for grading, fill and topsoil placement.
 - b. Utility slopes and invert elevations.
 - 2. Batter boards for structures.
- C. From time to time, verify layouts by same methods.

1.06 RECORDS

- A. Maintain a complete, accurate log of all control and survey work, if required, as it progresses.

1.07 SUBMITTALS

- A. Submit name and address of Surveyor and Professional Engineer to Engineer.
- B. On request of Engineer, submit documentation to verify accuracy of field engineer work.
- C. Submit certificate signed by Registered Engineer or Surveyor certifying that elevations and locations of improvements are in conformance, or non-conformance, with Contract Documents.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01090

REFERENCE STANDARDS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Abbreviations and acronyms used in Contract Documents to identify reference standards.

1.02 QUALITY ASSURANCE

- A. Application: When a standard is specified by reference, comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.
- B. Publication Date: The publication in effect on the date of issue of Contract Documents, except when a specific publication date is specified.

1.03 ABBREVIATIONS, NAMES, AND ADDRESSES OF ORGANIZATIONS

- A. Obtain copies of referenced standard direct from publication source, when needed for proper performance of Work, or when required for submittal by Contract Documents.

AASHTO
American Association of State Highway and
Transportation Officials
444 North Capital Street, Northwest
Washington, DC 20001

ACI
American Concrete Institute
Post Office Box 19150
Detroit, MI 48219
(313) 523-2600

ANSI, APS
American National Standards Institute, Inc.
10E 40th Street
New York, NY 10018

AREA
American Railroad Engineering Association
200 "L" Street, Northwest
Washington, DC 20036

ASCE
American Society of Civil Engineers
345 East 47th Street
New York, NY 10017

ASME
American Society of Mechanical Engineers
385 E. 47th Street
New York, NY 10017

ASTM
American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

AWWA
American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235

CRSI
Concrete Reinforcing Steel Institute
933 No. Plumb Grove Road
Schaumburg, IL 60173-4758

FHWA
Federal Highway Administration
Federal Building, U.S. Courthouses
Nashville, TN 37202

FS
Federal Specification
Superintendent of Documents
Government Printing Office
Washington, DC 20234

FSS
Federal Specification and Standards
General Services Administration
Specifications and Consumer Information Distribution
Section (WFSIS)
Washington Navy Yard, Building 197
Washington, DC 20407

TDOT
Tennessee Department of Transportation
James K Polk Building
505 Deaderick Street
Nashville, TN 37243

TDEC
Tennessee Department of Environment and Conservation
312 Rosa L. Parks Avenue
Tennessee Tower, 2nd Floor
Nashville, TN 37243

WEF
Water Environment Federation
601 Wythe Street
Alexandria, VA 22314-1994

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01150

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 ITEMS INCLUDED

- A. Those items included in the Bid which have been installed in accordance with the Plans and Specifications and which have been approved by the Owner and Engineer shall be measured and paid for in the manner presented hereinafter. Payment shall be compensation in full for furnishing all materials and equipment and performing all labor and services necessary for completing all of the work, ready for operations shown on the Plans, and as specified herein. Any work specified but not included in the Bid Proposal shall be considered incidental and shall not be a separate pay item.

1.02 RELATED REQUIREMENTS

- A. Section GC 1-20: General Conditions
- B. Section 01152: Applications for Payment
- C. Section 01370: Schedule of Values
- D. Section 01700: Contract Closeout

1.03 MEASUREMENT AND BASIS OF PAYMENT

- A. The wastewater pump station improvements shall be measured as a unit constructed, tested, and accepted including all work specified herein and as shown on the Drawings to be within the limits of the Contract. This work shall include, but not be limited to, the following major components as illustrated on the plans or referenced herein:

Tonys Pump Station

1. Provide and install two (2) new submersible solids handling pumps, guide rails, lifting chains, bases, fittings, floats, discharging piping within wet well, connections, and all necessary appurtenances as required for complete and functional station operation. Spray liner system shall provide a 10-year warranty.
2. Rehabilitate existing wet well through multi-layer spray lining system.
3. Provide and install new wet well top and safety hatch.
4. Install new electrical and pump control equipment as shown on plans.
5. Complete all proposed site improvements, perform site cleanup, and site restoration.
6. Perform all other work for the above to provide a complete, functional system.
7. No additional payment shall be made for bypass pumping.

- B. Payment will be made based on Work actually performed completing each item in the Contract, such work including, but not limited to, the furnishing of all necessary labor, materials, equipment, transportation, clean up, and all other appurtenances to complete the construction, installation, testing and start-up of the work to the configuration and extent as shown on the Project Drawings and as described in the Specifications. Refer to Section 01370 Schedule of Values for establishing payment requirements for the project.
- C. Notwithstanding any other Sections, paragraphs, sentences, or words in the Contract Documents, payments shall not be made for work not performed, materials not supplied and/or any other item/items for which the Owner does not receive the benefit described or intended.
- D. The contract amount will include all items necessary to provide a complete, functional system.
- E. Some equipment specifications include specific brand and/or model numbers. Any substitutions must be approved by the Owner and the Engineer prior to the Bid opening date.
- F. The general construction work, as above stipulated, shall be paid for at the contract lump sum price.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 01152

APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Submit Applications for Payment to Engineer in accordance with the schedule established by Conditions of the Contract and Agreement Between Owner and Contractor.

1.02 RELATED REQUIREMENTS

- A. Section 00500: Agreement
- B. Section 00700: General Conditions
- C. Section 01370: Schedule of Values
- D. Section 01700: Contract Closeout

1.03 FORMAT AND DATA REQUIRED

- A. Submit applications typed on the Application for Payment Form included herein, with itemized data typed on 8-1/2" x 11" white paper continuation sheets.
- B. Provide itemized data on continuation sheet:
 - 1. Format, schedules, line items, and values: Those of the Schedule of Values accepted by Engineer.

1.04 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

- A. Application Form:
 - 1. Fill in required information, including that for Change Orders executed prior to date of submittal of application.
 - 2. Fill in summary of dollar values to agree with respective totals indicated on continuation sheets.
 - 3. Execute certification with signature of a responsible officer of contract firm.
- B. Continuation Sheets:
 - 1. Fill in total list of all scheduled component items of Work, with item number and schedule dollar value for each item.
 - 2. Fill in dollar value in each column for each scheduled line item when work has been performed or products stored.

- a. Round off values to nearest dollar, or as specified for Schedule of Values.
- 3. List each Change Order executed prior to date of submission, at the end of the continuation sheets.
 - a. List by Change Order Number, and description, as for an original component item of work.

1.05 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

- A. When the Owner or the Engineer requires substantiating data, Contractor shall submit suitable information, with a cover letter identifying:
 - 1. Project
 - 2. Application number and date
 - 3. Detailed list of enclosures
 - 4. For stored products:
 - a. Item number and identification as shown on application.
 - b. Description of specific material.
- B. Submit one (1) copy of data and cover letter for each copy of application.

1.06 PREPARATION OF APPLICATION FOR FINAL PAYMENT

- A. Fill in Application Form as specified for progress payments.
- B. Use continuation sheet for presenting the final statement of accounting as specified in Section 01700 - Contract Closeout.

1.07 SUBMITTAL PROCEDURE

- A. Submit Application for Payment to Engineer at the times stipulated in the Agreement.
- B. Number: Five (5) copies of each Application.
- C. When Engineer finds Application properly completed and correct, he will transmit certificate for payment to Owner, with copy to Contractor.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01153

CHANGE ORDER PROCEDURES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Promptly implement change order procedures:
 - 1. Provide full written data required to evaluate changes.
 - 2. Maintain detailed records of work done on a time-and-material/force account basis.
 - 3. Provide full documentation at Engineer's request.
- B. Designate in writing the member of Contractor's organization:
 - 1. Who is authorized to accept changes in the Work.
 - 2. Who is responsible for informing others in the Contractor's employ of the authorization of changes in the Work.
- C. Owner will designate in writing the person who is authorized to execute Change Orders.

1.02 RELATED REQUIREMENTS

- A. Agreement: The amounts of established unit prices.
- B. Conditions of the Contract:
 - 1. Methods of determining cost or credit to Owner resulting from changes in Work made on a time and materials basis.
 - 2. Contractor's claims for additional costs.
- C. Section 01152: Applications for Payment
- D. Section 01720: Project Record Documents

1.03 DEFINITIONS

- A. Change Order: See General Conditions
- B. Engineer's Supplemental Instructions: A written order, instructions, or interpretations, signed by Engineer making minor changes in the Work not involving a change in Contract Sum or Contract Time.

1.04 PRELIMINARY PROCEDURES

- A. Owner or Engineer may initiate changes by submitting a Proposal Request to Contractor. Request will include:
 - 1. Detailed description of the Change, Products, and location of the change in the Project.
 - 2. Supplementary or revised Drawings and Specifications.
 - 3. The projected time span for making the change, and a specific statement as to whether overtime work is, or is not authorized.
 - 4. A specific period of time during which the requested price will be considered valid.
 - 5. Such request is for information only, and is not an instruction to execute the changes, nor to stop Work in progress.

- B. Contractor may initiate changes by submitting a written notice to Engineer containing:
 - 1. Description of the proposed changes.
 - 2. Statement of the reason for making the changes.
 - 3. Statement of the effect on the Contract Sum and the Contract Time.
 - 4. Statement of the effect on work of separate contractors.
 - 5. Documentation supporting any change in Contract Sum or Contract Time, as appropriate.

1.05 DOCUMENTATION OF PROPOSALS AND CLAIMS

- A. Support each quotation for a lump-sum proposal, and for each unit price which has not previously been established, with sufficient substantiating data to allow Engineer to evaluate the quotation.

- B. On request, provide additional data to support time and cost computations:
 - 1. Labor required.
 - 2. Equipment required.
 - 3. Products required.
 - a. Recommended source of purchase and unit cost.
 - b. Quantities required.
 - 4. Taxes, insurance, and bonds.
 - 5. Credit for work deleted from contract, similarly documented.
 - 6. Overhead and profit.
 - 7. Justification for any change in Contract Time.

- C. Support each claim for additional costs, and for work done on a time-and-material/force account basis, with documentation as required for a lump-sum proposal, plus additional information:
 - 1. Name of the Owner's authorized agent who ordered the work, and date of the order.
 - 2. Dates and times work was performed, and by whom.

3. Time record, summary of hours worked, and hourly rates paid.
4. Receipts and invoices for:
 - a. Equipment used, listing dates, and times of use.
 - b. Products used, listing of quantities.
 - c. Subcontracts.

1.06 PREPARATION OF CHANGE ORDERS

- A. Engineer will prepare each Change Order.
- B. Form: Contract Change Order Form included herein.
- C. Change Order will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change.
- D. Change Order will provide an accounting of the adjustment in the Contract Sum and in the Contract Time.

1.07 LUMP-SUM/FIXED PRICE CHANGE ORDER

- A. Content of Change Orders will be based on, either:
 1. Engineer's Proposal Request and Contractor's responsive Proposal as mutually agreed between Owner and Contractor.
 2. Contractor's Proposal for a change, as recommended by Engineer.
- B. Owner and Engineer will sign and date the Change Order as authorization for the contractor to proceed with the changes.
- C. Contractor may sign and date the Change Order to indicate agreement with the terms therein.

1.08 UNIT PRICE CHANGE ORDER

- A. Content of Change Orders will be based on, either:
 1. Engineer's definition of the scope of the required changes.
 2. Contractor's Proposal for a change, as recommended by Engineer.
 3. Survey of completed work.
- B. The amounts of the unit prices to be:
 1. Those stated in the Agreement.
 2. Those mutually agreed upon between Owner and Contractor.
- C. When quantities of each of the items affected by the Change Order can be determined prior to start of the work:
 1. Owner and Engineer will sign and date the Change Order as authorization for Contractor to proceed with the changes.

2. Contractor may sign and date the Change Order to indicate agreement with the terms therein.
- D. When quantities of the items cannot be determined prior to start of the work:
1. Engineer or Owner will issue a construction change authorization directing Contractor to proceed with the change on the basis of unit prices, and will cite the applicable unit price.
 2. At completion of the change, Engineer will determine the cost of such work based on the unit prices and quantities used:
 - a. Contractor shall submit documentation to establish the number of units of each time and any claims for a change in Contract Time.
 3. Engineer will sign and date the Change Order to indicate his agreement with the terms therein.
 4. Order to indicate their agreement with the terms therein.

1.09 CORRELATION WITH CONTRACTOR'S SUBMITTALS

- A. Periodically revise Request for Payment forms to record each change as a separate item of Work and to record the adjusted Contract Sum.
- B. Periodically revise the Construction Schedule to reflect each change in Contract Time.
- C. Upon completion of work under a Change Order, enter pertinent changes in Record Documents.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Within twenty (20) days after the delivery of the executed Agreement and prior to commencing work on the project, the Contractor shall meet with the Engineer and the Owner for a Pre-construction Conference. The Engineer shall designate the time and place.
- B. As he sees fit, the Engineer may periodically request that the Contractor meet with the Owner and the Engineer to discuss the progress of the Work. The Contractor shall attend such meetings.

1.02 RELATED REQUIREMENTS

- A. Conditions of the Contract
- B. Notice of Award
- C. Section 01310: Construction Schedules

1.03 RECORD OF DISCUSSION

- A. The Engineer shall prepare a written record of the discussions conducted during such meetings and shall distribute a copy to each party in attendance or affected by the discussions.
- B. Any party whose understanding of a discussion or action differs from that presented by the Engineer in the written record shall promptly notify the Engineer of the difference.

PART 2 - PRODUCTS

(Not used)

PART 3 - EXECUTION

(Not used)

END OF SECTION

SECTION 01310

CONSTRUCTION SCHEDULES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Within ten (10) days after delivery of the Notice to Proceed, prepare and submit to Engineer estimated construction progress schedules for the Work, with sub-schedules of related activities which are essential to its progress.
- B. Submit revised progress schedules periodically.

1.02 RELATED REQUIREMENTS

- A. Section 00700: General Conditions
- B. Section 01010: Summary of Work
- C. Section 01340: Shop Drawings, Product Data, and Samples

1.03 FORM OF SCHEDULES

- A. Prepare schedules in the form of a horizontal bar chart.
 - 1. Provide separate horizontal bar for each trade or operation.
 - 2. Horizontal time scale: identify the first workday of each week.
 - 3. Scale and spacing: to allow space for notations and future revision.
 - 4. Minimum sheet size: 8-1/2" x 11".
- B. Format of listings: the chronological order of the start of each item of work.
- C. Identification of listings: by major specification section numbers.

1.04 CONTENT OF SCHEDULES

- A. Construction Progress Schedule:
 - 1. Show the complete sequence of construction by activity.
 - 2. Show the dates for the beginning and completion of each major element of construction. Where applicable, specifically list:
 - a. Site clearing
 - b. Site utilities
 - c. Foundation work
 - d. Structural framing
 - e. Subcontractor work
 - f. Equipment installations
 - g. Finishings

3. Show projected percentage of completion for each item, as of the first day of each month.
- B. Submittals Schedule for Shop Drawings, Product Data Samples. Show:
1. the dates for Contractor's submittals, and
 2. the dates approved submittals will be required from the Engineer. Allow a minimum of three (3) weeks.
- C. Prepare and submit subschedules for each separate stage of work specified in Section 01010.
- D. Provide subschedules to define critical portions of prime schedules.

1.05 PROGRESS REVISIONS

- A. Indicate progress of each activity to date of submission.
- B. Show changes occurring since previous submission of schedule:
1. Major changes in scope.
 2. Activities modified since previous submission.
 3. Revised projections of progress and completion.
 4. Other identifiable changes.
- C. Provide a narrative report as needed to define:
1. Problem areas, anticipated delays, and the impact on the schedule.
 2. Corrective action recommended, and its effect.
 3. The effect of changes on schedules of other prime contractors.

1.06 SUBMISSIONS

- A. Submit initial schedules within ten (10) days after Notice to Proceed.
1. Engineer will review schedules and return review copy within fourteen (14) days after receipt.
 2. If required, resubmit within seven (7) days after return of review copy.
- B. Submit revised progress schedules with each application for payment.
- C. Submit the number of opaque reproductions which the contractor requires, plus three (3) copies which the Engineer will retain.

1.07 DISTRIBUTION

- A. Distribute copies of the reviewed schedules to:
1. Job site files.
 2. Subcontractors
 3. Other concerned parties.

- B. Instruct recipients to report promptly to the contractor, in writing, any problems anticipated by the projections shown in the schedules.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01320

PRE AND POST CONSTRUCTION VIDEO AND PHOTOGRAPHIC RECORDS

PART 1 - GENERAL

1.01 SCOPE

- A. The Contractor shall furnish all equipment, labor, and materials required to provide the Owner with construction videos and photographs of the Project.
- B. Original documents and negatives respectively shall become the property of the Owner and none of the videos and photographs herein shall be published without express permission of the Owner.

1.02 PRE AND POST CONSTRUCTION VIDEO RECORDINGS AND PHOTOGRAPHS

- A. Prior to the beginning of any work, the Contractor shall take video recordings of the entire project work area and project photographs of any existing conditions that appear to be of special interest.
- B. Following completion of the work, another recording shall be made showing the same areas and features as in the pre-construction videos and photographs.
- C. All conditions which might later be subject to disagreement shall be shown in sufficient detail to provide a basis for decisions.
- D. The pre-construction videos and photographs shall be submitted to the Engineer within twenty-five (25) calendar days after the date of receipt by the Contractor of Notice to Proceed. Post-construction videos and photographs shall be provided prior to final acceptance of the project.

1.03 SUBMITTALS

- A. Photographs shall be submitted in digital format (.jpeg) on compact discs.
- B. Video recordings shall be DVD format.

PART 2 - PRODUCTS

(Not used)

PART 3 - EXECUTION

(Not used)

END OF SECTION

SECTION 01340

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Submit Shop Drawings, Product Data, and Samples required by Contract Documents.

1.02 RELATED REQUIREMENTS

- A. Section 00300: Bid Proposal
- B. Section 00700: General Conditions
- C. Section 01310: Construction Schedules
- D. Section 01720: Project Record Documents
- E. Designate in the construction schedule, or in a separate coordinated schedule, the dates for submission and the dates that reviewed Shop Drawings, Product Data, and Samples will be needed.

1.03 SHOP DRAWINGS

- A. Drawings shall be presented in a clear and thorough manner.
 - 1. Details shall be identified by reference to sheet and detail, schedule or room numbers shown on Contract Drawings.
- B. Minimum Sheet size: 8-1/2" x 11"

1.04 PRODUCT DATA

- A. Preparation:
 - 1. Clearly mark each copy to identify pertinent products or models.
 - 2. Show performance characteristics and capacities.
 - 3. Show dimensions and clearances required.
 - 4. Show wiring or piping diagrams and controls.
- B. Manufacturer's standard schematic drawings and diagrams:
 - 1. Modify drawings and diagrams to delete information that is not applicable to the work.
 - 2. Supplement standard information to provide information specifically applicable to the Work.

1.05 SAMPLES

- A. Office samples shall be of sufficient size and quantity to clearly illustrate:
 - 1. Functional characteristics of the product, with integrally related parts and attachment devices.
 - 2. Full range of color, texture, and pattern.

1.06 CONTRACTOR RESPONSIBILITIES

- A. Review Shop Drawings, Product Data, and Samples prior to submission.
- B. Determine and verify:
 - 1. Field measurements,
 - 2. Field construction criteria,
 - 3. Catalog numbers and similar data, and
 - 4. Conformance with specifications.
- C. Coordinate each submittal with requirements of the Work and of the Contract Documents.
- D. Notify the Engineer in writing, at time of submission, of any deviations in the submittals from requirements of the Contract Documents.
- E. Begin no fabrication or work which requires submittals until return of submittals with Engineer approval.

1.07 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the work, or in the work of any other contractor.
- B. Number of submittals required:
 - 1. Shop Drawings: Submit the number of opaque reproductions which the contractor requires, plus four (4) copies which will be retained by the Engineer.
 - 2. Product Data: Submit the number of copies which the Contractor requires, plus four (4) which will be retained by the Engineer.
 - 3. Samples: Submit the number stated in each specification section.
- C. Submittals shall contain:
 - 1. The date of submission and the dates of any previous submissions.
 - 2. The project title and number.
 - 3. Contract identification.
 - 4. The names of:
 - a. Contractor
 - b. Supplier

c. Manufacturer

5. Identification of the project, with the specification section number.
6. Field dimensions, clearly identified as such.
7. Relation to adjacent or critical features of Work or materials.
8. Applicable standards, such as ASTM or Federal Specification numbers.
9. Identification of deviations from Contract Documents.
10. Identification of revisions on resubmittals.
11. An 8" x 3" blank space for Contractor and Engineer stamps.
12. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work.

1.08 RESUBMISSION REQUIREMENTS

- A. Make any corrections or changes in the submittals required by the Engineer and resubmit until approved.
- B. Shop Drawings and Product Data:
 1. Revise initial drawings or data, and resubmit as specified for the initial submittal.
 2. Indicate any changes which have been made other than those requested by the Engineer.
- C. Samples: Submit new samples as required for initial submittal.

1.09 DISTRIBUTION

- A. Distribute reproductions of Shop Drawings and copies of Product Data which carry the Engineer stamp of approval to:
 1. Job site file
 2. Record documents file
 3. Other affected contractors
 4. Subcontractors
 5. Supplier or fabricator
- B. Distribute samples which carry the Engineer stamp of approval as directed by Engineer.

1.10 ENGINEER DUTIES

- A. Review submittals with reasonable promptness and in accordance with schedule.
- B. Affix stamp and initials or signature, and indicate requirements for resubmittal, or approval of submittal.

C. Return submittals to Contractor for distribution, or for resubmission.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01370

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Submit to the Engineer a Schedule of Values allocated to the various portions of the Work, within ten (10) days after award of contract, for lump sum contracts only.
- B. Upon request of Engineer, support the values with data which will substantiate their correctness.
- C. The Schedule of Values, unless objected to by the Engineer, shall be used only as the basis for the Contractor's Applications for Payment for lump sum contracts only.

1.02 RELATED REQUIREMENTS

- A. Conditions of the Contract
- B. Section 01152: Applications for Payment

1.03 FORM AND CONTENT OF SCHEDULE OF VALUES

- A. Type schedule on 8-1/2" x 11" white paper; Contractor's standard forms and automated printout will be considered for approval by Engineer upon Contractor's request. Identify schedule with:
 - 1. Title of Project and location
 - 2. Engineer and project number
 - 3. Name and address of Contractor
 - 4. Contract designation
 - 5. Date of submission
- B. Schedule shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction.
- C. Follow the table of contents of this Project Manual as the format for listing component items.
 - 1. Identify each line item with the number and title of the respective major section of the specification.
- D. For each major line item, list sub-values of major products or operations under the item.
- E. For the various portions of the Work:

1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.
2. For items on which progress payments will be requested for stored material, break down the value into:
 - a. The cost of the materials, delivered and unloaded, with taxes paid.
 - b. The total installed value.

1.04 SUBSCHEDULE OF UNIT MATERIAL VALUES

- A. Submit a subschedule of unit costs and quantities for:
 1. Products on which progress payment will be requested for stored products.
- B. The form of submittal shall parallel that of the Schedule of Values, with each item identified the same as the line item in Schedule of Values.
- C. The unit quantity of bulk materials shall include an allowance for normal waste.
- D. The unit values for the materials shall be broken down into:
 1. Cost of the material, delivered and unloaded at the site, with taxes paid.
 2. Installation costs, including Contractor's overhead and profit.
- E. The installed unit value multiplied by the quantity listed shall equal the cost of that item in the Schedule of Values.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01410

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 LABORATORY SERVICES

- A. Owner will employ and pay for services of an Independent Testing Laboratory, acceptable to the Engineer, to perform specified services. See respective specification sections for required services.
- B. Inspection, Sampling, and Testing are required for:
 - 1. Concrete mixing and placing.
 - 2. Soil compaction testing.
 - 3. Other areas as specified elsewhere.

1.02 QUALIFICATION OF LABORATORIES

- A. Meet the recommended requirements for independent laboratory qualifications as published by American Council of Independent Laboratories.
- B. Meet basic requirements of ASTM E329-77 "Standards for Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction."
- C. Be licensed to operate in the State of the project.
- D. Have properly calibrated equipment, calibrated within the past twelve (12) months by devices of accuracy traceable to either:
 - 1. National Bureau of Standards.
 - 2. Accepted values of natural physical constants.

1.03 LABORATORY DUTIES

- A. Cooperate with Engineer and Contractor and provide qualified personnel promptly on notice.
- B. Perform specified inspections, sampling and testing of materials, and methods of construction.
- C. Comply with specified standards, ASTM, other recognized authorities, and as specified.
- D. Ascertain compliance with requirements of Contract Documents.
- E. Promptly notify Engineer and Contractor of irregularities or deficiencies in Work

which are observed during performance of duties.

- F. Promptly submit three (3) copies of reports of inspections and tests to Engineer, and submit two (2) copies of those reports to Contractor at the project site, including:
 - 1. Date issued.
 - 2. Project title, number, and location.
 - 3. Testing laboratory name and address.
 - 4. Name and signature of inspector.
 - 5. Date of inspection and sampling.
 - 6. Date of test.
 - 7. Identification of product and specifications section.
 - 8. Type of inspection or test.
 - 9. Observations regarding compliance with Contract Documents.

1.04 LIMITATIONS OF AUTHORITY

- A. Laboratory is not authorized to:
 - 1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Approve or accept any portion of Work.
 - 3. Perform any duties of the Contractor.

1.05 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with Laboratory personnel and provide access to Work.
- B. Provide to Laboratory, representative samples of materials to be tested, in required quantities.
- C. Furnish copies of mill test reports.
- D. Furnish casual labor and facilities:
 - 1. To provide access to Work to be tested.
 - 2. To obtain and handle samples at the site.
 - 3. To facilitate inspections and tests.
 - 4. For Laboratory's exclusive use for storage and curing of test samples.
- E. Notify Laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.
- F. Pay Laboratory travel and labor costs when Laboratory is notified that Work to be sampled will be in progress, and Laboratory personnel come to the site to perform their duties and that phase of the Work is not performed within a reasonable time.
- G. Pay for additional tests when initial tests indicate Work does not comply with Contract Documents.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01510

TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Furnish, install, and maintain temporary utilities required for construction; remove on completion of Work.

1.02 RELATED REQUIREMENTS

- A. Section 01010: Summary of Work
- B. Section 01590: Field Offices and Sheds

1.03 REQUIREMENTS OF REGULATORY AGENCIES

- A. Comply with Federal, State, and local codes and regulations, and with utility company requirements.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Materials may be new or used but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

2.02 TEMPORARY ELECTRICITY AND LIGHTING

- A. Arrange with utility company, provide service required for power and lighting, and pay all costs for service and for power used.
- B. Install circuit and branch wiring, with area distribution boxes located so that power and lighting is available throughout the construction by the use of construction-type power cords.
- C. Provide adequate artificial lighting for all areas of work when natural light is not adequate for work and for areas accessible to the public.

2.03 TEMPORARY HEAT AND VENTILATION

- A. Provide temporary heat and ventilation as required to maintain adequate environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for the installation of materials, and to protect materials and finishes from damage due to temperature or humidity.
- B. Provide adequate forced ventilation of enclosed areas for curing of installed material, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors, or gases.
- C. Portable heaters shall be standard approved units complete with controls.
- D. Pay all costs of installation, maintenance, operation, and removal, and for fuel consumed.

2.04 TEMPORARY WATER

- A. Arrange with utility service company, provide water for construction purposes; pay all costs for installation, maintenance and removal, and service charges for water used.
- B. Install branch piping with taps located so that water is available throughout the construction by the use of hoses. Protect piping and fittings against freezing.

2.05 TEMPORARY SANITARY FACILITIES

- A. Provide sanitary facilities in compliance with laws and regulations.
- B. Service, clean, and maintain facilities and enclosures.
- C. Existing facilities may be used during the construction period.

PART 3 - EXECUTION

3.01 GENERAL

- A. Maintain and operate systems to assure continuous service.
- B. Modify and extend systems as work progress requires.

3.02 REMOVAL

- A. Completely remove temporary materials and equipment when their use is no longer required.

- B. Clean and repair damage caused by temporary installations or use of temporary facilities.
- C. Restore existing facilities, if any, used for temporary services, to specified or original condition.
- D. Restore permanent facilities, if any, used for temporary services to specified condition.

END OF SECTION

SECTION 01520

CONSTRUCTION AIDS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Furnish, install, and maintain required construction aids, remove on completion of Work.

1.02 RELATED REQUIREMENTS

- A. Section 01010: Summary of Work

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Materials may be new or used, suitable for the intended purpose, but must not violate requirements of applicable codes and standards.

2.02 CONSTRUCTION AIDS

- A. Provide construction aids and equipment required by personnel and to facilitate execution of the Work; scaffolds, staging, ladders, stairs, ramps, runway, platforms, railings, hoists, cranes, chutes, and other such facilities and equipment.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Consult with Engineer, review site conditions and factors which affect construction procedures and construction aids, including adjacent properties and public facilities which may be affected by execution of Work.

3.02 GENERAL

- A. Comply with applicable requirements specified in sections of Divisions 2-16.
- B. Relocate construction aids as required by progress of construction, by storage or work requirements, and to accommodate legitimate requirements of Owner and other contractors employed at the site.

3.03 REMOVAL

- A. Completely remove temporary materials, equipment, and services:
 - 1. When construction needs can be met by use of permanent construction.
 - 2. At completion of Project.

- B. Clean and repair damage caused by installation or by use of temporary facilities.
 - 1. Remove foundations and underground installations for construction aids.
 - 2. Grade areas of site affected by temporary installations to required elevations and slopes, and clean the area.

- C. Restore existing facilities used for temporary purposes to specified or to original condition.

- D. Restore permanent facilities, if any, used for temporary purposes to specified condition.

END OF SECTION

SECTION 01530

BARRIERS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Furnish, install, and maintain suitable barriers as required to prevent public entry, and to protect the Work, existing facilities, trees, and plants from construction operations; remove when no longer needed, or at completion of the Work.

1.02 RELATED REQUIREMENTS

- A. Section 01010: Summary of Work
- B. Section 01520: Construction Aids

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. Materials may be new or used, suitable for the intended purpose, but must not violate requirements of applicable codes and standards.

2.02 FENCING

- A. Materials to be Contractor's option, minimum fence height six (6') feet.

2.03 BARRIERS

- A. Materials to be Contractor's option, as appropriate to serve required purpose.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install facilities of a neat and reasonably uniform appearance, structurally adequate for required purposes.
- B. Maintain barriers during entire construction period.
- C. Relocate barriers as required by progress of construction.

3.02 TREE AND PLANT PROTECTION

- A. Preserve and protect existing trees and plants at site which are designated to remain, and those adjacent to site.

- B. Consult with Engineer and remove agreed-on roots and branches which interfere with construction.
 - 1. Employ qualified tree surgeon to remove and to treat cuts.
- C. Provide temporary barriers to a height of six (6') feet, around each, or around each group of trees and plants.
- D. Protect root zones of trees and plants:
 - 1. Do not allow vehicular traffic or parking.
 - 2. Do not store materials or products.
 - 3. Prevent dumping refuse or chemically injurious materials or liquids.
 - 4. Prevent puddling or continuous running water.
- E. Carefully supervise excavating, grading, filling, and subsequent construction operations to prevent damage.
- F. Replace, or suitably repair, trees, and plants designated to remain which are damaged or destroyed due to construction operations.

3.03 REMOVAL

- A. Completely remove barricades, including foundations, when construction has progressed to the point that they are no longer needed and when approved by the Engineer.
- B. Clean and repair damage caused by installation, fill and grade areas of the site to required elevations and slopes, and clean the area.

END OF SECTION

SECTION 01540

SECURITY

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Provide a Project security program, to:
 - 1. Protect Work stored products and construction equipment from theft and vandalism.
 - 2. Protect premises from entry by unauthorized persons.
- B. Comply with local security requirements.

1.02 RELATED REQUIREMENTS

- A. Section 01510: Temporary Utilities
- B. Section 01530: Barriers

1.03 MAINTENANCE OF SECURITY

- A. Initiate security program in compliance with Owner's system, prior to job mobilization.
- B. Maintain security program throughout construction period, until Owner occupancy or Owner acceptance precludes the need for Contractor security.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01560

TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Provide and maintain methods, equipment, and temporary construction, as necessary to provide controls over environmental conditions at the construction site and related areas under Contractor's control; remove physical evidence of temporary facilities at completion of work.

1.02 RELATED REQUIREMENTS

- A. Section 01570: Traffic Regulations
- B. Section 01710: Cleaning

1.03 DUST CONTROL

- A. Provide positive methods and apply dust control materials to minimize raising dust from construction operations and provide positive means to prevent airborne dust from dispersing into the atmosphere.

1.04 WATER CONTROL

- A. Provide methods to control surface water to prevent damage to the Project, the site, or adjoining properties.
 - 1. Control fill, grading, and ditching to direct surface drainage away from excavations, pits, tunnels, and other construction areas; and to direct drainage to proper runoff.
- B. Provide, operate, and maintain hydraulic equipment of adequate capacity to control surface and groundwater.
- C. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site, or to adjoining areas.

1.05 DEBRIS CONTROL

- A. Maintain all areas under contractor's control free of extraneous debris.
- B. Initiate and maintain a specific program to prevent accumulation of debris at construction site, storage and parking areas, borrow areas, or along access roads and haul routes.
 - 1. Provide containers for deposit of debris as specified in Section 01710 - Cleaning.
 - 2. Prohibit overloading of trucks to prevent spillages on access and haul routes.
 - a. Provide periodic inspection of traffic areas to enforce

requirements.

- C. Schedule periodic collection and disposal of debris as specified in Section 01710 - Cleaning.

1.06 POLLUTION CONTROL

- A. Provide methods, means, and facilities required to prevent contamination of soil, water, or atmosphere by discharge of noxious substances from construction operations.
- B. Provide equipment and personnel, perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids.
 - 1. Excavate and dispose of any contaminated earth on-site and replace with suitable compacted fill and topsoil.
- C. Take special measures to prevent harmful substances from entering public waters.
 - 1. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.
- D. Provide systems for control of atmospheric pollutants.
 - 1. Prevent toxic concentrations of chemicals.
 - 2. Prevent harmful dispersal of pollutants into the atmosphere.

1.07 EROSION CONTROL

- A. Plan and execute construction and earthwork by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
 - 1. Hold the areas of bare soil exposed at one time to a minimum.
 - 2. Provide temporary control measures such as berms, dikes, and drains.
- B. Construct fills and waste areas by selective placement to eliminate surface silts or clays which will erode.
- C. Periodically inspect earthwork to detect any evidence of the start of erosion, apply corrective measures as required to control erosion.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01570

TRAFFIC REGULATIONS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Provide, operate, and maintain equipment, services, and personnel, with traffic control and protective devices, as required to expedite vehicular traffic flow on haul routes, at site entrances, on-site access roads, and parking areas.
- B. Remove temporary equipment and facilities when no longer required, restore grounds to original, or to specified conditions.

1.02 RELATED REQUIREMENTS

- A. Section 01530: Barriers
- B. Section 01560: Temporary Controls

1.03 TRAFFIC SIGNALS AND SIGNS

- A. Provide and operate traffic control and directional signals required to direct and maintain an orderly flow of traffic in all areas under Contractor's control, or affected by Contractor's operations.
- B. Provide traffic control, directional signs, and warning signs mounted on barricades or standard posts:
 - 1. At each change of direction of a roadway and at each crossroads.
 - 2. At detours.
 - 3. At parking areas.
 - 4. Well in advance of the work area toward oncoming traffic.

1.04 FLAGMEN

- A. Provide qualified and suitably equipped flagmen when construction operations encroach on traffic lanes, as required for regulation of traffic.

1.05 FLARES AND LIGHTS

- A. Provide flares and lights during periods of low visibility:
 - 1. To clearly delineate traffic lanes and to guide traffic.
 - 2. For use by flagmen in directing traffic.
- B. Provide illumination of critical traffic and parking areas.

1.06 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, Owner's operations, or construction operations.
- B. Monitor parking of construction personnel's private vehicles.
 - 1. Maintain free vehicular access to and through parking areas.
 - 2. Prohibit parking on or adjacent to access roads, or in non-designated areas.

1.07 HAUL ROUTES

- A. Consult with governing authorities and establish public thoroughfares which will be used as haul routes and site access.
- B. Confine construction traffic to designated haul routes.
- C. Provide traffic control at critical areas of haul routes to expedite traffic flow to minimize interference with normal public traffic.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01590

FIELD OFFICES AND SHEDS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. At Contractor's option to furnish, install, and maintain temporary field offices during entire construction period.
- B. Furnish, install, and maintain storage and work sheds needed for construction.
- C. At completion of work, remove field offices, sheds, and contents.

1.02 RELATED REQUIREMENTS

- A. Section 01010: Summary of Work
- B. Section 01510: Temporary Utilities

1.03 OTHER REQUIREMENTS

- A. Prior to installation of offices and sheds, consult with Engineer on location, access, and related facilities.

1.04 REQUIREMENTS FOR FACILITIES

- A. Construction:
 - 1. Structurally sound, weathertight, with floors raised above ground.
 - 2. Temperature transmission resistance: compatible with occupancy and storage requirements.
 - 3. At Contractor's option, portable or mobile buildings may be used.
 - a. Mobile homes, when used, shall be modified for office use.
 - b. Do not use mobile homes for living quarters.
- B. Office for Engineer and Owner's Representative:
 - 1. A separate space for sole use of designated occupants, with secure entrance doors and one (1) key per occupant.
 - 2. Area: 150 square feet minimum, with minimum dimension of eight (8') feet.
 - 3. Windows:
 - a. Minimum: Total area of 10% of floor area.
 - b. Operable sash and insect screens.
 - c. Locate to provide view of construction areas.
 - 4. Furnishings:
 - a. One (1) standard size desk with three (3) lockable drawers.

- b. One (1) drafting table: 30" x 72" x 36" high, with one (1) equipment drawer.
 - 1. Locate table oriented in relation to the site at a window with a view of the site.
 - c. One (1) plan rack to hold a minimum of six sets of Project drawings.
 - d. One (1) chair per occupant.
 - e. One (1) drafting table stool.
 - f. One (1) waste basket per desk and table.
 - g. One (1) tackboard, 36" x 30".
5. Services:
- a. Lighting: 50 foot-candles at desk top height.
 - b. Exterior lighting at entrance door.
 - c. Automatic heating and mechanical cooling equipment to maintain comfortable conditions.
 - d. Minimum of four (4) 110 volt duplex electric convenience outlets, at least one (1) on each wall.
 - e. Electric distribution panel: Two (2) circuits minimum, 110 volt, 60 hertz service.
 - f. Convenient access to drinking water and toilet facilities.
 - g. Telephone: One (1) direct line instrument. Local service to be paid by contractor. Long distance charges to be paid by Engineer.

C. Contractor's Office and Facilities

- 1. Size: As required for general use and to provide space for project meetings.
- 2. Lighting and temperature control: As specified for Engineer's office.
- 3. Telephone: One (1) direct line instrument.
- 4. Furnishings in Meeting Area:
 - a. Table and Chairs for at least eight (8) persons.
 - b. Racks and files for Project Record Documents in or adjacent to the meeting areas.
- 5. Other furnishings: Contractor's option.
- 6. One (1), ten (10") inch (250 mm) outdoor-type thermometer.

D. Storage Sheds:

- 1. To requirements of various trades.
- 2. Dimensions: Adequate for storage and handling of products stored.
- 3. Ventilation: Comply with specified and code requirements for products stored.
- 4. Heating: Adequate to maintain temperatures specified in respective sections for the products stored.

PART 2 - PRODUCTS

2.01 MATERIALS, EQUIPMENT FURNISHINGS

- A. May be new or used, but must be serviceable, adequate for acquired purpose, and must not violate applicable codes and regulations.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Fill and grade sites for temporary structures to provide surface drainage.

3.02 INSTALLATION

- A. Construct temporary field offices and storage sheds on proper foundations, provide connections for utility services.
 - 1. Secure portable or mobile buildings when used.
 - 2. Provide steps and landings at entrance doors.
- B. Mount thermometer at convenient outside location, not in direct sunlight.

3.03 MAINTENANCE AND CLEANING

- A. Provide periodic maintenance and cleaning for temporary structures, furnishings, equipment, and services.

3.04 REMOVAL

- A. Remove temporary field offices, contents, and services when no longer needed.
- B. Remove foundations and debris; grade site to required elevations and clean the areas.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Material and equipment incorporated into Work:
 - 1. Conform to applicable specifications and standards.
 - 2. Comply with size, make, type, and quality specified, or as specifically approved in writing by the Engineer.
 - 3. Manufactured and Fabricated Products:
 - a. Design, fabricate, and assemble in accordance with the best engineering and shop practices.
 - b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
 - c. Two (2) or more items of the same kind shall be identical, by the same manufacturer.
 - d. Products shall be suitable for service conditions.
 - e. Equipment capacities, sizes, and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
 - 4. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.02 RELATED REQUIREMENTS

- A. Conditions of the Contract
- B. Section 00300: Bid Form
- C. Section 01010: Summary of Work
- D. Section 01340: Shop Drawings, Product Data, and Samples
- E. Section 01710: Cleaning

1.03 REUSE OF EXISTING MATERIAL

- A. Except as specifically indicated or specified, materials and equipment removed from the existing structure, if any, shall not be used in the completed work.
- B. For material and equipment specifically indicated or specified to be used in the Work:
 - 1. Use special care in removal, handling, storage, and reinstallation, to assure

- proper function in the completed Work.
2. Arrange for transportation, storage, and handling of products which require off-site storage, restoration, or renovation. Pay all costs for such work.

1.04 MANUFACTURER'S INSTRUCTIONS

- A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two (2) copies to Engineer.
 1. Maintain one (1) set of complete instructions at the job site during installation and until completion.
- B. Handle, install, connect, clean, condition, and adjust products in strict accordance with such instructions and in conformity with specified requirements.
 1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for further instructions.
 2. Do not proceed with work without clear instructions.
- C. Perform work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

1.05 TRANSPORTATION AND HANDLING

- A. Arrange deliveries of Product in accordance with construction schedules, coordinate to avoid conflict with work and conditions at the site.
 1. Deliver Products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
 2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that Products are properly protected and undamaged.
- B. Provide equipment and personnel to handle Products by methods to prevent soiling or damage to Products or packaging.

1.06 STORAGE AND PROTECTION

- A. Store Products in accordance with manufacturer's instructions with seals and labels intact and legible.
 1. Store Products subject to damage by the elements in weathertight enclosures.
 2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

- B. Exterior Storage:
 - 1. Store fabricated Products above the ground, on blocking or skids, prevent soiling or staining. Cover Products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.
 - 2. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
- C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored Products to assure that Products are maintained under specified conditions, and free from damage or deterioration.
- D. Protection after Installation:
 - 1. Provide substantial coverings as necessary to protect installed Products from damage from traffic and subsequent construction operations. Remove when no longer needed.

1.07 SUBSTITUTIONS AND PRODUCT OPTIONS

- A. Products List:
 - 1. Within ten (10) days after contract Date, submit to Engineer a complete list of major Products proposed to be used, with the name of the manufacturer and the installing subcontractor.
- B. Contractor's Options:
 - 1. For Products specified only by reference standard, select any Product meeting that standard.
 - 2. For Products specified by naming several Products or manufacturers, select any one (1) of the Products or manufacturers named, which complies with the specifications.
 - 3. For Products specified by naming one (1) or more Products or manufacturers and stating "or equal," Contractor must submit a request for substitutions for any Product or manufacturer not specifically named.
 - 4. For Products specified by naming only one (1) Product and manufacturer, there is no option.
- C. Substitutions:
 - 1. Major Equipment Items
 - a. For a period of fourteen (14) days after the Bid opening, Engineer will consider written requests from Contractor for substitutions identified in the major equipment Schedule of the Bid Form.
 - 2. Other Products
 - a. For a period of thirty (30) days after Contract Date, Engineer will consider written requests from Contractor for substitutions on Products.

3. Submit a separate request for each Product, supported with complete data, with drawings and samples as appropriate, including:
 - a. Comparison of qualities of the proposed substitution with that specified.
 - b. Changes required in other elements of the work because of the substitution.
 - c. Effect on the construction schedule.
 - d. Cost data comparing the proposed substitution with the Product specified.
 - e. Any required license fees or royalties.
 - f. Availability of maintenance service, and source of replacement materials.
 4. Engineer shall be the judge of the acceptability of the proposed substitution.
- D. Contractor's Representation:
1. The request for a substitution constitutes a representation that contractor:
 - a. Has investigated the proposed Product and determined that it is equal to or superior in all respects to that specified.
 - b. Will provide the same warranties or bonds for the substitution as for the Product specified.
 - c. Will coordinate the installation of an accepted substitution into the work, and make such other changes as may be required to make the work complete in all respects.
 - d. Waives all claims for additional costs, under this responsibility, which may subsequently become apparent.
- E. Engineer will review requests for substitutions with reasonable promptness, and notify Contractor, in writing, of the decision to accept or reject the requested substitution.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the Work.

1.02 RELATED REQUIREMENTS

- A. Conditions of the contract: Fiscal provisions, legal submittals and additional administrative requirements:
- B. Section 01710: Cleaning
- C. Section 01720: Project Record Documents
- D. The respective sections of Specifications: Closeout Submittals Required of Trades.

1.03 SUBSTANTIAL COMPLETION

- A. When Contractor considers the Work is substantially complete, he shall submit to Engineer:
 - 1. A written notice that the Work, or designated portion thereof, is substantially complete.
 - 2. A list of items to be completed or corrected.
- B. Within a reasonable time after receipt of such notice, Engineer will perform an inspection to determine the status of completion.
- C. Should Engineer determine that the Work is not substantially complete:
 - 1. Engineer will promptly notify the Contractor in writing, giving the reasons for Work not being substantially complete.
 - 2. Contractor shall remedy the deficiencies in the Work and send a second written notice of substantial completion to the Engineer.
 - 3. Engineer will reinspect the Work.
- D. When the Engineer finds that the Work is substantially complete, he will:
 - 1. Prepare and deliver to Owner a tentative Certificate of Substantial Completion of NSPE Form 1910-8-D with a tentative list of items to be completed or corrected before final payment.

2. After consideration of any objections made by the Owner as provided in Conditions of the Contract, and when Engineer considers the Work substantially complete, he will execute and deliver to the Owner and the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected.

1.04 FINAL INSPECTION

- A. When Contractor considers the Work is complete, he shall submit written certification that:
 1. Contract Documents have been reviewed.
 2. Work has been inspected for compliance with Contract Documents.
 3. Work has been completed in accordance with Contract Documents.
 4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
 5. Work is complete and ready for final inspection.
- B. Engineer will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
- C. Should Engineer consider that Work is incomplete or defective:
 1. Engineer will promptly notify the Contractor in writing, listing the incomplete or defective Work.
 2. Contractor shall take immediate steps to remedy the stated deficiencies in the Work and send a second written certification to the Engineer that the Work is complete.
 3. Engineer will reinspect the Work.
- D. When the Engineer finds that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

1.05 REINSPECTION FEES

- A. Should Engineer perform reinspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:
 1. Owner will compensate Engineer for such additional services.
 2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.06 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER

- A. Evidence of compliance with requirements of governing authorities.
- B. Project Record Documents: to requirements of Section 01720

- C. Evidence of Payment and Release of Liens: to requirements of General and Supplementary Conditions.
- D. Certificate of Insurance for Products and Completed Operations, as applicable.

1.07 FINAL ADJUSTMENT OF ACCOUNTS

- A. Submit a final statement of accounting to Engineer.
- B. Statement shall reflect all adjustments to the Contract Sum:
 - 1. The original Contract Sum.
 - 2. Additions and deductions resulting from:
 - a. Previous Change Orders
 - b. Allowances
 - c. Unit Prices
 - d. Deductions for uncorrected work
 - e. Penalties and Bonuses
 - f. Deductions for liquidated damages
 - g. Deductions for reinspection payments
 - h. Other adjustments
 - 3. Total Contract Sum, as adjusted
 - 4. Previous payments
 - 5. Sum remaining due
- C. Engineer will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.08 FINAL APPLICATION FOR PAYMENT

- A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the conditions of the Contract.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01710

CLEANING

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Execute cleaning, during progress of the Work, and at completion of the Work, as required by General Conditions.

1.02 RELATED REQUIREMENTS

- A. Conditions of the Contract
- B. Section 01560: Temporary Controls
- C. Each Specification Section: Cleaning for specific Products or Work.

1.03 DISPOSAL REQUIREMENTS

- A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Use only those cleaning materials which will not create hazards to health or property, and which will not damage surfaces.
- B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
- C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION

- A. Execute periodic cleaning to keep the Work, the site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris, resulting from construction operations.
- B. Provide on-site containers for the collection of waste materials, debris, and rubbish.

- C. Remove waste materials, debris, and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.02 DUST CONTROL

- A. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.
- B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

3.03 FINAL CLEANING

- A. Employ skilled workmen for final cleaning.
- B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces.
- C. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
- D. Prior to final completion, or Owner occupancy, Contractor shall conduct an inspection of sight-exposed surfaces, and all work areas, to verify that the entire Work is clean.

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Maintain at the site for the Owner one (1) record copy of:
 - 1. Drawings
 - 2. Specifications
 - 3. Addenda
 - 4. Change Orders and other Modifications to the Contract
 - 5. Engineer Field Orders or written instructions
 - 6. Approved Shop Drawings, Product Data and Samples
 - 7. Field test records

1.02 RELATED REQUIREMENTS

- A. Section 01340: Shop Drawings, Product Data, and Samples

1.03 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Store documents and samples in Contractor's field office apart from documents used for construction.
 - 1. Provide files and racks for storage of documents.
 - 2. Provide locked cabinet or secure storage space for storage of samples.
- B. File documents and samples in accordance with CSI/CSC format.
- C. Maintain documents in a clean, dry legible condition and in good order. Do not use record documents for construction purposes.
- D. Make documents and samples available at all times for inspection by Engineer.

1.04 MARKING DEVICES

- A. Provide felt tip marking pens for recording information in the color code designated by Engineer.

1.05 RECORDING

- A. Label each document "PROJECT RECORD" in neat large printed letters.
- B. Record information concurrently with construction progress.
 - 1. Do not conceal any Work until required information is recorded.

1.06 SUBMITTAL

- A. At Contract closeout, deliver Record Documents to Engineer for the Owner.
- B. Accompany submittal with transmittal letter in duplicate, containing:
 - 1. Date
 - 2. Project title and number
 - 3. Contractor's name and address
 - 4. Title and number of each Record Document
 - 5. Signature of Contractor or his authorized representative

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 01740
WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Compile specified warranties and bonds.
- B. Submit to Owner for review.

1.02 RELATED REQUIREMENTS

- A. Section 00100: Instructions to Bidders
- B. Section 00700: General Conditions
- C. Section 00800: Supplementary General Conditions
- D. Section 01700: Contract Closeout

1.03 SUBMITTAL REQUIREMENTS

- A. Assemble warranties, bonds, and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Number of original signed copies required: Two (2) each.
- C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.
 - 1. Product or Work item.
 - 2. Firm, with name of principal, address, and telephone number.
 - 3. Scope.
 - 4. Date of beginning of warranty, bond, or service and maintenance contract.
 - 5. Duration of warranty, bond, or service maintenance contract.
 - 6. Provide information for Owner's personnel:
 - a. Proper procedure in case of failure.
 - b. Instances which might affect the validity of warranty or bond.
 - 7. Contractor, name of responsible principal, address, and telephone number.

1.04 FORM OF SUBMITTALS

- A. Prepare in duplicate packets.
- B. Format:
 - 1. Size 8-1/2 in. x 11 in., punch sheets for standard 3-ring binder.
 - 2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:
 - a. Title of Project.
 - b. Name of Contractor.

C. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.

1.05 SUBMITTALS REQUIRED

A. Submit warranties, bonds, service, and maintenance contracts as specified in respective sections of Specifications.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 02100
EROSION CONTROL

PART 1 - GENERAL

1.01 RELATED WORK

- A. Section 01050: Field Engineering
- B. Section 02221: Trenching, Backfilling, and Compacting
- C. Section 02485: Seeding

1.02 JOB CONDITIONS

- A. Excavation, trenching, backfilling, and grading operations to elevations as needed to meet the requirements shown on the Contract Documents, shall be done in such a manner as to cause the least amount of soil erosion and siltation.
- B. Appropriate management practices and control structures shall be in place prior to clearing of vegetation for necessary construction activities near streams, rivers, and lakes.
- C. Provisions required to maintain uninterrupted surface water flow shall be maintained during the work. Storm water flow in existing gutters, surface drains, and swales shall not be interrupted.
- D. The Engineer shall be notified of any unexpected subsurface or other unforeseen conditions. Work shall be discontinued until the Engineer provides notification to resume work.

1.03 PERMITS

- A. All conditions set forth in the Corps of Engineers 404 Permit, Tennessee Valley Authority 26A Permit (if applicable), and the Tennessee Department of Environment and Conservation Notice of Coverage (and Storm Water Pollution Prevention Plan (SWPPP)) shall be strictly adhered to. The Owner shall obtain the appropriate permit.
- B. If applicable, the Contractor and his/her subcontractors will be required to sign the SWPPP and the Notice of Intent (NOI), thus binding them to the conditions outlined in the SWPPP and the Notice of Cover (NOC). The contractor shall be responsible for all fines and penalties arising from failure to adhere to the SWPPP, NOC, or proper erosion control practices.

PART 2 - PRODUCTS

2.01 PROTECTIVE MATERIALS

- A. Straw Bale Barriers

- B. Silt Fence and Stakes
- C. Sand Bags
- D. Stone Rip Rap
- E. Floating Boom
- F. Burlap
- G. Temporary Diversion Dike or Berm
- H. Diversion
- I. Temporary Sediment Trap
- J. Temporary Sediment Basin
- K. Check Dams
- L. Riprap
- M. Construction Road Stabilization
- N. Stream Crossings
- O. Permanent & Temporary Vegetation
- P. Storm Drain Inlet Protection
- Q. Culvert Inlet Protection

PART 3 - EXECUTION

3.01 PREPARATION

- A. Erosion and sediment control shall be in accordance with the Tennessee Water Quality Control Act of 1977, as amended, and the Federal Act PI 92-59.
- B. The Tennessee Department of Conservation Publication, Tennessee Erosion & Sediment Control Handbook, latest revision, shall be used as a guide for construction of projects that require erosion and sediment controls to protect adjoining property and waters of the state.

3.02 PERFORMANCE

- A. Whenever possible, a buffer strip of vegetation cover shall be kept adjacent to grading operations.
- B. Control measures shall be in place and functional before earth moving operations begin, and must be properly constructed and maintained during the construction period.
- C. Staked and entrenched straw bales or silt fence shall be installed along the base of all sloped cuts and fills, on the down hill sides of stockpiled soil, and along stream banks.

- D. All surface water flowing toward the construction area shall be diverted around the area as much as possible to reduce erosion potential by using beams, channels, and/or sediment traps as necessary.
- E. Maintenance of erosion and sediment control methods shall be performed on a regular basis throughout the construction period and until a good vegetative cover is established over the entire disturbed area.
- F. A vegetation buffer strip shall be maintained between any stream and pipe trenching. Excavated material from the trench shall not be placed between the trench and stream.
- G. Trenches or pits shall be backfilled as soon as practicable to reduce erosion potential.
- H. Erosion control measures shall be removed when they have served their useful purpose. The disturbed soil shall be fine graded, top soiled, and planted with permanent vegetation as soon as the construction sequence allows to prevent further potential erosion and sedimentation. Any seeded areas which are eroded shall be reworked as soon as possible.

3.03 INSPECTION

- A. The erosion and sediment control measures shall protect adjacent properties, shall be in accordance with the Tennessee Erosion and Sediment Control Handbook and local ordinances, and shall be approved by the Engineer. All measures shall be sized and designed in accordance with the criteria specified in the handbook. All erosion control measures shall be placed prior to commencement of grading.
- B. Temporary measures shall be applied throughout the construction of the project to control erosion and to minimize siltation of drainage ditches, storm drains, and waterways. The Contractor, as a minimum, shall employ all erosion control measures indicated on the drawings and specified herein.
- C. Limit grading to areas of workable size so as to limit the duration of exposure of disturbed and unprotected area. All appropriate conservation practices should be applied in sequence of work. Disturbed areas that are to be left unfinished for more than 30 days shall be stabilized with seed and mulch, or any other necessary temporary or permanent measures.
- D. Protect stockpiling material with mulch, temporary vegetation, or sediment barrier at base. Slopes of stockpiled material shall not exceed 2:1.
- E. Stabilize all streets and parking areas, within fifteen (15) days of final grading, with base coarse-crushed stone.
- F. Allow no water to enter the storm drainage system prior to settlement or screening of excess siltation.

- G. No more than five-hundred (500') feet of trench shall be open at any one time.
- H. Synthetic filter fabric fencing shall be used for sediment control when land disturbing activities are within twenty-five (25') feet of a live creek or stream.
- I. No excavated material shall be placed in streambeds.
- J. On disturbed short, steep slopes, where erosion hazard is high, or in vegetated channels or ditches, contractor shall provide soil stabilization blankets and matting as directed by Owner or Engineer.

3.04 FAILURE TO EXECUTE

- A. In the event the Contractor repeatedly fails to satisfactorily control erosion or siltation, the Owner reserves the right to employ outside assistance or to use his own forces to provide the erosion and sediment control indicated and specified. The cost of such work, plus related engineering costs, will be deducted from monies due to the Contractor for other work.

END OF SECTION

SECTION 02110

CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 RELATED WORK

- A. Section 01050: Field Engineering
- B. Section 01090: Reference Standards
- C. Section 01410: Testing Laboratory Services
- D. Section 01720: Project Records Documents
- E. Section 02260: Finish Grading
- F. Section 02485: Seeding

1.02 JOB CONDITIONS

- A. Clear, grub, remove, and dispose of vegetation, rocks, and debris within the limits of the work except items to remain as designated on the drawings.
- B. Excavate, backfill, compact, and grade the site to the elevations shown on the drawings, as specified herein, and as needed to meet the requirements of the construction shown in the Contract Documents.
- C. Existing utilities, poles, services lines, fences, structures, trees, shrubs, or other improvements encountered during the construction, whether above or below ground, shall be protected by the Contractor. Any item damaged or removed by the Contractor shall be repaired or replaced at the Contractor's expense to at least its original condition and to the satisfaction of the Owner. It shall be the Contractor's responsibility to locate any existing utilities in the path of construction.
- D. Notify the Engineer of any unexpected subsurface conditions. Discontinue work in area until the Engineer provides notification to resume work.

1.03 QUALITY ASSURANCE

- A. All work included in this section shall conform to the minimum standards of the local codes and authorities having jurisdiction over the project area.
- B. Identify and mark location of all structures, utilities, vegetation, and other existing site features that are to remain.

- C. Provide barricades, coverings, or other type of protection necessary to prevent damage to existing improvements.
- D. Excavations for structures must conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction required, and for inspection.
- E. Areas to receive topsoil must be graded to within not more than 0.10 feet +/- above or below the required subgrade elevations. Shape surface of areas under walks and pavement to not more than 0.10 feet +/- above or below the required subgrade elevation.

1.04 PROTECTION

- A. Protect living trees not marked for removal and outside the construction area. Treat cut or scarred surfaces of trees or shrubs with a paint prepared especially for tree surgery.
- B. Protect benchmarks and existing structures, roads, sidewalks, paving, and curbs against damage from vehicular or foot traffic.
- C. Maintain designated temporary roadways, walkways, and detours for vehicular and pedestrian traffic.
- D. It is mandatory that the contractor employ construction methods and techniques that will not cause unnecessary environmental impact. The contractor will enforce ecologically sound construction practices to ensure acceptance by the Owner and the public and minimal environmental impact and, comply with environmental laws and regulations.
- E. Any unreasonable environmental impacts or potential noncompliance issue as determined by the appropriate regulatory agency, shall be noted and rectified at the contractor's expense, to the satisfaction of the Owner and the appropriate regulatory agency.
- F. Care shall be taken to avoid oil or chemical spills while working in or near bodies of water. Oil and fuels near bodies of water where, they can reasonably be expected to discharge to watercourses, shall be diked so that the spill can be retained until cleaned up. Any spills will be reported immediately to the Owner and Engineer.
- G. Maintenance of equipment shall not cause damage to the area being cleared and grubbed. Equipment fluids shall not drip or be drained onto any surface area. If a release occurs, notify the Owner and Engineer, and the contractor shall remediate the affected area to the satisfaction of the Owner and appropriate regulatory agency.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Topsoil shall be friable clay loam surface soil found in a depth of not less than four (4") inches, free of subsoil, clay lumps, stones, and other objects over two (2") inches in diameter and without weeds, roots or other objectionable material.

PART 3 - PRODUCTS

3.01 PREPARATION

- A. Maintain benchmarks, monuments, and other reference points. Re-establish if disturbed or destroyed at no cost to Owner.
- B. Provide a minimum of seventy-two (72) hours notice to property owners whose property will potentially be disturbed.

3.02 CLEARING AND GRUBBING

- A. Clear rights-of-way, easements, borrow pit, and other stockpile areas of objectionable material to the ground surface except for trees and stumps.
- B. Cut trees and stumps outside the construction area marked for removal by the Engineer to within six (6") inches of the ground surface.
- C. Remove low hanging, unsound, or unsightly branches on trees or shrubs designated to remain. All branches shall be cut at the appropriate branch collars.
- D. Grub construction area of protruding obstructions except sound undisturbed stumps and roots six (6") inches or less above the ground which will be a minimum of five (5') feet below subgrade or embankment slope provided undercutting, topsoil stripping, or other corrective measures are not stipulated.
- E. Areas required for embankment construction, all stumps, roots, etc., shall be removed to a depth of minimum of five (5') feet below the existing ground surface.
- F. Herbicide use shall only be Environmental Protection Agency (EPA) approved materials and shall be applied in accordance with manufacturer recommendations. Use of herbicides must be approved by the Owner.
- G. Rights-of-way and easements will be completely clear within their total width.
- H. Grub borrow pit and stockpile areas of all objectionable material. Strip overburden over the material to be obtained in stockpile areas.

- I. Perform clearing and grubbing well in advance of construction or material removal activities.
- J. Fences are to be maintained at all times. Under no circumstances is a fence to be let down or cut without prior arrangement with the property owner. If fences are damaged, the contractor shall repair and put the fence in first class condition entirely acceptable to the property owner. Repair work is to be accomplished at time of damage, or as soon thereafter as possible at the sole expense of the Contractor
- K. Wherever feasible, access to right-of-way and/or easement shall be through an existing gate (with agreement of the property owner). The gate shall be closed immediately after each passage. Any agreements with property owners shall be obtained in writing. Copies of agreements shall be provided to the Owner and Engineer prior to proceeding.

3.03 USE OF CHEMICALS AND SPRAYS

- A. All Right-of-Way/Easement spraying shall be performed by a certified and licensed applicator. Contractor shall be responsible for purchasing, storing, and furnishing chemicals to its crews. Engineer and Owner shall be consulted prior to any use of chemicals or sprays by Contractor.
- B. Spraying of right of way/easements may be done at various locations using suitable herbicides to control vegetation particular to that location. Detailed records of the applicator's name, property owner permission, date, location, amount and type of herbicide used shall be kept and copies furnished to the Owner and Engineer on a routine basis or upon completion of the job. Prior to commencement of any Work involving the application of chemicals, the Contractor shall thoroughly familiarize and inform himself of all local conditions and other factors which could or might affect chemical spraying.
- C. Unless otherwise specified by the Owner or Engineer, the Contractor shall mix and apply the chemicals in accordance with the recommendations of the manufacturer, and the following general specifications:
 - 1. For Foliage Application: This method shall be used only on brush over three (3') feet in average height during the active plant growth period, generally between May 1 and September 1. Chemical mixture shall be applied to completely wet the entire leaf, stem and trunk surface of each plant.
 - 2. For Basal Application: This method shall be used on brush of any size at any season of the year. Chemical mixture shall be applied to completely wet the entire surface of the stem or trunk from the root crown up the stem eighteen (18") inches, with emphasis on completely wetting the root crown.

3. For Stump Application: This method shall be used on all new stumps at any season of the year. Stumps shall be sprayed as soon as practical, but always on the same day that the cutting is performed. Chemical mixture shall be applied in sufficient volume to completely wet the sapwood, bark area, root crown and any exposed roots.
- D. No spraying shall be done within thirty (30) minutes after fog, dew, or rain events sufficiently heavy to cause runoff.
- E. Contractor shall not spray any portion of a Right-of-Way or Easement where damages to crops, orchards, or ornamental plants may result from chemical drift.
- F. Owner or Engineer will have the right to specify when and where chemical application and/or chemical spraying will be used in rural areas or otherwise.
- G. Contractor's use of chemicals in connection with the Work shall be in strict compliance with all federal and state laws, rules and regulations which from time to time govern the use of chemicals, including but not limited to the Tennessee Hazardous Chemical Right to Know How (T.C.A. Section 5032001, et seq.), the Tennessee Hazardous Substance Act (T.C.A. Section 6827101, et seq.), the Tennessee Application of Pesticides Act of 1978 (T.C.A. Section 6221101, et seq.), the Federal Insecticide, Fungicide and Rodenticide Act (7 U.S.C. Section 136, et seq.), and the Federal Hazard Communications Standard (29 CFR 1910.1200). By undertaking to perform any part of the Work in which chemicals are used, the Contractor certifies that Contractor is familiar with, has complied with, and at all times will comply with all requirements (including but not limited to those relating to training and the giving and posting of all required notices) under all of the foregoing laws, rules and regulations and further, the Contractor shall indemnify and hold harmless the Owner and Engineer against any liability, claim, demand, cause of action of every kind and description, damage, losses and expenses, including attorney's fees through appeals, arising or resulting from the Contractor's noncompliance with or violation of any of the foregoing laws, rules or regulations.
- H. Contractor shall be solely responsible for the accurate recording and submission of all forms required by the applicable regulatory agencies and other governing authorities in connection with the use of chemicals.
- I. Chemical spills shall be immediately cleaned up in a manner consistent with label restrictions, Federal and State regulations, and acceptable environmental procedures mandated by law, as well as, notify the Owner and Engineer. Any and all notifications to proper authorities in connection with such spills shall be made by the Contractor. Each crew responsible for chemical applications shall be supplied with a suitable spill response kit for cleaning up and neutralizing spills of

chemicals, all at the sole expense of the Contractor. Contractor shall insure that its employees are trained in the proper techniques for spill response, and are supplied with the necessary personal protective equipment required to perform spill mitigation duties.

- J. Contractor shall at all times be solely responsible for the continuous safeguarding of its workforce, including compliance with all applicable Federal, State, and local laws, together with its responsibilities for training its employees in the proper methods and use of personal protective equipment required for handling chemicals used in connection with this Work.

3.04 BACKFILLING AND SURFACE PREPARATION

- A. Backfill and compact all depressions resulting from clearing and grubbing with suitable materials.
 - 1. Backfill embankment areas to natural ground elevation.
 - 2. Backfill excavation areas below finished subgrade to finish subgrade.
- B. Perform backfilling a satisfactory distance ahead of construction operations.
- C. Prepare areas designated on the drawings to receive erosion control matting to smooth surfaces that have been shaped, fertilized, and seeded.
- D. All depressions/holes remaining after clearing and grubbing shall be backfilled and tamped as directed by the Engineer. In areas to be immediately excavated, the Engineer may direct that the holes may not be backfilled.
- E. The entire area will be repaired to prevent ponding of water and to provide drainage.
- F. All disturbed areas shall be restored in accordance with Section 02260 Finish Grading and Section 02485 Seeding

3.05 FILL

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

- B. Place backfill and fill materials in layers not more than eight (8") inches in loose depth. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of maximum density. Do not place backfill or fill material on surfaces that are muddy, frozen or contain frost or ice.

3.06 GRADING

- A. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
- B. Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces to be free from irregular surface changes.
- C. Grade surface of fill under building slabs smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades to within a tolerance of 1/4" when tested with a ten (10') foot straightedge.
- D. Ditches shall be cut accurately to the cross section and grades indicated on the drawings or as directed by the Engineer. All roots, stumps and other foreign matter shall be cut below the finished surface of the ditch and backfilled to the true section and grade.

3.07 COMPACTION

- A. Areas to be landscaped or to remain unimproved should not be compacted, and heavy equipment should not be allowed to pass over these areas except to spread topsoil at the completion of construction.

3.08 DEBRIS REMOVAL

- A. Promptly remove cleared debris from site.
- B. Obtain permission from applicable regulatory authority for disposal of debris to waste disposal site.
- C. Under no circumstances are brush, trees, and debris to be buried within the property, right-of-way, easements, borrow pit, and other stockpile areas.

3.09 CLEAN-UP

- A. Upon acceptance of the Work, the Contractor shall reinstate the Project areas affected by the operations.

- B. Removal and replacement of fences, damage repair to yards, lawns, sidewalks, driveways, roads, other utilities, etc. due to movement of excavating or other equipment and/or erection of equipment and/or any other activities associated with the Work shall be the sole responsibility and at the sole expense of the Contractor unless specifically designated for payment under the Contract Unit Price Schedule.
- C. Protect newly graded areas from traffic and erosion, and keep free of trash and debris.
- D. Remove waste materials, including unacceptable excavated material, trash and debris, from the project vicinity and dispose of it in a legal manner.

3.10 MEASUREMENT AND PAYMENT

- A. Measurement of clearing and grubbing area will not be made unless it is identified as a Unit Price Item on the Bid Form.
- B. Payment for clearing and grubbing shown on the drawings or specified herein shall be included in the work with which they are associated.
- C. Clearing and grubbing will be considered subsidiary to the subsequent bid item unless a specific bid item is provided in the proposal. All work performed in clearing and grubbing areas not so designated on the Plans or in the Special Provisions, will not be paid for directly but shall be considered subsidiary work pertaining to the various bid items.
- D. Payment will not be made for unauthorized work.
- E. If a specific bid item is included in the bid proposal, all work performed will be paid for at the unit price bid for clearing and grubbing or as a lump sum price according to the bid proposal. Price shall include full compensation for furnishing all labor, materials, equipment, tools, supplies, and incidentals necessary to complete the work.

END OF SECTION

SECTION 02210

SITE GRADING AND FILLING

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section 01150: Measurement and Payment
- B. Section 01410: Testing Laboratory Services
- C. Section 01710: Cleaning
- D. Section 01720: Project Record Documents
- E. Section 02221: Trenching, Backfilling, and Compacting

1.02 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
 - 1. Comply with requirements of the authority having jurisdiction for work done on controlled property.
 - 2. Obtain permits and notices, as required, for removal of walks and drives on controlled property.
- B. Testing Laboratory and Geotechnical Engineer:
 - 1. The Geotechnical Engineer's and Testing Laboratory's fee will be paid for by Owner except when the Geotechnical Engineer or Testing Laboratory personnel are notified by Contractor that work will be in progress, and they come to job site and work is not in progress. In that case, the Contractor shall pay for Geotechnical Engineer's or Testing Laboratory personnel's time and mileage. Contractor shall pay for retesting as specified below.
 - 2. Have earth borrow fill tested and approved by design Testing Laboratory before moving it to the job site.
 - 3. Soils compaction testing of in-place soil and filled and compacted areas will be performed by Testing Laboratory in accordance with ASTM D698-78 Standard Proctor as specified below.

1.03 PROTECTION

- A. Protect excavations and grounds from water ponding and water damage. Construct and maintain temporary drainage. Pump, if required, to keep excavations free of water. Maintain site in well drained condition at all times.

- B. Protect, maintain, and restore benchmarks, monuments, and other reference points affected by this work. If benchmarks, monuments, or other permanent reference points are displaced or destroyed, points shall be re-established and markers reset under supervision of a licensed surveyor who shall furnish Engineer with certification of his work.
- C. Protect Utilities and other construction designated to remain in place.
- D. Protect trees to remain in place.

1.04 LINES AND GRADES

- A. It is imperative that lines and grades established on drawings, except for allowance for installation of fill aggregate, concrete, and topsoil established below, be met when this work is completed.

1.05 SUBMITTALS TO ENGINEER

- A. Submit one (1) copy of permits and notices obtained from authority having jurisdiction before commencing work.
- B. Obtain and submit certification of adequacy of site grading and filling from Testing Laboratory, signed and sealed by a qualified Geotechnical Engineer, stating that work is in accordance with Contract Documents, and that soils are capable of supporting the structure to be constructed under the Contract.
- C. If benchmarks and other permanent reference points are displaced, obtain and submit certification, signed and sealed by a licensed surveyor, of proper re-establishment of benchmarks and reference points.

PART 2 - PRODUCTS

2.01 ENGINEERED FILL

- A. Material considered suitable for use as engineered fill should be clean soil free of organics, trash, and other deleterious materials, containing no rock fragments greater than 3 inches in dimension. Engineered soil fill material shall have a standard Proctor maximum dry density of 90 pounds per cubic foot (pcf) or greater and a plasticity index (PI) of 35 percent, or less. Materials to be used as engineered fill shall be tested by the Geotechnical Engineer before being placed.
- B. Dense Graded Aggregate (DGA) shall meet Tennessee Department of Transportation (TDOT) Specification 903.5 Type A, Grading D or E. Dense Graded Aggregate may be used as backfill in undercut excavations, in utility trench excavations, and other places shown in the drawings.

- C. The native soils removed during cutting operations can be used as fill if it is approved by the Geotechnical Engineer.
- D. Off-site borrow may be utilized provided the Geotechnical Engineer approves its use.

PART 3 - EXECUTION

3.01 REMOVAL OF OBSTRUCTIONS

- A. Clean out cellars, wells, cisterns, septic tanks and drain fields, cesspools, catch basins, manholes, and similar items to solid subgrade and break up masonry and/or concrete bottoms so that no pieces remain which are over twelve (12") inches in their largest dimension. Break out masonry and concrete sides of such construction to a depth of at least two (2') feet below bottoms of footings to be installed as part of this project or subgrade, as applicable.
- B. Fill basements, cellars, walls, and other items enumerated above with specified granular fill and compact to 100 % Standard Proctor Density.

3.02 DISPOSITION OF ABANDONED UTILITIES

- A. If abandoned underground utility lines and electric conduit are uncovered in the course of grading, then that part uncovered shall be removed and capped off at points of removal as well as at property lines.

3.03 REMOVAL AND STORAGE OF TOPSOIL

- A. Remove topsoil to its entire depth from areas within building lines and for a distance of five (5') feet beyond, under pavements, or other areas to be excavated, filled, or graded.
- B. Mow grass, weeds, brush, and other annual-type growth close to ground.
- C. Scrape or rake area to remove brush, roots, loose grass, weeds, and rocks before stripping topsoil.
- D. Topsoil to be stored for reuse shall meet requirements established above.
- E. Store topsoil in area designated by Architect. Store to prevent erosion and mixture with debris and other materials.

3.04 SITE EXCAVATION AND PROOF-ROLLING

- A. After stripping and excavation is complete, proof-roll these areas with a fully-loaded tandem-axle dump truck. Operate the truck at a normal walking speed so that the Geotechnical Engineer may observe the ground while walking beside the truck.
- B. The Geotechnical Engineer will inspect the areas for soft spots.

3.05 REMEDIAL WORK

- A. The Geotechnical Engineer shall observe proof-rolling. Areas judged to perform unsatisfactorily (e.g., pumping and/or rutting) by the Engineer should be undercut and replaced with structural soil fill or remediated at the Geotechnical Engineer's recommendation.

3.06 GENERAL SITEWORK

- A. Before depositing fill material, remove vegetation and other unsuitable materials. Do not place fill on a subgrade that contains frost, is muddy or frozen.
- B. Fill and grade to attain elevations indicated +/- 0.1' less allowance for placement of aggregate, concrete, walks, drives and parking areas, and topsoil.
- C. Outside of structures, in areas designated to receive topsoil, grade, or fill and compact specified earth, to bring areas to finished grade +/- 0.1' less six (6") inches for placing topsoil.

3.07 GRADING

- A. Grade to uniform levels and slopes, without abrupt changes. Make transitions from levels to slopes smooth and with large radius cuts.
- B. Finish areas to a reasonably true and even plane at required elevations, less allowances for items specified above.
- C. Along the lines indicating the limits of work, taper finish grade to the existing grade at a slope matching the natural contour. Perform all of this work within the limit lines.

3.08 FILLING

- A. Where soft spots are taken out at the direction of the Geotechnical Engineer, backfill with specified engineered fill. Deposit fill in loose lifts not to exceed six (8") inches and thoroughly compact each lift before placing succeeding lifts.
- B. Within the structure lines and for a distance of five (5') feet outside of building lines, place specified engineered fill in loose lifts not to exceed eight (8") inches and thoroughly compact each lift before placing succeeding lifts.

3.09 COMPACTION DENSITIES

- A. Compaction density requirements of all engineered fill shall be per the Geotechnical Engineer's recommendations.

3.10 COMPACTION TESTING

- A. While filling and compacting operations are in progress, Geotechnical Engineer will make density tests at random depths and at random locations to determine adequacy of compaction. If compaction tests do not meet specified densities, take action to compact to require densities and pay for retesting to prove compaction densities.

3.11 PLACING OF TOPSOIL

- A. Place topsoil in areas disturbed by construction and not covered by paving, buildings and other hard-surfaced materials.
- B. When directed by Engineer or Owner's Representative, scarify sub-grade to a depth of three (3") inches and spread topsoil uniformly to bring finished grade to elevations indicated after topsoil has been lightly compacted with roller. Topsoil shall be six (6") inches thick.
- C. Level and slope topsoil as indicated so that finished grades are +/- 0.1' elevations indicated.

3.12 CLEAN-UP

- A. After all other work of this section is completed, leave area clean and free of any debris.

END OF SECTION

SECTION 02220

FOUNDATION, EXCAVATING, AND BACKFILLING

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section GC 1-20: General Conditions
- B. Section 01710: Clean-up
- C. Section 01720: Record documents required
- D. Section 02210: Site grading and filling
- E. Division 15 – Mechanical Work
- F. Division 16 – Electrical Work

1.02 QUALITY ASSURANCE

- A. A Geotechnical Engineer will be employed and paid for by the Owner to inspect foundation bottoms, except when Geotechnical Engineer is notified by Contractor that work requiring inspection will be in progress and he comes to the job site and work is not in progress. In that case, the Contractor shall pay for Geotechnical Engineer's time and mileage.
- B. The Contractor shall pay for any retesting required as a result of work not meeting project specifications.

1.03 PROTECTION:

- A. Protect utilities and other items of physical property to remain in place.
- B. Protect excavations and grounds from water ponding and water damage. pump as required to remove water.

1.04 VERIFYING:

- A. Lay out building lines and verify grades. Prior to construction, building location must be staked and certified by a registered engineer or surveyor acceptable to the Engineer. If discrepancies exist between actual lines and elevations and those indicated on drawings, notify Engineer and obtain a decision before starting work.

1.05 COORDINATION:

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- A. Coordinate with other trades whose work will be affected by this work. Especially coordinate with plumbing and electrical trade for pipes and conduits required to pass below foundations.

PART 2 - PRODUCTS

2.01 EARTH FILL

- A. Clean earth (free from organic material, cinders, ice and rocks over two (2") inches in their longest dimension) consisting of low plasticity clay having a plasticity index of less than 35. Material should exhibit a standard proctor dry density of at least 90 p.c.f. Refer to soils report for compaction densities at particular locations.
- B. On-site earth removed during cutting operations may be used if it meets the above requirements.

2.02 GRANULAR FILL

- A. Crushed stone conforming to Tennessee D.O.T. Specification "303, Grading D, crusher run" shall be used under concrete foundations and as backfill for exterior concrete walls, unless otherwise indicated.

2.03 LEAN CONCRETE

- A. Refer to Cast-in-place Concrete Section. Use 1500 psi concrete when placed with a 4 to 6 inch slump for filling where it is necessary to overexcavate because of soft spots. See 3.02 Excavating section below.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Have the Geotechnical Engineer inspect all foundation excavations prior to placement of concrete.

3.02 EXCAVATING

- A. Excavate to depths indicated. If forms are required, provide sufficient space to permit erection of forms, shoring, construction and inspection.
- B. Do not excavate to full depth when there is probability of frost forming or ground freezing in excavations before concrete is placed.
- C. Level bottoms of trenches and excavations. Where elevation changes are required, bench excavation.

- D. Foundation trenches may be cut to true size where earth is firm enough to permit it, so that concrete can be placed without forms, unless unknown conditions prohibit it.
- E. As subgrade areas are exposed and inspected and approved by the Geotechnical Engineer, a thin concrete mud-mat of 1 to 2 inches should be placed to protect the foundation soils until the excavation is complete and the concrete mat foundations are placed.
- F. For excavation to go to rock, any crevasses or slots which are encountered should be hand cleaned and filled with lean concrete as directed by the Geotechnical Engineer. Soft soils will need to be substantially removed to provide sufficient rock surfaces for concrete to bond.
- G. Keep excavations dry by sloping ground away from holes and trenches. Furnish pumps to keep spaces clear of water, where necessary.
- H. For foundations to bear on soil: If rock is encountered during excavation, remove as necessary to provide foundation system indicated on Drawings. Dispose of excavated rock in an approved manner. If rock pinnacles are encountered within twelve (12") inches below the foundation bottom, the rock should be overexcavated and backfilled with select backfill as indicated in the soils report.
- I. When excavation reaches full depth, Geotechnical Engineer will inspect for adequacy of bearing. If Geotechnical Engineer directs, excavate to a greater depth and backfill with specified concrete. In this case, keep accurate records of material removed and concrete placed.
- J. Drilling and blasting shall be conducted with due regard for the safety and property in the vicinity and in strict conformity with requirements of all ordinances, laws, and regulations governing blasting and the use of explosives. Rock excavation near existing pipelines or other structures shall be conducted with the utmost of care to avoid damage using mechanical methods of rock demolition and removal.

3.03 BACKFILL AND COMPACTING

- A. Do not perform this work until Engineer has approved foundations below grade, and other construction to be covered up.
- B. Before depositing backfill, remove vegetation and other unsuitable material. Do not place backfill on subgrade that is muddy or is frozen.
- C. Use caution to protect walls from unbalanced loads. Place foundation drains and waterproof walls.
- D. Backfill all retaining walls with granular fill Tennessee D.O.T. Specification 303

Class A, Grading D. Place and compact in 6" lifts to levels of adjacent grades.

- E. Backfill foundation walls with granular fill or suitable on-site material approved by the soils Engineer. Place and compact in six (6") inch lifts to levels of adjacent grades.
- F. Where backfill is placed against exterior concrete walls to a level above finished floor, place backfill to subgrade level, place vapor barrier or waterproofing, and pour slab before placing full height of backfill.

3.04 CLEAN-UP

- A. Remove excess excavated materials from job site and when work is completed, leave site in a clean condition.

END OF SECTION

SECTION 02221

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 RELATED WORK

- A. Section 01050: Field Engineering
- B. Section 01150: Measurement and Payment
- C. Section 01530: Barriers
- D. Section 01570: Traffic Regulations
- E. Section 01720: Project Record Documents
- F. Section 02100: Erosion Control
- G. Section 02260: Finish Grading
- H. Section 02485: Seeding

1.02 JOB CONDITIONS

- A. Provide for uninterrupted surface water flow during the work. Provide means whereby storm water can be uninterrupted in existing gutters and surface drains, or temporary drains.
- B. All pipe shall be installed in a dry trench. No extra compensation shall be allowed for trench dewatering.
- C. Immediately notify the Engineer of any unexpected subsurface or other unforeseen conditions. Discontinue work in area until Engineer provides notification to resume work.
- D. Existing utilities, poles, service lines, fences, structures, trees, shrubs, or other improvements encountered during the construction, whether above or below ground, shall be protected by the Contractor. Any item damaged or removed by the Contractor shall be repaired or replaced at the Contractor's expense to at least its original condition and to the satisfaction of the Owner. It shall be the Contractor's responsibility to locate any existing utilities in the path of construction.
- E. Adjacent structures which may be damaged by excavation work shall be underpinned or supported by other means.
- F. Excavations shall be protected by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave in or loose dirt from falling into excavation.

1.03 PERMITS

- A. Permits shall be obtained from authorities having jurisdiction prior to any explosives being brought to the site. The Contractor shall be responsible for providing such insurance that is required to hold the Owner harmless from any claims that may arise due to blasting operations at the site. The minimum insurance requirement will be that which is outlined in the General Conditions.
- B. All conditions set forth in the Corps of Engineers 404 Permit and Tennessee Valley Authority 26A Permit (if applicable) shall be strictly adhered to. The Owner shall obtain the appropriate permit.

1.04 QUALITY ASSURANCE

- A. 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 the proper performance of the work in this section shall be used.
- B. Equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner shall be used.

PART 2 - PRODUCTS

2.01 WATER SERVICE LINES

A. BEDDING MATERIALS

- 1. Material excavated from the trench, free from large stones (any dimension greater than two (2") inches), clods, debris, or frozen lumps shall be used.
- 2. Borrow materials previously approved by the Engineer may be used for backfill material if suitable material is not available from trench.
- 3. Frozen materials shall not be used.

B. CRUSHED STONE MATERIAL SHALL BE USED AS FOLLOWS:

- 1. On road crossings where open cut crossings are made, crushed stone shall be used for haunching and backfill.
- 2. In areas where rock excavation is required for installation of pipe, crushed stone shall be used for bedding, haunching, and initial backfill.

2.02 UNSUITABLE MATERIALS

- A. Wherever muck, soft clay or other material unsuitable for pipe beds or backfilling is encountered, remove it and continue excavation until suitable material is encountered. If suitable material is not encountered at a reasonable depth, the Engineer shall instruct the Contractor as to the limits of removal and procedure for stabilization.

- B. The material removed shall be disposed of in a manner acceptable to the Engineer.
- C. Refill the areas excavated for this reason with TDOT Size No. 3 crushed stone up to the level of the lines, grades or cross sections shown on the Drawings. The top six (6") inches of this refill shall be TDOT Size No. 67 crushed stone for bedding.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Line and grade for trench shall be established.
- B. Location of all underground utilities, existing and proposed shall be located.
- C. Location of existing sewer laterals, manholes and service connections shall be located prior to commencement of trenching.
- D. Location of existing water services, meters, and appurtenances shall be located prior to commencement of trenching.

3.02 PERFORMANCE

- A. All earthwork and trenching operations shall comply with the requirements of OSHA Construction Standards for the construction industry (29 CFR part 1926).
- B. Unless otherwise shown on the drawings or required by the specifications or authorized by the Engineer, all work shall be done in open, vertical trenches. Any sheeting driven below the level of the top of the pipe shall not be disturbed or removed. The responsibility for assessing the need for sheeting and analyzing the stresses induced shall be the total responsibility of the Contractor.
 - 1. Trench sheeting left in place shall be backfilled to a level of twelve (12") inches above the top of the pipe. It shall then be cut off and the upper portion removed.
 - 2. Sheeting for structures shall be left in place until backfill has been brought to a level of twelve (12") inches above the top of the bottom footing. It shall then be cut off and removed.
- C. Clearing, including removal of surfacing and pavement, shall be done as necessary to carry on the construction in the proper manner. Material shall be removed only to minimum width necessary to allow adequate construction area. Concrete and asphalt shall be saw cut.
- E. If rock is encountered in the trench, it shall be excavated in a manner approved by the Owner and as specified below:
 - 1. No separate payment for trench rock excavation will be made. Trench excavation shall be considered unclassified.
 - 2. Trench shall be undercut six (6") inches where rock is in the trench and

- backfilled with crushed stone.
3. Drilling and blasting operations shall be conducted with due regard for the safety of persons and property in the vicinity and in strict conformity with requirements of all ordinances, laws, and regulations governing blasting and the use of explosives. Rock excavation near existing pipelines or other structures shall be conducted with the utmost of care to avoid damage.
 4. All drilling, blasting, and use of explosives shall be in strict accordance with OSHA standards for the construction industry (29 CFR part 1926).
- F. Excavated material suitable for backfilling shall be stockpiled no closer than two (2') feet from the edge of the trench and shall not obstruct crosswalks, sidewalks, or street intersections, and shall not cause unreasonable interference with travel on the streets by occupants of adjacent property. Gutters and other drainage facilities shall not be obstructed. Free access shall also be maintained to fire hydrants, mailboxes, sewer and water manholes, gas meters, or other municipal facilities.
- G. Cut the banks of trenches between vertical parallel planes equidistant from the pipe centerline. The horizontal distance between the vertical planes or, if sheeting is used, between the inside faces of that sheeting, shall vary with the size of the pipe to be installed, but shall not be more than the distance determined by the following formula: $[(1.33 \times D) + (2 \times 10 \text{ inches})]$, where "D" represents the internal diameter of the pipe in inches.
- H. When approved in writing by the Engineer, the banks of trenches from the ground surface down to a depth not closer than one (1') foot above the top of the pipe may be excavated to non-vertical and nonparallel planes, provided the excavation below that depth is made with vertical and parallel sides equidistant from the pipe centerline in accordance with the formula given above.
- I. Any cut made in excess of the formula $[(1.33 \times \text{Dia. in Inches}) + (2 \times 10 \text{ inches})]$ shall be at the expense of the Contractor and may be cause for the Engineer to require that stronger pipe or a higher class of bedding be used at no cost to the Owner.
- J. For rigid pipe, shape the bottom of all trenches to provide uniform bearing for the bottom of the pipe barrel.
- K. Do not excavate pipe trenches more than 200 feet ahead of the pipe laying, and perform all work so as to cause the least possible inconvenience to the public. Construct temporary bridges or crossings when and where the Engineer deems necessary to maintain vehicular or pedestrian traffic.

- L. In all cases where materials are deposited along open trenches, place them so that in the event of rain or surcharge loading from such deposits no damage will result to the work or to adjacent property.

3.03 STRUCTURE EXCAVATION

- A. Structure excavation shall not be greater in horizontal area than that required to allow a two (2') foot clearance between the outer surface of the structure and the walls of the adjacent excavation or of the sheeting used to protect it. The bottom of the excavation shall be true to the required shape and elevation shown on the Drawings.
- B. Cut excavation without rounded corners. Allow no rock projections into the neat lines of the structures.
- C. Structure excavation may be performed with non-vertical banks except beneath pavements or adjoining existing improvements.
- D. No earth backfilling will be permitted under structures. Should the Contractor excavate below the elevations shown or specified, he shall, at his own expense, fill the void with either concrete or granular material approved by the Engineer.
- E. Maintain excavation free from standing water.
- F. Request Engineer approval of excavation prior to structure construction/installation.

3.04 BEDDING, HAUNCHING, AND BACKFILLING

- A. Pipe shall be installed as shown on the drawings.
- B. Initial backfill shall be hand placed and compacted to provide cover over the pipe. Pipe shall be protected from large particles of backfill material.
- C. Balance of backfill shall be placed by a method which will not damage or displace the pipe, nor cause bridging action in the trench. Backfill material shall be compacted with earthmoving equipment as material is placed so that excessive settlement of the trench material will not occur. Material shall be neatly mounded over the trench. Trench and settled areas shall be maintained as they occur. Finish grade shall be completed to eliminate uneven areas.

3.05 TESTING OF BACKFILL

- A. A testing laboratory or the Owner shall verify compaction of the bedding and haunching material after placement and compaction.

END OF SECTION

SECTION 02260
FINISH GRADING

PART 1 - GENERAL

1.01 RELATED WORK

- A. Section 02210: Site Grading and Filling
- B. Section 02221: Trenching, Backfilling, and Compacting
- C. Section 02485: Seeding

1.02 SITE COMPACTION TESTING

- A. Testing of compacted fill materials shall be performed by an independent testing laboratory appointed and paid for in accordance with Section 01410.
- B. When work of this section or portions of work are completed, notify the testing laboratory to perform density tests. Do not proceed with additional portions of work until results have been verified.
- C. If, during progress work, tests indicate that compacted materials do not meet specified requirements, remove defective work, replace, and retest at no cost to Owner.

1.03 SAMPLES

- A. Submit minimum ten (10 lb.) pound samples of each type of excavated fill material to be used. Forward samples to testing laboratory, packed tightly in containers to prevent contamination.
- B. If recent test results are available for fill materials to be used, disregard sample submission and submit such test results to the testing laboratory for approval. Such test results are to clearly indicate types of materials and composition, hardness, compactability, and suitability for proposed usage.

1.04 PROTECTION

- A. Prevent damage to existing fencing, trees, landscaping, natural features, benchmarks, pavement, utility lines, and structures. Correct damage at no cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Topsoil: Friable loam free from subsoil, roots, grass, excessive amount of weeds, stones and foreign matter; acidity range (pH) of 5.5 to 7.5; containing a minimum of 4% and a maximum of 25% organic matter. Use topsoil stockpiled on site if conforming to these requirements.

PART 3 - EXECUTION

3.01 SUB-SOIL PREPARATION

- A. Rough grade sub-soil systematically to allow for a maximum amount of natural settlement and compaction. Eliminate uneven areas and low spots. Remove debris, roots, branches, stones, and etc., in excess of three (3") inches in size. Remove sub-soil which has been contaminated with petroleum products.
- B. Cut out areas, to sub-grade elevation, which has been contaminated with petroleum products.
- C. Bring sub-soil to required levels, profiles, and contours. Make changes in grade gradual. Blend slopes into level areas.
- D. Slope grade away from building minimum two (2") inches in ten (10') feet unless indicated otherwise on drawings.
- E. Cultivate sub-grade to a depth of three (3") inches where topsoil is to be placed. Repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted sub-soil.
- F. Compact sub-soil to the following:
 - 1. Under Topsoil: 85 percent modified Proctor, ASTM D1557.
 - 2. Under Streets, Drives, and Parking Areas: 95 % modified Proctor ASTM D1557.
 - 3. Under Walks: 85 % modified Proctor, ASTM D1557.

3.02 PLACING TOPSOIL

- A. Place topsoil in areas where seeding and planting is to be performed. Place to the following minimum depths, up to finished grade elevations.
 - 1. Six (6") inches for seeded areas.
 - 2. Twenty-four (24") inches for shrub beds.
- B. Use topsoil in relatively dry state. Place during dry weather.
- C. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles, and contours of sub-grades.
- D. Remove stone, roots, grass, weeds, debris, and other foreign material while spreading.
- E. Manually spread topsoil around trees, plants, and buildings to prevent damage which may be caused by grading equipment.
- F. Lightly compact placed topsoil.

3.03 SURPLUS MATERIAL

- A. Remove surplus sub-soil and topsoil from site.
- B. Leave stockpile areas and entire job site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 02444

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 RELATED

- A. Section GC 1-20: General Conditions
- B. Section 01340: Shop Drawings, Product Data, and Samples
- C. Section 03300: Cast-in-Place Concrete
- D. Section 11010: Mechanical Equipment General
- E. Section 150001: Mechanical General Provisions
- F. Division 15 – Mechanical Work
- G. Division 16 – Electrical Work

1.02 ERECTOR QUALIFICATIONS

- A. Completion of twenty (20) equivalent installations

1.03 REFERENCES

- A. Chain Link Fence Manufacturers Institute (CLFMI) – Standard Guide for Chain Link Fence Installation.
- B. ASTM A123 - Zinc (Hot Dip-Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A392 – Zinc-Coated Steel Chain Link Fence Fabric
- D. ASTM A824 – Metallic Coated Steel Tension Wire
- E. ASTM A1083 – Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Fence Structures
- F. ASTM F567 – Installation of Chain Link Fence
- G. ASTM F626 – Fence Fittings
- H. ASTM F668 – Specification for Polymer Coated Chain Link Fence Fabric
- I. ASTM F900 – Industrial and Commercial Swing Gates

- J. ASTM F934 – Specification for Standard Colors for Polymer-Coated Chain Link
- K. ASTM F1043 – Specification for Strength and Protective Coatings of Steel Industrial Chain Link Fence Framework

1.04 SHOP DRAWINGS AND PRODUCT DATA

- A. Submit shop drawings and product data in accordance with Section 01340.
- B. Clearly indicate plan layout, grid, spacing of components, accessories, fitments, and anchorage.
- C. Submit manufacturer's installation instructions and procedures, including standard details of fence and gate installation.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Galvanized Fencing and Gates
 - 1. Framework: ASTM A1083; Schedule 40, butt weld, standard weight, hot dip galvanized to 2.0 oz/sq. ft coating.
 - 2. Mesh: FS RR-F-00191 Type I – Zinc-coated steel.
- B. Vinyl Coated Fencing and Gates
 - 1. Framework: ASTM A1083; Schedule 40, butt weld, standard weight, vinyl coating fused and bonded to the exterior zinc coating of the galvanized pipe in accordance with ASTM F1043.
 - 2. Mesh: ASTM F668 Class 2B thermally fused and bonded. Color shall be Black in compliance with ASTM F934.

2.02 CONCRETE MIX

- A. Concrete: ASTM C94, Portland Cement, 2,500 psi at twenty-eight (28) days, two (2") to three (3") inch slump.

2.03 COMPONENTS

- A. Line Posts: 2.00 inch diameter. Galvanized Steel tubing.
- B. Corner and Terminal Posts: 4.00 inch diameter. Galvanized Steel tubing.
- C. Gate Posts: 4.0 inch diameter. Galvanized Steel tubing (Maximum Leaf width fourteen (14') feet).

- D. Top and Brace Rail: 1.625 inch diameter. Plain end, sleeve coupled.
- E. Gate frame: 1.90 inch diameter. Galvanized Steel tubing.
- F. Caps: Cast or pressed steel, or malleable iron, hot dip galvanized sized to post dimension, set screw retained.
- G. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings, steel galvanized.
- H. Fabric: Two (2") inches diamond mesh, interwoven, 9 gauge, 0.148" nominal diameter coated wire top selvage twisted tight, bottom selvage knuckle end closed.
- I. Bottom Tension Wire: 6 gauge steel single strand, galvanized.
- J. Swing Gates: Galvanized steel pipe welded fabrication in compliance with ASTM F900. Gate frame members 1.625 in. outside diameter ASTM F 1083 schedule 40 galvanized steel pipe. Frame members spaced no greater than 8 ft. apart vertically and horizontally. Welded joints protected by applying zinc-rich paint in accordance with ASTM Practice A780. Positive locking gate latch, pressed steel galvanized after fabrication. Galvanized malleable iron or heavy gauge pressed steel post and frame hinges. Provide lockable drop bar and gate holdbacks with double gates. Match gate fabric to that of the fence system. Gateposts per ASTM F1083 schedule 40 galvanized steel pipe. Gateposts shall be 4.00 inches outside diameter. For polymer coated gate frames and gateposts; match the coating type and color to that specified for the fence framework. Moveable parts such as hinges, latches and drop rods may be field coated using a liquid polymer touch up.
- K. Cantilever Slide Gates: In compliance with ASTM F1184 Type II. Cantilever Slide Gates shall be Class 2 – Internal Roller Design. Gate frame fabricated by welding, vertical and horizontal members installed no greater than 8 ft. (2440 mm) apart. Class 2 cantilever slide gates to comply with the performance deflection criteria listed in ASTM F1184. Gates designed to open or close by applying an initial pull force no greater than 40 lbs. Internal truck assemblies designed to handle the forces required for gate size opening and height. Match chain link fabric to that of the fence system. Gateposts, 4.000 in. O.D. schedule 40 pipe per ASTM F1083.
- L. Gate Hardware: Gate center rest, three (3) pieces drop latch, chain gate holdbrace, gate hinge 180 degree male and female, fork latch and latch catch, drop bolt, hardware for padlock, three (3) per leaf.
- M. Provide gate stops for all gates.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install line posts, corner posts, top rails, post caps, barbed wire arms, fabric, and gates, to provide a rigid structure for fence. Use manufacturer's standard fittings, fasteners, and hardware. Slope barbed wire arms outward.
- B. Maximum spacing of posts: Equally spaced at maximum interval of ten (10') feet.
- C. Install line, corner, and terminal posts plumb, set in concrete footings as specified in CLFMA Standard. Also set terminal posts at abrupt changes in vertical and horizontal alignment.
- D. Set post in within six (6") inches from bottom of concrete footing. Slope top of concrete for water runoff. Set top of footing two (2") inches above finished grade.
- E. Position bottom of fabric two (2") inches above finished grade with tension wire stretched taut between posts.
- F. Pass top rail through line post tops to form continuous bracing. Install seven (7") inch long couplings midspan at pipe ends.
- G. Brace each gate and corner post back to adjacent line post with horizontal center brace rail. Install brace rail, one (1) bay from end and gate posts.
- H. Install center and bottom brace rail on corner and gate leaves.
- I. Fasten fabric to top rail, line posts, braces, and bottom tension wire with wire ties on maximum fifteen (15") inch centers.
- J. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
- K. Stretch fabric between terminal posts or at intervals of 100 ft. maximum whichever is the least dimension.
- L. Install three (3) strands of barbed wire on arms, tensioned, and secured.
- M. Install gates using fabric and barbed wire overhand to match fence. Install three (3) hinges per leaf, latch, catches, and drop bolt.
- N. Provide concrete center rest and drop bolt retainers at center of double gate openings.

END OF SECTION

SECTION 02485

SEEDING

PART 1 - GENERAL

1.01 RELATED WORK

- A. Section 01310: Construction Schedules
- B. Section 01560: Temporary Controls
- C. Section 01700: Contract Closeout
- D. Section 02100: Erosion Control
- E. Section 02260: Finish Grading

1.02 QUALITY ASSURANCE

- A. Seeds shall meet the requirements of the Official Seed Analysis of North America.
- B. Contractor shall provide sod where applicable for exotic grasses such as, Zoysia, Bermuda etc. The contractor and field representative shall meet with the property owner to discuss re-establishing the disturbed areas.
- C. Sod shall meet the requirements of the local producer members of Turfgrass Producers International, (TPI). TPI should be consulted on all sodding projects to gain information related to “micro-climates” and other localized conditions that could affect selection, installation and overall satisfaction with a newly sodded area.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed in original containers showing analysis of seed mixture, percentage or purse seed, year of production, net weight, date of packaging, and location of packaging. Damaged packages are not acceptable.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- C. Every shipment of sod shall be accompanied by an invoice or sales slip indicating whether the material is of a single variety, a blend or a mixture, species, and the quality grade of the shipment.

PART 2 - PRODUCTS

2.01 FERTILIZER

- A. Commercial type, 10-20-10 grade, granular type.
- B. Sod type, 16-16-16 grade, granular type.

- C. All fertilizers shall be uniform in composition, free flowing and suitable for application with approved equipment. Fertilizers shall be delivered to the site fully labeled, according to applicable fertilizer laws and shall bear the name, trade name or trademark, and warranty of the producer or manufacturer.

2.02 SEEDS

- A. Vegetation and re-vegetation of lawn type areas where scheduled maintenance and upkeep are desired and will be necessary to preserve the quality and appearance of the mature ground cover.
 - 1. Type "A" mixtures of the following:
 - (a) Type "A-1" mixture as required to match existing vegetation
 - (b) Type "A-2" Mixture of turf type tall fescue and rye consisting of: 60% turf type tall fescue -(30% certified Rebel II) (30% certified Titan) 40% turf type perennial -Rye (Palmer)
 - 2. Purity: 98 %
 - 3. Germination: 90 %
 - 4. Weed Seed: Less than 0.5 percent

- B. General vegetation and re-vegetation of pipeline trenches, tank and pump station sites, pastures, and roadway slopes where minimum maintenance and upkeep are required.
 - 1. Type "B" mixtures of the following:
 - (a) Type B-1, non-seasonal, mixture-KY-31 tall fescue - 50%, annual rye - 50%
 - (b) Type B-2, seasonal, shall consist of the following;

TIME OF YEAR	TYPE	% (BY WEIGHT)
February-May	KY-31 Tall Fescue	80
	English Rye	5
	Korean Lespedeza	15
June-September	KY-31 Tall Fescue	55
	English Rye	20
	Korean Lespedeza	15
	German Millet	10
October-January	KY-31 Tall Fescue	70
	English Rye	20
	White Clover	10
	Purity	90
	Germination	90
	Weed Seed	less than 1%
	Phyter Tall Fescue (Fungus free) shall be used in all pasture applications, with Ky-31 Tall Fescue used in other applications	

- C. Vegetation and re-vegetation of slopes greater than 3:1 or as may be otherwise specified elsewhere in the contract documents where superior soil protection, erosion prevention, and minimum maintenance and upkeep are required.
 - 1. Type "C": Mixture of the following mixture:
 - (a) Type C-1, same as Type "B"
 - (b) Type C-2, preferred for slopes of 2:1 and greater, shall consist of the following:
 - Crown Vetch: 25%
 - Ky-31 Tall Fescue: 70%
 - English Rye: 5%
 - 2. Purity: 90%
 - 3. Germination: 90%
 - 4. Weed Seed: Less than 1.0 percent
 - 5. Type C-2 shall be applied with use of a TDOT approved soil inoculant to stimulate reproduction at the rate specified by the manufacturer of the produce selected.
 - 6. Phyter Tall Fescue (Fungus Free) shall be used in all pasture applications, with KY-31 tall Fescue used in other applications.

2.03 MULCH

- A. Non-toxic to vegetation and to the germination of seed, free from noxious seeds and weed seeds, and fresh.
 - 1. Hand or machine placement - Wheat, rye, or oat straw, air dried.
 - 2. Hydro-placement - wheat, rye or oat straw; shredded newspaper or peanut hulls, or other as approved by the Engineer.
- B. Asphalt Emulsion: SS-1.

2.04 SOD

- A. Sod shall be of good quality, free of weeds, disease, and insects and of good color and density
- B. Thickness of Cut: Sod shall be machine cut at a uniform soil thickness of 0.60 inch, plus or minus 0.25 inch, at the time of cutting. Measurement for thickness shall exclude top growth and thatch.
- C. Pad Size: Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus 0.5 inch (15 mm) on width and plus or minus 5 % on length. Broken pads and torn or uneven ends will not be acceptable.
- D. Strength of Turf Sod Sections: Standard size sections of sod shall be strong enough that it can be picked up and handled without damage.
- E. Moisture Content: Sod shall not be harvested or transplanted when its moisture content (excessively dry or wet) may adversely affect its survival.

- F. Time Limitations: Sod shall be harvested, delivered and installed/transplanted within a period of twenty-four (24) hours, unless a suitable preservation method is approved prior to delivery. Sod not transplanted within this period shall be inspected and approved by the field representative prior to its installation.
- G. Delivery and Off-Loading: Sod shall be delivered to the site specified in this contract and off-loaded using equipment furnished by the sod supply contractor. Palletized or large-roll sod shall be off-loaded at the location(s) designated for this purpose at the installation site.

2.05 LIME

- A. Agricultural ground limestone, minimum 80% passing No. 8 sieve, with a minimum 80 % calcium carbonate equivalent.
- B. One (1) or both percentages greater than eighty (80) so that multiplication of the percent passing No. 8 sieve by the percent of calcium carbonate equivalent will be at least 0.72.

2.06 APPLICATION RATES

- A. Fertilizer: Ten (10 lb.) pounds per 1,000 sq. ft.
- B. Seeds:
 - 1. Type A 5.0 lbs/1000 sq. ft.
 - 2. Type B 5.5 lbs/1000 sq. ft.
 - 3. Type C 6.0 lbs/1000 sq. ft.
- C. Mulch: Two (2") inch thickness, loose measure.
- D. Asphalt Emulsion: 100 gallons per ton mulch.
- E. Lime: 75 lbs/1,000 sq. ft.

PART 3 - EXECUTION

3.01 PREPARATION

- A. When soil is in a tillable condition, cultivate to a depth of four (4") inches, reducing soil particles to a size no larger than two (2") inches for Type "B" and "C" seeding and one (1") inch for type "A" seeding.
- B. Assure seed bed is level and free of weeds, clods, stones, root, sticks, rivulets, gullies, crusting, and caking.
- C. Slopes greater than 20% shall be "raked" or "tracked" to produce horizontal grades following the surface contours to assist establishment of vegetation cover and reduce wash-off before germination.
- D. Preparation of areas designated for type "C" grassing. Disturbed area shall be:
 - 1. Brought to general contours three (3") inches below finished grades and prepared in accordance with 3.01, A and B.

2. The surface shall be tightened by "tracking" using a single pass of a D-6 class track machine with a minimum of 80% pad depth, on earth tracks traveling vertically up and down the slope.
 3. Top soil shall be placed to a uniform depth at four (4") inches over the area to bring the site up to finished grade elevations.
 4. Should seeding methods other than hydro-seeding be approved by the Engineer, lime and fertilizer shall be placed at this time.
 5. The surface shall be tightened by "tracking" using a final single pass of a D-6 class track machine with a minimum of 80% pad depth, on earth tracks traveling vertically up and down the slope. Care should be taken to establish and protect a uniform "tracking" pattern over the entire surface to assist the establishment of vegetation cover and reduce wash-off before germination.
 6. Areas that cannot be "tracked" as outlined in 3.01 - D-5 above shall be hand raked to establish horizontal lines following the surface contours.
- E. Preparation for disturbed areas for sod replacement shall be:
1. Brought to general contours to a point equivalent to the thickness of the cut below finished grades and prepared in accordance with 3.01, A and B.
 2. Moistening the Soil: During periods of higher than optimal temperature for the species being specified, and after all unevenness in the soil surface has been corrected, the soil shall be lightly moistened immediately prior to installation of the sod.
 3. Starter Strip: The first row of sod shall be laid in a straight line, with subsequent rows placed parallel to and tightly against each other. Lateral joints shall be staggered to promote more uniform growth and strength. Care shall be exercised to ensure that the pieces are not stretched or overlapped and that all joints are butted tightly to prevent voids that would cause air drying of the roots.
 4. Sloping Surfaces: On 3:1 or greater slopes, traditional size (1 sq yd / 1 sq m) sod shall be laid across the angle of the slope (perpendicular), with staggered joints and secured by tamping, pegging, stapling or other approved methods of temporarily securing each piece. Large-roll sod shall be laid in the direction of the slope, with temporary securing being at the discretion of the field representative.
 5. Swales and Intermittent Waterways: The installation of sod within drainage ways or intermittent waterways shall be determined after considering maximum channel velocities for storms of a designated intensity. Traditional size sod shall be laid perpendicular to the direction of flow and pegged to resist washout during the establishment period, while large-roll pieces shall be laid in the direction of the flow, with temporary securing being at the discretion of the field representative.

6. Watering and Rolling: The installation contractor shall water the sod immediately after transplanting to prevent drying. As sodding is completed in any one section, the entire area shall be lightly rolled. It shall then be thoroughly watered to a depth sufficient to ensure the underside of the new sod pad and soil immediately below the pad are thoroughly wet. The general contractor shall be responsible for having adequate water available at the site prior to and during installation.

3.02 FERTILIZING AND LIMING

- A. Fertilizer and lime placed mechanically shall be applied separately and mixed into the top two (2") inches of soil. Apply within forty-eight (48) hours of seeding.

3.03 MULCHING AND SEEDING

- A. Seed: Apply over the prepared area using methods that will produce a uniform application to the entire area.
- B. Mulch:
 1. Apply mulch uniformly over the area after seeding.
 2. Application shall be undertaken in a manner as to minimize bald and tightly clumped spots in the mulch that will adversely affect the seed germination and growth.
 3. Mulch shall be tacked with SS-1 or other methods as approved by the Engineer to hold mulch in place until development of the vegetation cover.
- C. Hydroseeding: Apply complete mix of fertilizer, lime, seed, and mulch uniformly over the entire area to produce a final application free of bald or weak spots and of the rates specified herein.

3.04 MAINTENANCE PERIOD

- A. Maintenance Period: Until final acceptance.

3.05 MAINTENANCE

- A. Maintain surfaces; supply additional topsoil and re-seed/sod where necessary, including areas affected by erosion.
- B. Water the entire area to ensure uniform seed germination, establish sod root system and re-water regularly to keep surface of soil damp and promote proper growth.
- C. Apply water slowly so that surface of soil will not puddle and crust.
- D. The contractor shall supply adequate water to the site. The single-most important factor in the successful rooting of newly installed sod/seeding is adequate, regular watering. Watering should begin immediately after installation. The amount of water required will vary depending upon season, weather, temperature, wind, slope, and sod/seed variety. The contractor shall ensure adequate water supply and application.

1. First Week: The contractor shall provide all labor and arrange for all watering necessary for rooting of the sod/seed. Soil on sod pads shall be kept moist at all times. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary during the first week and in sufficient quantities to maintain moist soil to a depth of at least four (4") inches. Watering should be done during the heat of the day to prevent wilting.
2. Second and Subsequent Weeks: The contractor shall water the sod/seed as required by the manufacturer to maintain adequate moisture in the upper four (4") inches of soil, necessary for the promotion of deep root growth.

3.06 ACCEPTANCE

- A. Seeded/Sodded areas will be accepted at end of maintenance period when seeded/sodded areas are properly established and otherwise acceptable.

END OF SECTION

SECTION 02540

SEWER FLOW CONTROL AND BYPASS PUMPING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Sewer flow control required to perform manhole replacement, sewer line replacement, television inspection, sewer line testing, and sewer line sealing. Flow control is required for all sewer line replacements and when sewer line flow is greater than one-third of the pipe diameter when inspecting pipe.

1.02 RELATED DOCUMENTS

- A. Section 01570: Traffic Regulations
- B. Section 01710: Cleaning
- C. Section 02722: Sanitary Sewers, Force Main and Appurtenances

1.03 SUBMITTALS

- A. A Flow Control Plan shall be submitted a minimum of forty-eight (48) hours prior to controlling flow. The Plan shall include, at a minimum:
 - 1. Estimate of peak flow.
 - 2. Detailed procedure for handling peak estimated flow.
 - 3. Schedule.
 - 4. Listing and informational drawings of proposed equipment including plugs, bypass pump(s), hoses, including sizes, capacities, power requirements, and material types.
 - 5. Plan for notifying sewer customers.
 - 6. Operation plan.
 - 7. Emergency procedures.
- B. Owner and Engineer will review the plan and either approve or comment on its contents. Contractor shall address comments and satisfy Owner and Engineer that the plan is sound and, that it will adequately address both low flows and peak flows within the portion of the collection system being affected by the work.

1.04 JOB CONDITIONS

- A. Notify the Engineer immediately if unusual or unexpected conditions are encountered. Discontinue Work until Engineer provides notification to resume Work.
- B. All Work in streets and roadways shall be conducted in strict accordance with provisions of Section 01570.
- C. Contractor shall plan the Work and arrange the Work schedules to minimize the length of the time sewer service is interrupted.

1.05 QUALITY ASSURANCE

- A. Adequate numbers of skilled workman who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specific requirements and the methods needed for proper performance of the Work in this section shall be provided and used to complete the work. Equipment adequate in size, capacity and numbers to accomplish the Work in a timely manner shall be provided and used to complete the Work.
- B. Contractor shall provide an adequate on-the-job supervisor of all Work and workmen to assure the Work meets all requirements of the Contract.

PART 2 - PRODUCTS

2.01 FLOW CONTROL SYSTEMS

- A. Provide adequate capacity and sized equipment to handle estimated flows. Equipment shall be capable of handling a minimum of 150 percent of the estimated peak flow.
- B. Plugs shall include connections for pressure gauges and air hoses, and shall include flow through capability. For pipe sizes less than twenty-four (24") inches, plugs shall be mechanical type with rubber gaskets or, shall be pneumatic type with rubber boots. For pipe sizes twenty-four (24") inches or greater, plugs shall be two-piece inflatable bag stoppers.
- C. Discharge piping shall be HDPE or DIP and shall be leak free, with butt-fused (HDPE) or rubber gasketed (DIP) joints. Discharge piping may be reused on subsequent placements if approved by the Owner.
- D. Flexible discharge piping may be used for low pressure flow control and low flow conditions, as determined by the Contractor. Flexible discharge hoses may not be used for controlling flow from sewer pipe sizes in excess of ten (10") inches.
- E. Bypass pumps shall be fully automatic self-priming units. Pumps shall be designed to handle a minimum of three (3") inch diameter solid and shall be capable for running dry for long periods of time without pump/ motor failure. Engines shall be low noise type (max ninety (90) decibels at fifty (50') feet). Provide one stand-by pump of each type utilized for the work.

PART 3 – EXECUTION

3.01 GENERAL

- A. Secure approval of "Traffic Control Plan" prior to working in roadways.
- B. Install barriers, signs and other devices to identify and protect the work site and all adjacent areas.
- C. Notify all properties that will or potentially have sewer service disruptions due to the planned work activities.
- D. Notify Owner a minimum of forty-eight (48) hours prior to implementing system.

- E. Operate and maintain the system seven (7) days per week and twenty-four (24) hours per day, no exceptions.
- F. Eliminate all flow from sewer line sections where point repairs, service connections, manhole construction, pipe replacement or rehabilitation are to occur.
- G. Remove flow control equipment and accessories after work is completed and pipe section is placed back into service, with approval of the Owner.

3.02 PLUGGING AND BLOCKING

- A. A sewer line plug shall be inserted into the lines upstream of the line section being worked. Secondary plugs are required where pipe diameters exceed ten (10") inches.
- B. Plugs shall be so designed that all or any portion of the sewage can be released. During TV inspection, testing and sealing operations, flow shall be reduced to within the limits specified above.
- C. After the Work has been completed, flow shall be restored to normal in controlled, gradual manner such that downstream surcharging is prevented.
- D. Temporary plugs shall be removed at the end of each day if the downstream pipe sections can handle the restored flow.

3.03 PUMPING AND BYPASSING

- A. When pumping and bypassing is required the Contractor shall supply the pumps, conduits, and other equipment to divert the flow of sewage around the line section in which Work is to be performed.
- B. Bypass pumping shall be performed in a manner that will not damage public or private property or create a nuisance.
- C. Provide a minimum of 72-hour notice to customers whose sanitary sewer service will potential be interrupted.
- D. Dumping sewage on private or public property in any form or fashion is strictly prohibited.**
- E. Contractor is responsible for all power requirements for bypass pumps and standby units.
- F. Service for disconnected sewer service connections shall be maintained in a manner approved by the Owner.

3.04 FLOW CONTROL PRECAUTIONS

- A. When flow in a sewer line is plugged, blocked, or bypassed; sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging.

- B. Contractor is solely responsible for any damage to public or private property and any claims resulting from the damage, which are a result of a failure of the flow control system.
- C. Precautions must also be taken to ensure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved.

3.05 QUALITY CONTROL AND MAINTENANCE OF SYSTEMS

- A. General:
 - 1. Contractor shall perform pressure and leakage tests of the system using clean water prior to bypass operations. Tests shall be performed at a minimum of 1.5 times the maximum working pressure of the system.
 - 2. Pressure and leakage tests shall be witnessed by the Owner.
- B. Inspection and Maintenance:
 - 1. Contractor shall inspect bypass system a minimum of every two (2) hours to ensure that it is operating correctly.
 - 2. Contractor shall ensure that the system is properly maintained and, that an operator is on hand at all times when pumping operations are occurring.
- C. Cleaning:
 - 1. Prior to tearing down and moving the system to a different location, all sewage within the system must be flushed to an existing operable sanitary sewer main.
 - 2. Areas disturbed by the operation must be cleaned and restored, including pavements, to a condition as good as better than prior to the operation taking place.

3.06 ADDITIONAL RESPONSIBILITIES OF THE CONTRACTOR

- 1. In the event of any Contractor-related overflow or interruption/backup of customer service, the Contractor shall immediately notify the Engineer and Owner. The Contractor shall contain and eliminate the overflow/interruption.
- 2. The Contractor shall be responsible for any fines levied by others, reimbursement of any agency incurred costs, damage, cleanup, restoration of flow and any disruption of service costs to customers as a result of the Contractor's work. This in addition to any and all costs incurred by the customer.
- 3. The Contractor shall respect the rights of property owners, and not enter upon private property without obtaining permission from the owner of the property.
- 4. For manholes located in easements of private property, the Contractor shall provide the residents with 24-hour advanced notice for easement access prior to entering the property, unless the resident provides immediate permission.

3.07 CLEAN-UP

- A. Clean-up and final completion of Work.
 - 1. Upon acceptance of the Work, the Contractor shall reinstate the Project areas affected by the operations.
 - 2. Removal and replacement of fences, damage repair to yards, lawns, sidewalks, driveways, roads, other utilities, etc. due to movement of by-pass pumping equipment, excavating or other equipment and/or erection of equipment and/or any other activities associated with the Work shall be the sole responsibility and the sole cost of the Contractor unless specifically designated for payment under the Contract Unit Price Schedule.

END OF SECTION

SECTION 02713

WATER LINES, VALVES, AND APPURTENANCES

PART 1 - GENERAL

1.01 RELATED WORK

- A. Section 01050: Field Engineering
- B. Section 01090: Reference Standards
- C. Section 01150: Measurement and Payment
- D. Section 01340: Shop Drawings, Product Data, and Samples
- E. Section 01530: Barriers
- F. Section 01570: Traffic Regulations
- G. Section 01720: Project Record Documents
- H. Section 02100: Erosion Control
- I. Section 02221: Trenching, Backfilling, and Compacting
- J. Section 02485: Seeding

1.02 QUALITY ASSURANCE

- A. The Contractor shall install, test, and disinfect water lines in accordance with regulations issued by the Tennessee Department of Environment and Conservation and the Caryville-Jacksboro Utilities Commission.
- B. The Contractor shall disinfect all potable water lines, fittings, valves, and appurtenances in accordance with regulations issued by the Tennessee Department of Environment and Conservation and Caryville-Jacksboro Utilities Commission.
- C. 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 in this section shall be used.
- D. Equipment adequate in size, capacity, and numbers to accomplish the work in a timely manner shall be used.

1.03 REFERENCES

- A. ASTM 2241: Poly (Vinyl Chloride) (PVC) Pipe (SDR-PR).

- B. AWWA C104: Cement-Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fittings for Water.
- C. AWWA C110/C153 - Gray Iron and Ductile-Iron Fittings, 3 in. through 48 in. for Water and other Liquids.
- D. AWWA C111 - Rubber Gasket Joints for Cast-Iron and Ductile-iron Pressure Pipe and Fittings.
- E. AWWA C151 - Ductile-Iron Pipe Centrifugally Cast, in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- F. ASTM D2412: Standard Test Method For Determination of External Loading Characteristics of Plastic Pipe By Parallel-Plate Loading.
- G. ASTM D1784: Rigid PVC Compounds and Chlorinated PVC Compounds
- H. ASTM F477: Elastomeric Seals For Joining Plastic Pipe
- I. ASTM B88 - Seamless Type K Copper Water Tube.
- J. AWWA C500: Gate Valves
- K. AWWA C508: Swing Check Valves
- L. AWWA C700: Cold Water Meters - Displacement Type
- M. AWWA C701: Cold Water Meters - Turbine Type for Customer Service
- N. AWWA C901: Polyethylene Tubing
- O. AWWA C504: Butterfly Valves
- P. AWWA C502: Fire Hydrants
- Q. ASTM F877: Standard Specification for Cross-Linked Polyethylene Plastic (PEX) Hot and Cold Water Distribution Systems
- R. Other AWWA and ASTM Standards as referenced herein.

1.04 SUBMITTALS

- A. Submittals shall be submitted as specified in Section 01340, promptly and in accordance with the approved schedule, in such a sequence that no delay to the work, or to the work of other Contractors is caused.
- B. Product data shall be submitted as required.
- C. Certification signed by manufacturer and Contractor that pipe and fittings meet specification requirements shall be submitted.
- D. Submit all data for pipes, fittings, gaskets, restrainers, valves, saddles, and other components of the new water system.

- E. Five (5) certified copies of disinfection test results for potable water lines shall be submitted.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Ductile iron pipe shall be protected from damage to coating and lining.
- B. PVC piping shall be stored to protect from long-term exposure to direct sunlight and shall be stacked in suitable support systems to prevent buckling and deformation.
- C. Interior of pipe and fittings shall be cleaned of dirt and other foreign material immediately prior to lowering into the trench.
- D. Carefully examine each pipe and fitting for cracks and other defects while suspended above the trench immediately before installation.

1.06 JOB CONDITIONS

- A. Whenever pipe laying is not actively in progress, open ends of all installed pipe and fittings shall be fitted with a watertight plug.
- B. Separation of Water Mains and Sewers:
 - 1. The new water main has been located so that the proper horizontal and vertical separation from the existing sewers has been provided where the water line parallels a sewer line. However, in the event field conditions reveal that a horizontal separation of 10 feet cannot be obtained, the water line shall be laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer so that the bottom of the water main is at least 18 inches above the top of the sewer pipe.
 - 2. Whenever the water main crosses a sewer main, a minimum vertical distance of 18 inches shall be provided between pipes. This distance shall be provided whether the water main is above or below the sewer pipe. At crossings, one full length of water pipe must be located so both joints will be as far from the sewer line as possible. Special structural support for the water and sewer lines shall be provided.
 - 3. Water lines shall not pass through or come in contact with storm or sanitary sewer manholes.
- C. Inside pipe shall be properly supported and aligned in accordance with the plans.
- D. Air piping shall have proper expansion/contraction provisions.

PART 2 - PRODUCTS

2.01 GENERAL PIPING AND VALVE APPLICATIONS

- A. Unless otherwise depicted on the accompanying Drawings, the following piping and valve applications apply for this project.
1. All buried non-chemical piping four (4") inch through twelve (12") inch shall be Pressure Class 350 ductile iron pipe with mechanical joint or push-on joint ends or Polyvinyl Chloride Pipe (PVC) ASTM D-2241 SDR17, as specified on accompanying Drawings. Fittings shall be ductile iron with mechanical joint ends for pipe sizes forty-eight (48") inches and smaller and with push-on ends for pipe sizes fifty-four (54") inches and larger. Restrained joints shall be used where noted on the accompanying Drawings.
 2. All buried valves shall be as depicted on the accompanying Drawings.
 3. All interior and above-ground valves shall be as depicted on the accompanying Drawings.
 4. All buried ductile iron pipe and fittings shall be wrapped in V-Bio polyethylene encasement or approved alternate. Encasement shall meet the requirements of ANSI/AWWA C105/A21.5, be a minimum of 8 mils thick, and shall be installed in accordance with Modified Method A (single tube per length of pipe/fitting with a minimum 12-inch overlap at joints).

2.02 DUCTILE IRON PIPE AND FITTINGS

- A. General
1. Ductile iron pipe (DIP) shall be centrifugally cast meeting the requirements of ANSI/AWWA Standard C151/A21.51. Pressure Classes as described in ANSI/AWWA Standard C151 shall be used unless indicated otherwise on the Drawings.
 2. The manufacturer of the DIP shall furnish a sworn, notarized statement that the inspection and specified tests required under section 5.1.1.2 of AWWA /ANSI standard C151/A21.51 have been made and that all results thereof comply with this standard.
 3. One (1) copy of written transcripts of the results of the acceptance tests and low temperature impact tests on pipe manufactured for use in performing the scope of work described in these Specifications shall be furnished to the Engineer.
 4. The weight, class, or nominal thickness, and casting period for each length of ductile iron pipe shall be shown on each length of DIP. The manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "DUCTILE" shall be cast or metal stamped on the pipe. All required markings shall be clear and legible, and all cast or metal-stamped marks shall be on or near the bell.
 5. Approved Manufacturers:
 - a. U.S. Pipe Company

- b. American Ductile Iron Pipe Company
 - c. Griffin Pipe Products
 - d. McWane Ductile Iron Pipe Company
- B. DIP Piping Installed Outside Above-Ground and Inside Structures
- 1. All ductile iron pipe installed outside above ground and inside structures shall conform to the wall thickness requirements of Thickness Class 52 and shall be flanged and shall conform to the requirements of AWWA/ANSI Standard C151/A1.15. Unless otherwise shown, flanges shall be dimensioned for facing and drilling in accordance with ASME/ANSI Standard B16.1 Class 125 and meeting the dimensional and bolting requirements of AWWA Standard C110/A21.10, Table 14. Bolts, gaskets, and installation of flanged DIP and ductile iron fittings shall comply with the requirements of AWWA/ANSI Standard C111/A21.1, Appendix B.
 - 2. The outside of ductile iron pipe and fittings for installation outside above-ground or inside structures shall be provided to the job site prime coated as specified in Section 09910 of these Specifications.
 - 3. Buried DIP Piping
 - a. All buried ductile iron pipe shall conform to the wall thickness requirements of Pressure Class 350 and shall have mechanical joints or push-on joints in accordance with AWWA/ANSI Standard C111/A21.11.
 - b. The inside of all DIP for potable water service shall be cement mortar lined in accordance with AWWA/ANSI C104/A21.4
 - c. Fittings for all buried DIP shall be delivered to the project site with their exterior coated with asphaltic material at least one (1) mil thick that conforms to all appropriate requirements at AWWA/ANSI Standard C104/A21.4.
 - d. Fittings for all DIP installed outside above-ground or inside structures flanges shall be dimensioned for facing and drilling in accordance with ASME/ANSI Standard B16.1 Class 125 and meeting the dimensional and bolting requirements of AWWA Standard C110/A21.10, Table 14. Bolts, gaskets, and installation of flanged DIP and ductile iron fittings shall comply with the requirements of AWWA/ANSI Standard C111/A21.1, Appendix B. Fittings shall be delivered to the project site with their exterior prime coated as described at Section 09910 of these Detailed Specifications.
 - e. Fittings for buried DIP pipelines shall be ductile iron and furnished with ductile iron mechanical joint retainer glands suitable for a working pressure of 75 psi plus a surge allowance of 75 psi. Ductile iron mechanical joint retainer glands shall be manufactured by American Cast Iron Pipe Company, EBAA Iron Sales, Inc., or approved equal. All set screws on the retainer glands shall be tightened, in the presence of the Owner's Representative, using a torque wrench to the manufacturer's recommended torque. As an alternate to ductile iron mechanical joint fittings with ductile iron retainer glands, the contractor

may furnish ductile iron fittings with Field Lok™ gaskets manufactured by United States Pipe and Foundry Company, or Fast-Grip® gaskets manufactured by American Cast Iron Pipe Company, both suitable for a working pressure of 100 psi plus a surge allowance of 100 psi.

- f. Ductile iron fittings meeting the requirements of AWWA/ANSI Standard C110/A21.10 shall have distinctly cast on them the pressure rating, nominal diameters of openings, manufacturer’s identification, the country where cast, and the number of degrees or fraction of the circle on all bends and the letters "DI" or "DUCTILE". Cast letters and figures shall be on the outside body of the fitting and shall have dimensions no smaller than the following:

Size (in.)	Height of Letters (in.)	Relief (in.)
Less than 8	As large as practical	As large as practical
8-10	¾	3/32
12-48	1 ¼	3/32

- g. Ductile iron fittings meeting the requirements of AWWA/ANSI Standard C153/A21.53 shall have distinctly cast on the outside of the body AWWA/ANSI C153/A21.53; the pressure rating; nominal diameter of openings; manufacturer’s identification; the country where cast; the letters "DI" or word "DUCTILE"; and the number of degrees or fraction of the circle.

2.03 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. General
 - 1. All polyvinyl chloride (PVC) pipe shall meet ASTM D2241, ASTM D1784 Cell Class 12454, with gaskets meeting ASTM F477 and joints meeting ASTM D3139 with an SDR of 17, unless otherwise specified.
 - 2. All pipe must meet a 250 psi working pressure rating and shall be IPS. Pipe shall be clearly marked with the manufacturer’s name, nominal diameter, SDR, pressure rating, and NSF approval seal.
- B. Fittings
 - 1. All fittings shall be ductile iron, AWWA C10 or AWWA C115, pressure rating as required.
 - a. Fittings shall be flanged for inside work and mechanical joints for underground.
 - b. Lining shall be cement mortar, AWWA C104.
 - c. All piping shall be connected to fittings using a restrained system equal to:

1. Midco Perma-Grip Restrained Joint System as manufactured by Midland Manufacturing Company.
 2. Uni-Flange Series 1300 restraint for PVC Pipe as manufactured by Ford Meter Box Company.
- C. Joints
1. All joints shall be push-on joints with gaskets as recommended by the manufacturer for the application.
- D. See 2.01-A(4) above for fitting protection.

2.04 WATER SERVICE PIPE

- A. Water service lines 1-1/2" and smaller shall be PEX-a, certified to AWWA C904, rated for 160 psi.
- B. Pipe shall be approved for use with AWWA C800 fittings.
- C. Service pipe shall be used to connect the mains to the meter assemblies.
- D. Pipe shall be 3/4 inch, unless otherwise specified or shown on the plans.

2.05 CORPORATION VALVE

- A. Corporation valves shall comply with AWWA C800.
- B. Valves shall be watertight and individually tested for leaks.
- C. Valves shall be manufactured by Ford, Muller, or an approved alternative.

2.06 SERVICE SADDLE

- A. Outlet threads shall meet AWWA C800.
- B. Shell shall be 304 stainless steel.
- C. Gasket shall be made of NSF 61 certified nitrile butadiene rubber.
- D. Service saddle shall be Romac Style 304, or preapproved alternate.

2.07 TAPPING SLEEVE

- A. Tapping sleeves shall be stainless steel with removable bolts and 360-degree gasket.
- B. Tapping sleeves shall meet AWWA C223 requirements.
- C. Tapping sleeves shall be Muller H-304, Ford FTSS, Romac SST, or approved alternate.

2.08 RESILIENT - SEATED GATE VALVES

- A. Resilient-Seated Gate Valves shall be iron body, Resilient-Wedge design rated for 250 psi working pressure, non-rising stem turning clockwise to open. Valves shall meet the requirements of AWWA C-515. The wedge shall be of ductile iron encapsulated with EPDM rubber and shall seal in either direction of flow.
- B. Valves shall be furnished with standard operating nut for yard installations and operating hand wheel for all interior installations unless otherwise specifically noted.

Valves shall operate smoothly through the entire lift and shall have an unobstructed waterway with a diameter not less than a full nominal diameter of the valve.

- B. Valve boxes shall be standard design cast-iron with cover. Boxes shall have an outside diameter of not less than 4 inches with a minimum thickness of metal at any point of not less than 0.1875 inches. Boxes shall be set in a concrete pad of minimum dimensions 18" x 18" x 6" with 4, #4 bars at fourteen (14") inches long each centered in the pad.
- C. All Resilient-Seated Gate Valves shall be mechanical joint type for yard installations and flanged joint type for all interior installations unless otherwise specifically noted.
- D. Gate valves for two (2") inch and smaller water service shall be iron body, bronze trim, non-rising stem, with operating nut for underground installations and hand-wheel operated for above ground installation.

2.09 AIR RELEASE VALVES

- A. Air Valves shall be ARI Model S-050-C (1") or Model D-04C (2") with reinforced nylon body with a protective ductile iron shell and shall be furnished and installed as shown in the Typical Details. These valves will be field located by the Owner's Representative during construction.

2.10 STEEL AND RUBBER COUPLINGS

- A. Steel couplings, where shown on the Drawings, shall be Dresser or Smith Blair, steel couplings for the particular pipe material, or equal.
- B. See 2.01-A(4) above for protection of steel couplings.

2.11 RUBBER EXPANSION JOINT/COUPLINGS

- A. Where shown on the Drawings, these shall be suitable for the service pressure in the line where used and for normal temperatures. Rubber expansion joints shall be supplied complete with steel retaining rings and shall be drilled for coupling to the pipe flanges they are used with. Rubber expansion joints shall be standard single arch joints and shall be filled arch type when used for wastewater service.

2.12 FIRE HYDRANT

- A. Fire hydrant shall meet the requirements of AWWA C502 and shall be designed for 150 PSI working pressure. Valve opening shall be 5-1/4 inches.
- B. Hydrant shall be equipped with two 2-1/2 inch nozzles, with National Standard threads and one (1) 4 1/2 inch brass pumper nozzle with National Standard Fire Hose coupling screw threads together with caps fastened securely to each hydrant and threaded to fit nozzles.

- C. Hydrants shall have a safety "breakaway flange" section located above ground line. The distance from the finished ground line of the hydrant to the "breakaway flange" shall be not less than 2-inches or more than 6-inches.
- D. The waterways of hydrants shall be as free as possible of obstructions, sharp turns, corners, or other causes for resistance. The hydrant shall have a six (6") inch mechanical joint shoe.
- E. The hydrant main valve shall be of the compression type, closing with pressure. The valve shall be faced with heavy impregnated waterproof ballast or other approved material. The hydrant shall be "dry head type" and shall be equipped with harnessing lugs.
- F. After installation, exposed surfaces of hydrants shall be painted with two (2) coats of chrome enamel in a color as specified by the Owner to represent the flow available from the hydrant. Paint selection shall be approved by the Engineer.
- G. The hydrant operating and outlet nozzle cap nuts shall be pentagonal in shape. The pentagon shall measure 1-1/2 inches from point to flat at the base of the nut and 1-7/16 inches at the top. Nut faces shall taper uniformly, and the height of the nut shall be not less than 1-inch.
- H. The hydrant shall be opened by turning the operating nut counterclockwise. A clearly visible arrow and the word "open" shall be cast in relief on the top of the hydrant to designate the direction of opening.
- I. In the interest of standardization fire hydrants shall be "AWWA Improved Type" hydrant as manufactured by Mueller Company, Centurion, (American-Darling B-84-8 and M&H Fire Hydrant No. 129 equals are acceptable) except as outlined in "K" below.
- J. Fire Hydrants shall be U.L. listed and Factory Mutual approved.
- K. Fire Hydrants shall match existing hydrants and shall meet the approval of the governing Utility. The Engineer will assist the Contractor by furnishing information and coordinating approval.

2.14 SERVICE METERS

- A. Owner to supply new meter yokes and boxes, contractor responsible for fittings needed for connection. Solid copper only under asphalt, no joints or couplings except for connection to corporation stops.

2.15 DEAD END CAPS

- A. Dead end cap systems for connecting existing mains, flushing, and testing shall be rated for 350 psi. Usage of temporary caps must be planned ahead in order to install the proper number of restraining gaskets. See Mechanical Thrust Restraint Table in the contract drawings.

2.16 SUPPORTS, ANCHORS AND SEALS

- A. Supports, anchors and seals shall be furnished and installed in accordance with the plans.

2.17 CONCRETE MATERIALS

- A. Class A in accordance with Section 03300.

2.18 DISMANTLING JOINTS

- A. Dismantling joints shall be manufactured of ASTM A536 ductile iron meeting or exceeding Grade 65-45-12.
- B. The flanged spool shall be AWWA Class D Ring Flange compatible with ANSI Class 125 and 150 bolt circles. Pipe shall be standard weight class per ASTM A53.
- C. MJ gaskets shall be SBR compounded per AWWA C111 and flange gaskets shall be NBR, both in accordance with ASTM D2000.
- D. Bolts and nuts shall be Type 304 SST.
- E. Pressure rating shall be equal to the pressure rating of the flange.
- F. Joint shall be coated with fusion bonded epoxy, NSF certified.

2.19 COPPER PIPE AND TUBING

- A. Copper pipe shall be Type K, hard drawn (buried service) or Type L, soft drawn (interior applications). Copper tubing shall conform to ASTM B88 for seamless copper water tube with copper or brass fittings unless otherwise called for on the drawings.

2.20 SINGLE ACTING ALTITUDE VALVE

- A. VALVE DESIGN
 1. Altitude valve manufacturer shall have an ISO-9001 quality management system certified by an accredited body.
 2. The main valve shall be pilot controlled, hydraulically operated, differential piston actuated and full ported.
 3. The control valve shall be “self-contained” and incorporate a system of pilot controls, factory assembled to and tested with the main valve. The valve shall be operated by line pressure and utilize the pilot system to open, close or throttle the differential piston main valve to perform the specified function(s).
 4. Valve shall be capable of differential level (delayed opening) operation (valve will remain open until tank level drops below a preset level).

B. CONSTRUCTION

1. The main valve body shall be globe style, constructed of high-strength cast iron conforming to ASTM A126 Class B with integral flanges, faced and drilled per ANSI B16.1 Class 125.
2. The valve shall be “full-ported” so that when fully open the flow area through the valve is no less than the area of its nominal pipe size. Valve shall have an integral bottom pad or feet to permit support directly beneath the body.
3. The main valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area and the area on the upper surface is greater than that of the underside. There shall be no diaphragms or springs in the main valve.
4. The valve piston shall be fully guided on its outside diameter and all guiding and sealing surfaces shall be lead-free bronze. To minimize the consequences of throttling, throttling shall be by long, stationary vee-ports located downstream of the seat and not by the seat itself. Sawtooth attachments or other add-on devices are not permitted.
5. The valve shall be fully capable of operating in any position without the need of springs and shall not incorporate stems, stem guides or spokes in the waterway. A visual position indicator and NEMA 6P SPDT limit switch shall be provided.
6. The main valve shall be serviceable in the line through a single flanged top cover that provides easy access to all internal components.
7. The valve shall be shop coated with NSF-61 certified epoxy on internal surfaces in accordance with American Water Works Association Standard C550 (latest revision).

C. PILOT SYSTEM

1. The valve shall be operated by a system of pilot controls necessary to perform the specified function(s).
2. The pilot system shall be factory pre-piped, installed on the main valve and tested as an assembly.
3. The system shall incorporate a wye-strainer and opening and/or closing speed control valves.
4. Sufficient isolating valves and pipe unions shall be provided to facilitate removal and maintenance of the pilot system without disturbing the main valve.
5. Pilots, controls, piping and fittings shall be lead-free bronze, brass, or copper.

- D. MANUFACTURER
 - 1. Control valve shall be GA Industries differential piston design as manufactured by VAG USA, LLC.
 - 2. Alternate valve manufacturers will be considered by the Owner if submitted a minimum of 2 weeks prior to the Bid date. The Owner's decision relative to alternate valves will be final.

2.21 PRE-CAST STRUCTURES

- A. ASTM C-478 and ASTM C-913.
- B. The manufacturer shall be certified by the National Pre-cast Concrete Association's Plant Certification Program prior to and during the production of products for this project.
- C. Openings shall be provided for the required number and size of pipes and shall be marked to ensure installation at proper locations. Openings shall be placed in such a manner to all adjustments through 20 degrees.
- D. All pre-cast sections shall include non-penetrating lift inserts with locking feature for safe handling.
- E. Flexible Joint Sealants shall be butyl rubber based conforming to Federal Specification SS-S-210A, AASHTO M-198, Type B - Butyl Rubber and as follows: maximum of 1% volatile matter and suitable for application temperatures between 10 and 100 degrees F. Material shall be RV-30 as manufactured by RuVan Inc. (or approved equal) with a minimum cross section 1¼ inches.
- F. Epoxy Gels for interior patching of wall penetrations when used as approved by the Engineer shall be a 2-component, solvent-free, moisture-insensitive, high modulus, high-strength, structural epoxy paste adhesive meeting ASTM C-881, Type I and II, Grade 3, Class B and C, Epoxy Resin Adhesive.
- G. Precast Component Fabrication and Manufacture shall be as described in the following paragraph:
 - 1. Precast Manufacturing shall be in conformance with ASTM C478. Wall and inside slab finishes resulting from casting against forms standard for the industry shall be acceptable. Exterior slab surfaces shall have a float finish. Small surface holes, normal color variations, normal form joint marks, and minor depressions, chips and spalls will be tolerated. Dimensional tolerances shall be those set forth in the appropriate References and specified below.
 - 2. Joint Surfaces between Bases, Risers and Cones shall be manufactured to the joint surface design and tolerance requirements of ASTM C361 or AWWA C302. The maximum slope of the vertical surface shall be 2 degrees. The maximum annular space at the base of the joint shall be 0.10". The minimum height of the joint shall be four (4") inch.

3. Lift Inserts and Holes shall be sized for a precision fit with the lift devices, shall comply with OSHA 1926.704, and shall not penetrate through the manhole wall.
 4. Step Holes: Step holes shall be cast or drilled in the Bases, Risers and cones to provide a uniform step spacing of sixteen (16") inch. Cast step holes shall be tapered to match the taper of the steps.
 5. Where manholes and other precast sections are to be lined (interior), the following materials are pre-approved:
 - a. AQUATAPOXY Coating "A-6" as manufactured by American Chemical Corporation.
 - b. QR-304 as manufactured by QUADDEX, Inc.
 - c. Color to be white or other manufacturer's standard colors, to be selected by the Owner.
- G. Pre-cast Base Sections shall be cast monolithically without construction joints with integral floor and benching. Inverts shall be smooth and contoured for positive flow with a minimum of 1/10 foot fall between influent and effluent openings. The bottom step shall be a maximum of twenty-six (26") inches from the top of the base slab. The width of the base extensions on Extended Base Manholes shall be no less than the base slab thickness.
- H. Precast Riser Sections shall have a minimum lay length of sixteen (16") inches.
- I. Precast Concentric and Eccentric Cone Sections shall be a minimum of twenty-four (24") inches in height and shall have an inside diameter at the top of twenty-six (26") inches. The width of the top ledge shall be no less than the thickness required for the cone section. Concentric cones shall be used only for Shallow Manholes.
- J. Precast Transition Cone Sections shall provide an eccentric transition from sixty (60") inch and larger manholes to forty-eight (48") inch diameter risers, cones and flat slab top sections. The minimum slope angle for the cone wall shall be 45 degrees.
- K. Precast Transition Top Sections shall provide an eccentric transition from sixty (60") inch and larger manholes to forty-eight (48") inch diameter risers, cones and flat slab top sections. Transition Top sections shall be furnished with vents as shown on the manhole details. The maximum amount of fill over the transition top section shall be twenty (20') feet. Transition Tops shall not be used in areas subject to vehicle traffic.
- L. Precast Flat Slab Top Sections shall have a minimum thickness of six (6") inches (8" for 60" diameter and larger manholes) and shall have an inside diameter at the top of twenty-six (26") inches. They shall be designed for HS-20 traffic loadings as defined in ASTM C890. Items to be cast into Special Flat Slab Tops shall be sized to fit within the manhole ID and the top and bottom surfaces.
- M. Precast Grade Rings shall be used to adjust ring and covers to finished grade. No more than 10 vertical inches of grade rings will be allowed per manhole. Grade Rings shall conform to ASTM C478 and shall be no less than four (4") inches in

height, and twenty-four (24") inches internal diameter.

- N. Precast Inverts shall meet the following requirements.
1. Pipe openings shall provide clearance for pipe projecting a minimum of two (2") inches inside the manhole. The height of the transition from the pipe opening to the invert trough shall be equal to $\frac{1}{2}$ of the Opening ID minus Pipe ID, plus or minus $\frac{1}{4}$ ". The crown of small I.D. pipe shall be no lower than the crown of the outlet pipe. When the fall between the inlet and the outlet holes is greater than four (4") inches, the inlet end of the trough shall be below the inlet pipe invert and aligned horizontally within one (1") inch.
 2. Invert Troughs shall be formed and finished to provide a consistent slope from the pipe outlet to the inlets up to four (4") inch tall. The minimum fall shall be one-tenth (1/10') foot. A one-half inch ($\frac{1}{2}$ ") radius shall be provided at the intersection of 2 or more channels. The minimum concrete thickness from the bottom of the trough to the bottom of the base shall be seven (7") inches.
 3. Invert Benches shall have a float finish with a uniform slope. A $\frac{1}{4}$ " radius shall be provided at the edge of the bench and trough.
 4. Depressions, high spots, voids, chips, or fractured over $\frac{1}{4}$ inch in diameter or depth shall be filled with a sand cement paste and finished to a texture reasonably consistent with that of the formed surface.
- O. Precast Components and grade rings shall be sealed around the external perimeter as follows:
1. External Seals shall consist of a polyethylene backed flat butyl rubber sheet no less than 1/16" thick and 6" wide applied to the outside perimeter of the joint. Material to be RV-40-PW (or approved equal) as manufactured by RuVan, Inc.
 2. Internal Seals shall consist of plastic backed butyl rubber rope no less than 14 feet long and having a cross-sectional area no less than the annular space times the height of the joint. Double mastic joints are the only mastic joint acceptable.
- P. Lifting devices for handling Pre-cast Components shall be provided by the Pre-cast Manufacturer and shall comply with OSHA Standard 1926.704.

2.22 MANHOLE STEPS

- A. Steps shall be provided in Bases, Risers, Cones, Transition Cones, and Transition Top sections aligned vertically on sixteen (16") inch centers in accordance with ASTM C478. Steps shall be secured to the wall with a compression fit in tapered holes or cast in place. Steps shall not be vibrated or driven into freshly cast concrete or grouted in place.
- B. The steps shall be Copolymer Polypropylene Plastic reinforced with a $\frac{1}{2}$ " diameter grade 60 bar and have serrated tread and tall end lugs with red side reflectors equal to Lane International P-10938. Steps shall be capable of supporting 300 lbs. live

load at any point, and step pullout strength shall be 2000 lbs. minimum when tested according to ASTM C497.

- C. Holes for steps must be mortared smooth following placement of the steps.

2.23 PIPE ENTRANCE COUPLINGS FOR STRUCTURES

- A. Pipe to Structure Connectors shall conform to ASTM C923, and to ASTM C-425. The location of the pipe connectors shall vary from the location shown on the Project Plans no more than 1/4 inch vertically and 5 degrees horizontally. Provide for control of the OD to within the tolerances of the connector on flexible pipes larger than twelve (12") inches.
- B. Rigid cement or synthetic type grouts are not acceptable as a seal between the manhole and entry pipe.
- C. The entrance coupling with the entry pipe shall be fitted with a Neoprene Boot insert, "KOR-N-SEAL", PSX, or approved equal.
- D. Other specially designed flexible products may be approved for use in adding a pipe entrance to an installed manhole and for other uses where available and where materials meet the requirements of ASTM C-923.
- E. Internal and external bands shall be Type 302 or 304 stainless steel meeting the requirements of ASTM C923.

2.24 PRE-CAST SECTION MARKINGS

- A. All sections shall be marked with the manufacturer name and date manufactured on the inside.
- B. All sections shall be marked with the project name, manhole designation (Letter/Number), size, specification, and product designation (MH,VV,WW,GW,MV) on the outside.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Install barriers and other devices to protect areas adjacent to construction.
- B. Protect and maintain all benchmarks and other survey points.
- C. Protect and maintain all pipe and equipment not scheduled for replacement, and/or all pipe and equipment scheduled for operation during the construction period of the new components.
- D. Prior to laying pipe, prepare a suitable bedding according to Section 02221.
- E. Before placing pipe in the trench, field inspect for cracks or other defect; remove

defective pipe from the construction site.

- F. Swab the interior of the pipe to remove all undesirable material.
- G. Prepare the bell end and remove undesirable material from the gasket and gasket recess.
- H. Establish line and grade for pipe and appurtenances. Verify location and elevation of other utilities and manholes for gravity sewers.

3.02 INSTALLATION

- A. Trenching and backfill shall meet the requirements of Section 02221.
- B. During pipe installation, Contractor shall take every precaution to prevent foreign material from entering the pipe or fittings. The contractor shall place a heavy, tightly woven canvas bag over each end of joint of pipe before lowering it into the trench.
- C. Jointing procedures, including cleaning of ends of pipe, and lubrication shall be in accordance with the manufacturer's recommendations. Pipe shall be laid with the bells pointing in the direction of laying.
- D. Field cutting of pipe shall be done according to the manufacturer's recommendations. Cut end shall be smooth and at right angles to the axis of the pipe. Field cuts shall be filed or trimmed to resemble the spigot end of the pipe as manufactured. Depth marks shall be placed on the pipe to assure pipe is inserted to the full depth when joint is made.
- E. Thrust blocking shall be provided at all bends (of 11-1/4 degrees or greater) and tees and valves. Blocking shall be poured against undisturbed earth, be a minimum of twelve (12") inches thick and constructed so that the pipe and fitting joints will be accessible for repairs. Install as shown in the Typical Details.
- F. All valves shall be installed plumb and true in a workmanlike manner.

3.03 PLACING DETECTION TAPE OR WIRE

- A. All buried, non-metallic water and sewer pipes shall be identified by buried detection tape and tracing wire.
- B. Tape shall be placed directly over the pipe between one foot and three feet below finished grade and at least one foot above the top of the pipe.
- C. A different color tape shall be used for each pipe carrying a different substance.
- D. Detection wire shall be placed just below or beside pipe. Wire shall be stubbed out of valve box a minimum of 6 inches.

3.04 FIELD TESTS

- A. All newly laid water lines shall be tested before being placed in service. Trenches may be backfilled as the pipe is laid, or where practicable and at the option of the Contractor, trenches or bell holes may be left open for visual inspection during tests. Prior to making tests, all air shall be expelled from the pipe. Contractor shall install taps at high points of the line for purpose of expelling air.
- B. Pressure Test: A two (2) hour test shall be made in accordance with AWWA C600 on the pipe line between valves or temporary plugs at a test pressure of at least 1.5 times the working pressure, but not less than 150 psi, except that the pressure rating of the pipe shall not be exceeded. Any open trench or bell holes over dry joints may be backfilled following this test. Where trenches have been backfilled prior to making the tests, any leaks evident at the surface shall be uncovered. All leaking joints disclosed by this test shall be remade and retested. All pipe, fittings, valves, and other materials found defective under this test shall be removed and replaced at the Contractor's expense.
- C. Leakage Test: A leakage test shall be made on the water line concurrent with the pressure test between valves or temporary plugs at a constant test pressure as specified in "B" above. The test shall be run in accordance with AWWA C600 except as modified below. Leakage in the test system shall be measured through a meter or approved measuring device. The allowable leakage shall not be greater than 0.67 gallons per hour per 1,000 feet of pipe. Should tests disclose leakage greater than the allowable amounts, the Contractor, at his expense, shall locate and repair defective joints until the leakage is within the specified tolerance.

3.05 DISINFECTING WATER LINES

- A. Disinfection of the completed lines shall be done in accordance with AWWA C651 and in a manner approved by the Tennessee Department of Environment and Conservation and, the Huntsville Utility District.
- B. Prior to chlorination, the main shall be flushed as thoroughly as possible with the water pressure and outlets available. Flushing shall be done after the pressure tests are made. After flushing, all valves shall be carefully inspected to see that the entire operating mechanism is in good condition.
- C. Following disinfection, all treated water shall be thoroughly flushed from the newly laid pipeline at its extremities until the replacement water throughout its length shall, upon test, be proved comparable to the quality of water served the public from the existing water supply system and approved by the Tennessee Department of Environment and Conservation. This quality of water delivered by the new main should continue for a period of at least two full days as demonstrated by laboratory examination of samples taken from a tap located and installed in such a way as to prevent outside contamination. Samples shall not be taken from an unsterilized hose or from a fire hydrant.

- D. Should the initial treatment fail to result in the condition specified in the preceding paragraph, the disinfection procedure shall be repeated until such results are obtained. The Contractor is responsible and shall obtain the approval of the Owner for the work performed under this section.
- E. Contractor shall submit a plan to treat/contain super chlorinated water flushed from new water main, branch, service etc. to prevent nearby stream contamination.

END OF SECTION

SECTION 02722

SANITARY SEWERS, FORCE MAINS AND APPURTENANCES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnishing and installation of sanitary sewerage systems.

1.02 RELATED DOCUMENTS

- A. Section 01530: Barriers
- B. Section 01560: Temporary Controls
- C. Section 01570: Traffic Regulations
- D. Section 01710: Cleaning
- E. Section 02100: Erosion Control
- F. Section 02221: Trenching, Backfilling and Compacting
- G. Section 02540: Sewer Flow Control and By-pass Pumping
- H. Section 02723: Sanitary Sewers Point Repairs and Appurtenances
- I. Section 02730: Manhole Repair and Rehabilitation
- J. Section 02740: Sewer Rehabilitation by Cured-In-Place Method
- K. Section 02760: Sewer Reconstruction by Pipe-Bursting Method

1.03 SUBMITTALS

- A. Submittals shall be submitted as specified in Section 01340, promptly and in accordance with approved schedule, in such a sequence that no delay to the work, or to the work of other Contractors is caused.
- B. Product data shall be submitted as required.
- C. Submit certification signed by manufacturer and Contractor that pipe, fittings, manholes, castings, and appurtenances meet specification requirements.
- D. Submit six (6) copies of required documents.

1.04 QUALITY ASSURANCE

- A. The Contractor shall install and test lines, fittings, valves and appurtenances in accordance with regulations issued by the Tennessee Department of Environment and Conservation and the Owner.
- B. The Contractor shall disinfect all potable water lines, fittings, valves and appurtenances in accordance with regulations issued by the Tennessee Department of Environment and Conservation.
- C. 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 in this section shall be used.
- D. Use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner.
- E. PVC piping shall be stored to protect from long term exposure to direct sun light and shall be stacked in suitable support systems to prevent buckling and deformation.
- F. Immediately prior to lowering pipe or fittings into the trench, each length of pipe and each component shall have the interior and mating surfaces cleaned of all dirt and foreign material.
- G. Carefully examine each pipe and fitting for cracks and other defects while suspended above the trench immediately before installation.

1.05 REFERENCES

- A. ASTM A48 - Gray Iron Casting
- B. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and sewer pipe
- C. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings
- D. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
- E. ASTM C478 - Pre-Cast Reinforced Concrete Manhole Sections
- F. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
- G. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures
- H. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals

- I. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- J. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- K. AWWA C111 - Rubber Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings
- L. AWWA C151 - Ductile-Iron Pipe Centrifugally Cast, in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
- M. ASTM D-1248 - High Density Polyethylene Pipe
- N. National Precast Concrete Association: Quality Control Manual for Precast Concrete Plants.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Product Delivery, Storage and handling shall be in strict accordance with the manufacturer's recommendations using the best available methods to prevent damage to materials and components.
- B. PVC piping shall be stored to protect from long term exposure to direct sun light and shall be stacked in suitable support systems to prevent buckling and deformation.
- C. Protect ductile iron pipe from damage to coating and lining.

1.07 JOB CONDITIONS

- A. All Work in streets and roadways shall be conducted in strict accordance with provisions of Section 01570.
- B. Whenever pipe laying is not actively in progress, open ends of all installed pipe and fittings shall be fitted with a watertight plug.
- C. Separation of Sewers and Water Mains:
 - 1. Parallel Installation of Sewers and Water Mains
 - a. Whenever possible the sewer shall be installed at least ten (10') foot horizontally from water mains, the distance measured from edge to edge.
 - b. If local conditions prevent a horizontal separation of ten (10') foot, the sewer shall be installed in a separate trench so that the top of the sewer pipe is at least eighteen (18") inches below the bottom of the water main.
 - c. If neither of these conditions can be met the sewer shall be constructed of push-on or mechanical joint ductile-iron pipe, and the pipe pressure tested to assure watertightness prior to backfilling.
 - 2. Crossing of Sewers and Water Mains:

- a. Whenever possible the sewer main shall be installed below the water main so that the minimum distance between the outside of the sewer pipe and the outside of the water pipe is at least eighteen (18") inches. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints.
 - b. If local conditions prevent this separation, the sewer shall be constructed of push-on or mechanical joint ductile-iron pipe, and the pipe pressure tested to assure water-tightness prior to backfilling.
 - c. Where the water main crosses under a sewer, adequate structural support shall be provided for the sewer to prevent damage to the water main.
- D. Sewage flow must be maintained in the existing sewers. Whenever pipe laying progresses to a point where this flow must be interrupted, the Contractor shall plug a manhole upstream of the construction and provide pump bypassing to a downstream manhole in accordance with Section 02540. All downstream pipes, manholes and appurtenances must be tested and determined to be acceptable to the Owner and the Engineer to receive sewage flow. Bypassing of raw sewage to the surface will not be permitted. Contractor shall notify the Owner, his field representative and/or other appropriate authorities and receive written remission prior to proceeding with bypassing. When working in areas where interruption of sewer flow may occur, the Contractor shall have at the site the necessary pumps, lines and all other equipment in readiness to provide pump bypassing.
- E. Contractor shall plan his Work and arrange his Work schedules, to minimize the length of time sewer service is interrupted.

PART 2 - PRODUCTS

2.01 POLYVINYL CHLORIDE PIPE AND FITTINGS FOR GRAVITY SEWERS

- A. Manufactured from virgin, National Sanitation Foundation (NSF) approved resin conforming to ASTM D-1784.
- B. Unless otherwise specified, all PVC pipe and fittings shall conform to ASTM D-3034 and have a Standard Dimension Ratio (SDR) of 35.
- C. The gaskets used for joining PVC sewer pipe shall conform to ASTM F-477.
- D. All PVC gravity sewer pipe shall be clearly marked with the manufacturer's name, nominal diameter, SDR, ASTM D-3034, and NSF approval seal.

2.02 DUCTILE IRON PIPE AND FITTINGS

- A. Pipe:
1. Manufactured in accordance with ANSI A-21.50 (AWWA C-151) and ANSI A-21.10 (AWWA C-110).
 2. A cement lining meeting the requirements of ANSI 21.4 (AWWA C-104).
 3. Where the pipe is shown as "Protecto 401 lined", the pipe will be lined with a ceramic epoxy lining meeting the following:
 - a. 40-mil dry film thickness lining manufactured under the name of Protecto 401.
 - b. Line interior of bell and exterior of spigot in joint sealing areas with 6 to 10 mils of specified lining.
 - c. Surface preparation: Prior to abrasive blasting, the entire area to receive the protective compound shall be inspected for oil, grease, etc. Any areas with oil, grease, or any substance that can be removed by solvent, shall be solvent cleaned to remove those substances. After the surface has been made free of grease, oil or other substances, all areas to receive the protective compounds shall be abrasive blasted using sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly adhering oxide may be left on the surface. Any area where rust reappears before lining must be reblasted.
 - d. Pinhole detection: 2,500 volts minimum over 100 percent of lined surfaces.
 4. A minimum of 1 mil thick bituminous coating on the outside surface.
 5. Clearly mark with manufacturer's name, D.I. or Ductile, weight, class or nominal thickness, and casting period.
 6. Unless otherwise specified or shown on the Contract Documents, ductile iron pipe shall be pressure class 350.
- B. Fittings
1. Fittings 4"-24": Pressure rated at 350 psi.
 2. Fittings 30"-36: Pressure rated at 250 psi.
 3. Joints meeting the requirements of ANSI A-21.11 (AWWA C-111).
 4. If specified, ceramic epoxy lining per 2.02 (3) above.
 5. Sewer Tee-Wye fittings shall conform to AWWA C 110

2.03 CONCRETE MATERIALS

- A. Standard Cement Concrete mix, with a minimum twenty-eight (28) day compressive strength of 2,500 psi.

2.04 CASTING FOR FRAME AND COVERS

- A. Gray iron, Class 30 unless otherwise specified, meeting AASHTO M-108.
- B. Cleaned and coated with bituminous paint that will produce an acceptable finish that is not affected by exposure to hot or cold weather.

- C. Rings and covers for use on watertight manholes shall be machined smooth uniform bearing that will provide a watertight sea.
- D. Frame and cover shall be capable of supporting 16,000 pounds wheel load, combined weight shall be as shown in the Project Details.
- E. Cover shall have concealed pickhole.
- F. The words SANITARY SEWER shall be cast into the cover.
- G. Horizontal and vertical mating surfaces shall be machined.
- H. Frame and cover shall provide a minimum of twenty-four (24") inches clear opening.

2.05 PRECAST MANHOLES

- A. AASHTO M-199 SR or ASTM C-478.
- B. Openings shall be provided for the required number and size pipes and shall be marked to insure installation at proper locations.
- C. Lift loops shall be ASTM A416 steel strand. Lifting loops made from deformed bars are not allowed.
- D. Flexible Joint Sealant Roping and Sealant Sheets shall be butyl rubber based conforming to Federal Specification SS-S-210A, AASHTO M-198, Type B - Butyl Rubber and as follows: maximum of 1.2% volatile matter and suitable for application temperatures between 10 and 100 degrees F. Material shall be RV-30 as manufactured by RuVan Inc. (or approved equal) with a minimum cross section of 1¼ inches for roping and sheets with minimum dimensions of 1/8 inch by six (6") inches.
- E. Epoxy Gels for interior patching of wall penetrations when used as approved by the Engineer shall be a 2-component, solvent-free, moisture-insensitive, high modulus, high-strength, structural epoxy paste adhesive meeting ASTM C-881, Type I and II, Grade 3, Class B and C, Epoxy Resin Adhesive.
- F. Precast Component Fabrication and Manufacture shall be as described in the following paragraph:
 - 1. Precast Manufacturing shall be in conformance with ASTM C478. Wall and inside slab finishes resulting from casting against forms standard for the industry shall be acceptable. Exterior slab surfaces shall have a float finish. Small surface holes, normal color variations, normal form joint marks, and minor depressions, chips and spalls will be tolerated Dimensional tolerances shall be those set forth in the appropriate References and specified below.
 - 2. Joint Surfaces between Bases, Risers and Cones shall be manufactured to the joint surface design and tolerance requirements of ASTM C361. The maximum slope of the vertical surface shall be 2 degrees.
The maximum annular space at the base of the joint shall be 0.10". The

- minimum height of the joint shall be four (4") inches.
3. Lift Inserts and Holes shall be sized for a precision fit with the lift devices, shall comply with OSHA 1926.704, and shall not penetrate through the manhole wall.
 4. Step Holes: Step holes shall be cast or drilled in the Bases, Risers and cones to provide a uniform step spacing of sixteen (16") inches. Cast step holes shall be tapered to match the taper of the steps.
- G. Precast Base Sections shall be cast monolithically without construction joints or with an approved galvanized or PVC waterstop in the cold joint between the base slab and the walls. The bottom step in base sections shall be a maximum of twenty-six (26") inches from the top of the base slab. The width of the base extensions on Extended Base Manholes shall be no less than the base slab thickness.
- H. Precast Riser Sections shall have a minimum lay length of sixteen (16") inches.
- I. Precast Concentric and Eccentric Cone Sections shall have an inside diameter at the top of twenty-six (26") inches. The width of the top ledge shall be no less than the wall thickness required for the cone section. Concentric cones shall be used only for Shallow Manholes.
- J. Precast Transition Cone Sections shall provide an eccentric transition from sixty (60") inch and larger manholes to forty-eight (48") inch diameter risers, cones and flat slab top sections. The minimum slope angle for the cone wall shall be 45 degrees.
- K. Precast Transition Top Sections shall provide an eccentric transition from sixty (60") inch and larger manholes to forty-eight (48") inch diameter risers, cones and flat slab top sections. Transition Top sections shall be furnished with vents as shown on the manhole details. The maximum amount of fill over the transition top section shall be twenty (20') feet. Transition Tops shall not be used in areas subject to vehicle traffic.
- L. Precast Flat Slab Top Sections shall have an inside diameter at the top of twenty-six (26") inches and shall be designed for HS-20 traffic loadings as defined in ASTM C890. Items to be cast into Special Flat Slab Tops shall be sized to fit within the manhole ID and the top and bottom surfaces.
- M. Precast Grade Rings shall be used to adjust ring and covers to finished grade. No more than 11 vertical inches of grade rings will be allowed per manhole. Grade Rings shall conform to ASTM C478 and shall be no less than four (4") inches in height.

- N. Precast Inverts shall meet the following requirements.
1. Pipe openings shall provide clearance for pipe projecting a minimum of two (2") inch inside the manhole. The height of the transition from the pipe opening to the invert trough shall be equal to $\frac{1}{2}$ of the Opening ID minus Pipe ID, plus or minus $\frac{1}{4}$ ". The crown of small I.D. pipe shall be no lower than the crown of the outlet pipe. When the fall between the inlet and the outlet holes is greater than four (4") inch, the inlet end of the trough shall be below the inlet pipe invert and aligned horizontally within 1".
 2. Invert Troughs shall be formed and finished to provide a consistent slope from the pipe outlet to the inlets up to four (4") inches. The minimum fall shall be one (1") inch. The minimum outside bending radius from influent to effluent shall be 1.5 times the pipe I.D. A one-half inch ($\frac{1}{2}$ ") radius shall be provided at the intersection of 2 or more channels. The minimum concrete thickness from the bottom of the trough to the bottom of the base shall be seven (7") inches.
 3. Invert Benches shall have a float finish with a uniform 2- $\frac{1}{2}$ " slope, plus or minus one (1"), from the high point at the manhole wall to the low point at invert trough. A $\frac{1}{4}$ " radius shall be provided at the edge of the bench and trough.
 4. Depressions, high spots, voids, chips, or fractured over $\frac{1}{4}$ inch in diameter or depth shall be filled with a sand cement paste and finished to a texture reasonably consistent with that of the formed surface.
- O. Precast Components and grade rings shall be sealed around the external perimeter as follows:
1. External Seals shall consist of a polyethylene backed flat butyl rubber sheet no less than $\frac{1}{8}$ " thick and 6" wide applied to the outside perimeter of the joint. Material to be RV-40-PW (or approved equal) as manufactured by RuVan, Inc.
 2. Internal Seals shall consist of a plastic backed butyl rubber rope no less than fourteen (14') feet long and having a cross-sectional area no less than the annular space times the height of the joint or $1\frac{1}{4}$ inches, whichever is greater.
- P. Lifting devices for handling Precast Components shall be provided by the Precast Manufacturer and shall comply with OSHA Standard 1926.704.
- Q. New manholes "wet-cast" shall have a waterproof admixture added during the batching process as manufactured by Xypex (C-1000R) or approved equal.
- R. Coatings
1. The exterior surface of all new "dry-cast" manholes shall be coated with a minimum of one (1) coat of specified material. The coating shall be applied by the manhole manufacturer, and applied and cured in strict accordance with the coating manufacturer's requirements
 2. Coating and sealing material shall be:

- DRYCON Water proofing/sealer (grey in color) as manufactured by IPA Systems, Inc.
 - PRECO Waterproofing/sealer (grey in color) as manufactured by FOSROC PRECO Industries, Ltd.
3. Coating is not required for manholes, which are manufactured utilizing the "wet-cast" method.
- S. All precast components shall be manufactured at a plant certified by the National Precast Concrete Association's Plant Certification Program prior to and during the production of products for this project.

2.06 MANHOLE STEPS

- A. Steps shall be provided in Bases, Risers, Cones, Transition Cones, and Transition Top sections aligned vertically on sixteen (16") inch centers. Steps shall be secured to the wall with a compression fit in tapered holes or cast in place. Steps shall not be vibrated or driven into freshly cast concrete or grouted in place. The steps shall be Copolymer Polypropylene Plastic reinforced with a ½" diameter grade 60 bar and have serrated tread and tall end lugs. Step pullout strength shall be 2,000 lbs. minimum when tested according to ASTM C497.

2.07 PIPE ENTRANCE COUPLINGS FOR MANHOLES

- A. Pipe to Manhole Connectors shall conform to ASTM C923, and to ASTM C-425 for Pipe Diameters twelve (12") inches and smaller. The location of the pipe connectors shall vary from the location shown on the Project Plans no more than ½ inch vertically and 5 degrees horizontally. Provide for control of the OD to within the tolerances of the connector on flexible pipes larger than twelve (12) inches.
- B. Rigid cement or synthetic type grouts are not acceptable as a seal between the manhole and entry pipe.
- C. The manhole entrance coupling with the entry pipe shall be fitted with either a Neoprene Boot insert, "A-Loc" or approved equal.
- D. Other specially designed flexible products such as "KOR-N-SEAL" may be approved for use in adding a pipe entrance to an installed manhole and for other uses where available and where materials meet the requirements of ASTM C-425.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Install barriers, signs and other devices to identify and protect areas the construction site and all adjacent areas.
- B. Protect and maintain all benchmarks and other survey points.
- C. Protect and maintain all pipe, manholes and other material and equipment not

scheduled for replacement, and/or all pipe and equipment scheduled for operation during the construction period of the new components. Repair or replacement of all damaged items shall be at the Contractors expense.

- D. Prior to laying pipe, prepare a suitable bedding according to Section 02221.
- E. Before placing pipe in the trench, field inspect for cracks or other defect; remove defective pipe from the construction site.
- F. The interior of each joint of the pipe shall be cleaned to remove all undesirable material.
- G. Prepare and clean the spigot and the bell end of the pipe and remove undesirable material from the gasket and gasket recess.
- H. Establish line and grade for pipe and appurtenances. Verify location and elevation of other utilities and manholes for gravity sewers.

3.02 INSTALLATION OF GRAVITY SANITARY SEWERS

- A. Lay pipe true to the lines and grades from the grade and alignment stakes, or equally usable references.
 - 1. Where laser equipment is used, provide offset hubs at every manhole location for purposes of checking grade between sections.
 - 2. Set offset hubs at such distance from centerline of excavation as is suitable for the excavating method and machinery used.
- B. Lay pipe progressively up grade, with bell upstream, in such a manner as to form close, concentric joints with smooth bottom inverts. Joining of all pipe shall be in accordance with manufacturer's specifications.
- C. Bed each pipe section and provide Check Dams in accordance with Section 02221.
- D. Unless otherwise specified, provide all gravity sewer lines with a minimum of four (4') feet of cover in roadways and 2-1/2 feet of cover in open areas, unless ductile iron pipe or concrete encasement is used.
- E. Do not allow walking on complete pipelines until backfill has been placed to a depth of at least six (6") inches above the crown of the pipe.
- F. Keep the interior of the pipe free of all unsuitable material, and upon completion of a section between any two manholes it shall be possible to view a complete circle of light when looking through the pipe.
- G. When pipe laying ceases, close the open ends of the pipe with a suitable plug to prevent the entrance of foreign materials.

- H. Couplings and adapters used for joining dissimilar gravity pipe materials, for repairing and rejoining sections of gravity sewer, and for connecting the first full joint of pipe to a short stub through a manhole wall shall meet the requirements of ASTM C-425. (See Project Details).
- I. All couplings and adapters for gravity sewer pipe shall be of rubber, plastic and metallic materials that will not react chemically or biologically with municipal wastewaters or aggressive elements in the soil and conform to ASTM - 425, Section 5.

3.03 INSTALLATION: TEE-WYE FITTINGS AND CLEANOUTS FOR SERVICE CONNECTIONS

- A. Use in-line factory made Tee-Wye fittings for all service connections.
- B. Install service connections on sanitary sewer mains for each service connection in accordance with the plans.
- C. All service laterals shall be 6" to property line and/or edge of easement installed at minimum of 1% slope, unless field verified by the engineer. A 6" x 4" increaser bushing (eccentric) as manufactured by Plastic Trends (part number 32642), or approved equal, installed after the cleanout shall be used for single family residential connection.
- D. The service lateral shall be terminated at the end of cleanout with a plug.
- E. Service laterals that originate on the sewer main shall be of the same material as the main at that location on the main. Ductile Iron service laterals shall be Class 350.
- F. The service lateral shall not protrude into the sewer main.
- G. Service lateral cleanouts shall be a 2-way cleanout as manufactured by Plastic Trends (G 1006), or approved equal, and extend 3' above finished grade to mark sewer service connections until building connection is made.
- H. Any sanitary sewer services which are over 12 feet in depth shall require water line and/or mechanical joint quality pipe.
- I. Reconnect existing service connections, including those that are intended to serve unoccupied or abandoned buildings or vacant lots, unless directed otherwise by the Owner or Engineer.
- J. Crushed stone bedding and haunching shall be placed in accordance with the Project Details.

- K. Initial and final backfill and surface restoration shall be completed as referenced and specified in Section 02221 and other appropriate sections.
- L. Contractor shall install tracer wire along the service line to the cleanout location.
- M. Contractor shall provide service Tee-Wye locations, including size, manhole reach, lot or building number, stationing from nearest downstream manhole, right or left side connection (looking upstream), invert of the sewer main at Tee-Wye location and depth of cleanout in a tabular form.

3.04 INSTALLATION: SEWER MANHOLES - GENERAL

- A. Unless otherwise specified, all manholes shall have inside diameter of not less than forty-eight (48") inches and a vertical wall height of not less than 2.5 feet.
- B. The clear opening into the manhole shall be not less than twenty-four (24") inches.
- C. Depth of the manhole shall be the vertical distance from the lowest invert in the manhole to the base of the ring.
- D. Backfill manholes in the same manner as specified for pipelines.

3.05 INSTALLATION: STANDARD PRECAST CONCRETE MANHOLES

- A. Manhole shall be installed in accordance with ASTM C-478.
- B. Excavate to the required depth and remove materials, that are unstable or unsuitable for a good foundation. Prepare a level, compacted foundation extending a minimum of six (6") inch beyond the manhole base.
- C. When wet or unconsolidated material occurs or when over excavation of the base occurs, provide a subbase with a minimum of twelve (12") inch of Class I, granular material, well compacted with mechanical tamping equipment.
- D. Set base plumb and level, aligning manhole invert with pipe invert.
- E. Secure Pipe Connectors to Pipe according to the Connector Manufacturer instructions. When pipe stub outs are installed, provide restraint from vertical and longitudinal movements before backfill.
- F. Inlets and outlets from each manhole shall be finished smooth and flush with the sides of manholes walls so as not to obstruct the flow of liquid through the manhole.
- G. Thoroughly clean bells and spigots to remove dirt and other foreign materials that may prevent sealing. Unroll the Butyl Sealant rope directly against base of spigot. Leave protective wrapper attached until sealant is entirely unrolled against spigot. Do not stretch. Overlap from side to side, not top to bottom and remove protective wrapper.
- H. Set risers and cones so that steps align, taking particular care to clean, prepare and

seal joints.

- I. After joining manhole sections and setting adjustment rings, apply the butyl sealant sheet around the outside perimeter of the joint as shown in the Project Details.
- J. Lift Holes leaving less than two (2") inches of wall thickness shall be plugged from the outside using a sand cement mortar, then covered with butyl sealant sheet. Should Lift Holes penetrate the wall they shall be additionally sealed with an interior application of an epoxy gel $\frac{3}{4}$ " thick extending two (2") inch beyond the penetration.
- K. Perform the final finishing to the manhole interior by filling all chips or fractures greater than $\frac{1}{2}$ inches in length, width or depth and depressions more than $\frac{1}{4}$ inch deep in inverts with an approval hydraulic cement. Do not fill the joints between the precast concrete sections with cementitious material. Clean the interior of the manhole, removing all dirt, spills, or other foreign matter.

3.06 INSTALLATION: MANHOLE RINGS AND COVERS

- A. Grout and anchor manhole rings and covers in place with butyl sealant rope and sheets and bolts in accordance with the Project Details.
- B. The bearing surfaces between cast rings and covers shall be machined, fitted together, and match marked to prevent rocking.
- C. All casting shall be of the types, dimensions, and weights as shown in the Project Details and shall be free of faults, cracks, blow-holes, or other defects.
- D. Set the manhole frames to the required elevation using no more than 11" of precast concrete grade rings, sealing all joints between cone, adjusting rings, and manhole frame.
- E. Standard manholes frames set above grade and all water tight frames shall be held in place by four (4) threaded anchors. Anchors shall consist of:
 - 1. Four (4) $\frac{3}{4}$ inch diameter by eight (8") inch long stainless steel all-thread rod.
 - 2. Set all-thread rod into $\frac{3}{4}$ inch holes 6 inches deep into the precast manhole with approved two (2) component epoxy anchor bolt setting compound.
 - 3. Secure ring with stainless steel washers and nuts after setting compound has cured.

3.07 INSTALLATION: DROP MANHOLE ASSEMBLIES

- A. Drop manhole assemblies shall be constructed as outlined in the Project Details and on the Contract Documents.
- B. The material used in the drop pipe construction shall be Protecto 401 lined Ductile Iron Pipe and Class B concrete.
- C. Inside drop bowl assembly shall be installed with stainless steel fasteners in accordance with the manufacture's recommendations.
- D. Abandonment of existing outside drop assembly shall be incidental to the cost of the inside drop assembly the abandonment procedure shall be as follows:
 - 1. Remove flow from subject line segment by plugging, by-pass pumping, or other methods approved by owner and engineer.
 - 2. Plug existing incoming sanitary sewer (lower pipe) from inside manhole with concrete or grout plug.
 - 3. Fill existing vertical outside drop pipe to within 6" of top with crushed stone.
 - 4. Cap off remaining 6" of existing drop pipe with concrete or grout plug. Provide smooth finish to match invert of existing incoming sanitary sewer.
- E. For inside drop assembly installations where incoming sanitary sewer is being lined, contractor to extend liner pipe a maximum of 2 inches into manhole and cut a "V" shaped notch at bottom edge of incoming pipe in accordance with drop bowl manufacturer's recommendations.

3.08 FIELD TEST - INITIAL PROOF TESTING OF SANITARY SEWERS

- A. It is the intent to specify a "test as you go" procedure in order to establish confidence in the installation and avoid the necessary delay of final acceptance.
- B. Before a reach of pipeline is approved for payment, successfully proof test that reach for grade, alignment, cleanliness, and leakage.
- C. In the event that four (4) or more reaches fail to satisfactorily pass proof testing procedures, cease pipe laying until deficiencies are identified and corrected.
- D. The basis for grade, alignment and cleanliness testing will be visual inspection. Leakage testing will be by means of low pressure air or exfiltration or infiltration as deemed acceptable by the Engineer.
- E. Proof test flexible pipeline installation for deflection by pulling a "go, no-go" test mandrel through the line after the initial backfill is complete to avoid unnecessary dig-ups.

3.09 FIELD TEST - FINAL GRAVITY SEWER TESTING

- A. Before the Work is accepted and before any house services are connected, a final testing procedure is to be followed.

- B. Perform a visual inspection when groundwater levels are above the pipeline if possible. All visible leaks shall be repaired.
- C. The standard leak test for all gravity sewers shall be a low pressure air exfiltration test. Other exfiltration tests, if approved by the Engineer, will be conducted in accordance with ASTM C-828 or latest revision.
- D. If flexible pipe is used, pull an approved go-no go deflection mandrel of 95/100 pipe diameter through all reaches of gravity sewer main. This test shall be conducted no sooner than twenty-four (24) hours after completion of backfilling of the tested reach. No sections will be accepted that exhibits a deflection of more than five (5%) percent.

3.10 LOW PRESSURE AIR EXFILTRATION TEST - GRAVITY SEWERS

- A. Calculate the pressure drop as the number of minutes for the air pressure to drop from a stabilized pressure of 4.0 to 3.0 PSIG.
- B. Times for mixed pipe sized of varying lengths should be calculated as described in ASTM, C828-76T using formula $t = K d/q$ ($q = .0020$).
- C. Lengths of sections under test shall not exceed 500 linear feet.
- D. Gravity sewer line testing shall include service laterals.
- E. The following items are for one (1) pipe size only:

**SPECIFICATION TABLE
(MIN:SEC) REQUIRED WHEN TESTING ONE PIPE DIAMETER ONLY**

DIA. (IN)	4	6	8	10	12	15	18	21	24	27	38	33	36	39	42
TEST SECT. (FT)															
25	0:04	0:10	0:18	0:28	0:40	1:02	1:29	2:01	2:38	3:20	4:08	4:59	5:56	6:58	8:05
50	0:09	0:20	0:35	0:55	1:19	2:04	2:58	4:03	5:17	6:41	8:15	9:59	11:53	13:57	16:10
75	0:13	0:30	0:53	1:23	1:59	3:06	4:27	6:04	7:55	10:01	12:23	14:58	17:00	18:25	19:50
100	0:18	0:40	1:10	1:50	2:38	4:08	5:56	8:05	10:34	12:45	14:10	15:35			
125	0:22	0:50	1:28	2:18	3:18	5:09	7:26	9:55	11:20				20:25	19:58	23:06
150	0:26	0:59	1:46	2:45	3:58	6:11	8:30			13:24	16:32	17:09	23:49	23:57	27:43
175	0:31	1:09	2:03	3:13	4:37	7:05			12:06	15:19	18:54	20:01	27:13	27:57	32:20
200	0:35	1:19	2:21	3:40	5:17			10:25	13:36	17:13	21:16	22:52	30:37	31:56	36:58
225	0:40	1:29	2:38	4:08	5:40		8:31	11:35	15:07	19:08	23:38	25:44	34:01	35:56	41:35
250	0:44	1:39	2:56	4:35			9:24	12:44	16:38	21:03	25:59	28:35	37:25	39:56	46:12
275	0:48	1:49	3:14	4:43		8:16	10:12	13:53	18:09	22:58	28:21	31:27	40:49	43:55	50:49
300	0:53	1:59	3:31		6:03	9:27	11:54	16:12	21:10	26:47	33:05	34:16	47:38	47:55	55:26
350	1:02	2:19	3:47		6:48	10:38	13:36	18:31	24:12	30:37	37:48	40:01	54:26	55:54	64:41
400	1:10	2:38			7:34	11:49	15:19	20:50	27:13	34:27	42:32	45:44	61:14	63:53	73:55
450	1:19	2:50		5:14	8:19	13:00	17:01	23:09	30:14	38:16	47:15	51:27	68:02	71:52	83:10
500	1:28			5:45	9:04	14:11	18:43	25:28	33:16	42:06	51:59	57:10	74:51	49:51	92:24
550	1:37		4:02	6:17	9:50	15:21	20:25	27:47	36:17	45:56	56:42	62:53	81:39	87:50	101:38
600	1:46	2:50	4:22	6:48			22:07	30:06	39:19	49:45	61:26	68:36	88:27	95:49	110:53
650	1:54											74:19		103:48	120:07

3.11 FIELD TEST - PRECAST MANHOLES

- A. Manholes shall be physically and vacuum tested to assure compliance with the Contract Documents and the desired workmanship of the finished work has been achieved.
- B. Manhole Vacuum Test:
 - 1. Backfill shall be placed around the base of the manhole to a depth of one (1) foot over the top of the sewer pipe before the vacuum test is performed.
 - 2. The maximum vacuum applied to a manhole shall be twelve (12") inches of mercury (Hg).
 - 3. All manholes shall be subject to a vacuum test of a minimum of ten (10") inches Hg prior to acceptance by the Owner. The test shall be considered acceptable if the vacuum drops no more than one (1") inch within the time specified in the following table:

Manhole I.D. (inches)	48	60	72	84	96	120
Test Time for up to 8 feet in depth (seconds)	60	70	80	90	100	120
Additional Test Time for each 4 Foot Added Depth (Seconds)	10	15	20	30	40	60

4. Testing Sequence:
 - a. All manholes shall be physically and vacuum tested. Manholes failing the test shall be repaired by the Contractor, and retested.
 - b. Manholes failing the vacuum test two (2) times may, at the discretion of the Owner, be allow to be hydrostatically tested by an exfiltration test for acceptance.
 - c. The OWNER may require complete replacement of any manhole failing three (3) leak tests. Replacement shall be at no cost to the OWNER.
5. The CONTRACTOR shall furnish all necessary equipment and personal to conduct the tests in the presence of the ENGINEER.
6. Costs for testing shall be included within and incidental to the Contract Unit Price for manhole construction or rehabilitating.
7. Repairing, retesting, pressure grouting and/or replacement of defective manholes shall be at the sole expense and responsibility of the CONTRACTOR, and shall be pursued in a timely manner to prevent disruption to the Project and/or sewer services.
8. Manholes moved, disturbed, displaced and/or damaged in any way during the finishing and/or backfilling operation subsequent to successful testing shall be retested for acceptance as specified above, at the CONTRACTOR's expense.

END OF SECTION

SECTION 02723

SANITARY SEWERS POINT REPAIRS AND APPURTENANCES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnishing and installation of sanitary sewerage systems.

1.02 RELATED DOCUMENTS

- A. Section 01530: Barriers
- B. Section 01560: Temporary Controls
- C. Section 01570: Traffic Regulations
- D. Section 01710: Cleaning
- E. Section 02100: Erosion Control
- F. Section 02221: Trenching, Backfilling and Compacting
- G. Section 02722: Sanitary Sewers, Force Mains and Appurtenances
- H. Section 02730: Manhole Repair and Rehabilitation
- I. Section 02760: Sewer Reconstruction by Pipe-Bursting Method

1.03 SUBMITTALS

- A. Submittals shall be submitted as specified in Section 01340, promptly and in accordance with approved schedule, in such a sequence that no delay to the work, or to the work of other Contractors is caused.
- B. Product data shall be submitted as required.
- C. Submit certification signed by manufacturer and Contractor that pipe, fittings, and appurtenances meet specification requirements.
- D. Submit six (6) copies of required documents.

1.04 QUALITY ASSURANCE

- A. The Contractor shall install and test lines, fittings, valves and appurtenances in accordance with regulations issued by the Tennessee Department of Environment and Conservation and the Owner.
- B. The Contractor shall disinfect all potable water lines, fittings, valves and appurtenances in accordance with regulations issued by the Tennessee Department of Environment and Conservation.
- C. 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 in this section shall be used.
- D. Use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner.
- E. PVC piping shall be stored to protect from long term exposure to direct sun light and shall be stacked in suitable support systems to prevent buckling and deformation.
- F. Immediately prior to lowering pipe or fittings into the trench, each length of pipe and each component shall have the interior and mating surfaces cleaned of all dirt and foreign material.
- G. Carefully examine each pipe and fitting for cracks and other defects while suspended above the trench immediately before installation.

1.05 REFERENCES

- A. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and sewer pipe
- B. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings
- C. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
- D. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
- E. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- F. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

- G. AWWA C111 - Rubber Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings
- H. AWWA C151 - Ductile-Iron Pipe Centrifugally Cast, in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
- I. ASTM D-1248 - High Density Polyethylene Pipe

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Product Delivery, Storage and handling shall be in strict accordance with the manufacturer's recommendations using the best available methods to prevent damage to materials and components.
- B. PVC piping shall be stored to protect from long term exposure to direct sun light and shall be stacked in suitable support systems to prevent buckling and deformation.
- C. Protect ductile iron pipe from damage to coating and lining.

1.07 JOB CONDITIONS

- A. All Work in streets and roadways shall be conducted in strict accordance with provisions of Section 01570.
- B. Whenever pipe laying is not actively in progress, open ends of all installed pipe and fittings shall be fitted with a watertight plug.
- C. Separation of Sewers and Water Mains:
 - 1. Parallel Installation of Sewers and Water Mains
 - a. Whenever possible the sewer shall be installed at least ten (10') foot horizontally from water mains, the distance measured from edge to edge.
 - b. If local conditions prevent a horizontal separation of ten (10') foot, the sewer shall be installed in a separate trench so that the top of the sewer pipe is at least eighteen (18") inches below the bottom of the water main.
 - c. If neither of these conditions can be met the sewer shall be constructed of push-on or mechanical joint ductile-iron pipe, and the pipe pressure tested to assure watertightness prior to backfilling.
 - 2. Crossing of Sewers and Water Mains:
 - a. Whenever possible the sewer main shall be installed below the water main so that the minimum distance between the outside of the sewer pipe and the outside of the water pipe is at least eighteen (18") inches. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints.
 - b. If local conditions prevent this separation, the sewer shall be constructed of push-on or mechanical joint ductile-iron pipe, and the

- pipe pressure tested to assure watertightness prior to backfilling.
- c. Where the water main crosses under a sewer, adequate structural support shall be provided for the sewer to prevent damage to the water main.
- D. Sewage flow must be maintained in the existing sewers. Whenever pipe laying progresses to a point where this flow must be interrupted, the Contractor shall plug a manhole upstream of the construction and provide pump bypassing to a downstream manhole in accordance with the approved plan submitted in accordance with Section 01340. All downstream pipes, manholes and appurtenances must be tested and determined to be acceptable to the Owner and the Engineer to receive sewage flow. Bypassing of raw sewage to the surface will not be permitted. Contractor shall notify the Owner, his field representative and/or other appropriate authorities and receive written remission prior to proceeding with bypassing. When working in areas where interruption of sewer flow may occur, the Contractor shall have at the site the necessary pumps, lines and all other equipment in readiness to provide pump bypassing.
- E. Contractor shall plan his Work and arrange his Work schedules, to minimize the length of time sewer service is interrupted.

PART 2 - PRODUCTS

2.01 POLYVINYL CHLORIDE PIPE AND FITTINGS FOR GRAVITY SEWERS

- A. Manufactured from virgin, National Sanitation Foundation (NSF) approved resin conforming to ASTM D-1784.
- B. Unless otherwise specified, all PVC pipe and fittings shall conform to ASTM D-3034 and have a Standard Dimension Ratio (SDR) of 35.
- C. The gaskets used for joining PVC sewer pipe shall conform to ASTM F-477.
- D. All PVC gravity sewer pipe shall be clearly marked with the manufacturer's name, nominal diameter, SDR, ASTM D-3034, and NSF approval seal.

2.02 DUCTILE IRON PIPE AND FITTINGS

- A. Pipe:
 - 1. Manufactured in accordance with ANSI A-21.50 (AWWA C-151) and ANSI A-21.10 (AWWA C-110).
 - 2. A cement lining meeting the requirements of ANSI 21.4 (AWWA C-104).
 - 3. A minimum of 1 mil thick bituminous coating on the outside surface.
 - 4. Clearly mark with manufacturer's name, D.I. or Ductile, weight, class or nominal thickness, and casting period.
 - 5. Unless otherwise specified or shown on the Contract Documents, ductile iron pipe shall be pressure class 350.

- B. Fittings
 - 1. Fittings 4"-24": Pressure rated at 350 psi.
 - 2. Fittings 30"-36: Pressure rated at 250 psi.
 - 3. Joints meeting the requirements of ANSI A-21.11 (AWWA C-111).

2.03 CONCRETE MATERIALS

- A. Standard Cement Concrete mix, with a minimum twenty-eight (28) day compressive strength of 2500 psi.

PART 3 – EXECUTION

3.01 GENERAL

The point repair contract item covers work required to repair or prepare defective sections of existing sewer lines for rehabilitation. Generally, the work will include repair of joints, replacement of pipe or correction of existing service connections.

3.02 PREPARATION

- A. Install barriers, signs and other devices to identify and protect areas the construction site and all adjacent areas.
- B. Protect and maintain all benchmarks and other survey points.
- C. Protect and maintain all pipe, manholes and other material and equipment not scheduled for replacement, and/or all pipe and equipment scheduled for operation during the construction period of the new components. Repair or replacement of all damaged items shall be at the Contractors expense.
- D. Prior to laying pipe, prepare a suitable bedding according to Section 02221.
- E. Before placing pipe in the trench, field inspect for cracks or other defect; remove defective pipe from the construction site.
- F. The interior of each joint of the pipe shall be cleaned to remove all undesirable material.
- G. Prepare and clean the spigot and the bell end of the pipe and remove undesirable material from the gasket and gasket recess.
- H. Establish line and grade for pipe and appurtenances. Verify location and elevation of other utilities and manholes for gravity sewers.

3.03 INSTALLATION OF GRAVITY SANITARY SEWERS POINT REPAIRS

- A. Installation in accordance with Section 02722.
- B. Bed each pipe section and provide Check Dams in accordance with Section 02221.

- C. Point Repair locations indicated on the plans cannot always exactly be determined before the pipe is exposed. The location shown on the plans shall be considered accurate if within five (5) feet of the actual location.
- D. All work to expose and correct the defect, materials and equipment shall conform to applicable provisions of this section.
- E. Unless otherwise indicated by the plans or the Engineer, the pipe and materials shall be P.V.C. or D.I.P.
- F. Bypass Pumping
 1. Where bypass pumping may be necessary to properly perform the point repair, the Contractor shall bypass the sewage around the section or sections of line that are to be point repaired by plugging an existing upstream manhole and pumping the sewage into a downstream manhole. The pump and bypass lines shall be of adequate capacity and size to transport the required bypassed flow. Bypass pumping shall be performed in accordance with Section 02540.
 2. Under no circumstance will the dumping of raw sewage on private property or, in or adjacent to lakes, streams, storm sewers, or in city streets be allowed.
 3. At the end of each working day, plugs shall be removed and temporary tie-ins shall be made between the point repair section and the existing system.
 4. Bypass pumping of sewage shall be considered an incidental obligation of the Contract and no separate payment shall be made for this Work.
- G. Couplings and adapters used for joining existing P.V.C. gravity pipe materials shall be SDR 35 Gasketed Sewer Fittings as manufactured by Plastic Trends or approved equal.
- H. Couplings and adapters used for joining existing D.I.P. or C.I.P. gravity pipe materials shall be American Made D.I.P. Fittings per Section 02722-2.02
- I. Couplings and adapters (Fernco or approved equal) used for joining dissimilar gravity pipe materials, for repairing and rejoining sections of gravity sewer, and for connecting the first full joint of pipe to a short stub through a manhole wall shall meet the requirements of ASTM C-425. (See Project Details)
- J. All couplings and adapters for gravity sewer pipe shall be of rubber, plastic and metallic materials that will not react chemically or biologically with municipal wastewaters or aggressive elements in the soil and conform to ASTM - 425, Section 5.
- K. The bedding must be kept dry during installation. If trench bottom is too wet, excavate wet portion and replace with suitable bedding material.

- L. Contractor shall remove the necessary length of pipe by cutting perpendicular to the pipe axis to leave a plain end. The section shall be replaced with P.V.C. or D.I.P. and diameter as the existing pipe. The new section shall be banded to the existing section with SDR 35 Gasketed Sewer Fitting, D.I.P. Fitting or a Fernco Type Fitting (See Project Details).
- M. Make transitions to original pipe using materials and procedures specified. Take care that replacement pipe is aligned properly with no offsets. Install concrete cradle per project details between different types of pipe before backfilling. Take care that no concrete from the cradle enters the existing pipeline. If this occurs remove the concrete.
- N. Service Lateral Connections shall be a Tee-Wye connection and match the point repair gravity pipe material.
- O. All active services within the point repair shall be identified by the Contractor and be reconnected to the replacement pipe.
- P. At the end of each day's work , and when for any reason the laying of pipe will be discontinued for an appreciable period, place a temporary section of pipe in the live line utilizing connections to insure that no leakage of sewage will occur.
- Q. After the pipeline is installed and visually inspected by the engineer, backfill the trench per Section 02221.
- R. Repair all pavement per Section 02610.
- S. Repair all sodded and grass areas to original condition per Section 02485.
- T. Repair all incidental damage to building, structures, utilities, pavements landscaping, etc...

3.04 FIELD TEST - INITIAL PROOF TESTING OF POINT REPAIRS

- A. It is the intent to specify a "test as you go" procedure in order to establish confidence in the installation and avoid delays in putting the line section back in service.
- B. Before a reach of pipeline is approved for payment, successfully proof test that reach for grade, alignment, cleanliness, and leakage.
- C. In the event that four (4) or more reaches fail to satisfactorily pass proof testing procedures, cease point repairs until deficiencies are identified and corrected.
- D. The basis for grade, alignment and cleanliness testing will be visual inspection.
- E. Mandrel testing may be required for proof testing of flexible pipeline installation for deflection by pulling a "go, no-go" test mandrel through the line after the initial backfill is complete to avoid unnecessary dig-ups.

3.05 FIELD TEST - FINAL POINT REPAIRS GRAVITY SEWER LINE TESTING

- A. Before the Work is accepted a final testing procedure is to be followed.
- B. Perform a visual inspection when groundwater levels are above the pipeline if possible. All visible leaks shall be repaired.
- C. The point repair gravity sewer line shall be cleaned and post closed circuit television (C.C.T.V.) inspection per Section 02790. Engineer shall review the CCTV information for approval.
- D. If flexible pipe is used, pull an approved go-no go deflection mandrel of 95/100 pipe diameter through all reaches of gravity sewer main. This test shall be conducted no sooner than twenty-four (24) hours after completion of backfilling of the tested reach. No sections will be accepted that exhibits a deflection of more than five (5%) percent.

END OF SECTION

SECTION 02730

MANHOLE AND WETWELL REPAIR AND REHABILITATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Section 01530: Barriers
- B. Section 01560: Temporary Controls
- C. Section 01570: Traffic Regulations
- D. Section 01710: Cleaning
- E. Section 02540: Sewer Flow Control and Bypass Pumping
- F. Section 02722: Sanitary Sewers, Force Mains, and Appurtenances

1.02 SUMMARY OF WORK

- A. The pump station wet well shall be rehabilitated to eliminate infiltration and exfiltration and lined to provide protection from normal conditions within the wet well.
- B. The contractor shall verify elevations of sanitary sewer services before plugging any inverts in order to eliminate sewer flows from backing up into homes and businesses.

1.02 SUBMITTALS

- A. Contractor shall supply a listing of all materials proposed for use under this Section including copies of the manufacturer's descriptive literature.
- B. Contractor shall supply a flow control plan, including bypass pumping.
- C. Submit six (6) copies of the required documents in accordance with Section 01340.

1.03 JOB CONDITIONS

- A. Immediately notify the Engineer of any unexpected or unusual conditions. Discontinue work until Engineer provides notification to resume Work.
- B. All Work in streets and roadways shall be conducted in strict accordance with provisions of Section 01570.
- C. By-pass pumping of sewage will be allowed only as provided in the Project Work Schedule, and submitted, and approved in accordance with Section 02540. Further, the Owner must approve any bypass pumping proposed by the Contractor.

1.04 QUALITY ASSURANCE

- A. Adequate numbers of skilled workmen who are thoroughly trained and experienced and approved by the manufacturer in the necessary crafts and who are completely familiar with the specific requirements and the methods needed for the proper performance of the Work in this section shall be provided and used to complete the Work.
- B. Equipment adequate in size, capacity, and numbers to accomplish the Work in a timely manner shall be provided and used to complete the Work.
- C. Contractor shall provide adequate on-the-job supervision of all Work and workmen to ensure that the Work meets all requirements of the Contract.

1.05 PATENTS AND LICENSES

- A. The Contractor shall warrant and hold harmless the Owner and Engineer against all claims for Patent and/or Licensing infringements and any loss thereof.

1.06 DELIVERY AND STORAGE

- A. Materials shall be delivered to the job site in their original, unopened containers. Each container shall be properly labeled. Materials shall be handled and stored to prevent damage to or loss of label.

PART 2 - PRODUCTS

2.01 SUMMARY

- A. Only materials listed below and/or those approved by the Engineer a minimum of seven (7) calendar days prior to the bid opening will be accepted for use on this Project.
- B. All materials and supplies shall be prepared, applied, and cured in strict accordance with the manufacturer's requirements and specifications.

2.02 GROUTING

- A. Leaks may be stopped using the following products depending upon the severity of the leaks. Please contact manufacturer for product recommendations.
- B. Foam type chemical grout, "AV-275 Soil Grout", as manufactured by the Avanti Company.
- C. Foam type chemical grout, "I&I Guard-MSF", as manufactured by Quadex, LLC (A Vortex Company)

- D. Foam type chemical grout, “I&I Guard-PRF”, as manufactured by Quadex, LLC (A Vortex Company)
- E. Fast-set grout, DRYCON-OCTOPLUG as manufactured by IPA Systems, Inc
- F. Fast-set grout, QUAD-PLUG as manufactured by Quadex, LLC (A Vortex Company)
- G. Fast-set grout, STRONG PLUG as manufactured by Strong Seal Systems

2.03 PATCHING

- A. Patching of walls is required in areas where large voids exist, such as mortar missing between bricks, around steps, frames, and pipe penetrations. All loose, cracked, and corroded material shall be removed from the area to be patched, exposing a sound substrate.
- B. These products will also be used for smoothing rough areas when necessary, filling voids, and repairing inverts/channels and benches.
- C. OCTOCRETE as manufactured by IPA Systems, Inc.
- D. HYPERFORM as manufactured by Quadex, LLC (A Vortex Company)
- E. QSR as manufactured by Strong Company, Inc.
- F. For joint repairs, Chimney Guard as manufactured by Quadex, LLC (A Vortex Company)

2.04 CEMENTITIOUS LINER

- A. Products:
 - 1. QM-1S Restore as manufactured by Quadex, LLC (A Vortex Company)
 - 2. MS-2A as manufactured by Strong Company, Inc.
 - 3. High Performance Mix as manufactured by Strong Company, Inc.
 - 4. Aluminaliner as manufactured by Quadex, LLC (A Vortex Company)
- B. The cured system shall conform to minimum physical standards as follows:

<u>CURED LINER</u>	<u>STANDARD</u>	<u>28 DAY</u>
Compressive Strength	ASTM C-109	>9,000 psi
Flexural Strength	ASTM C-321	>1,400 psi
Bond Strength	ASTMC-882	>2,000 psi
Density	ASTM	>130 pcf.

2.05 POLYUREA COATING

A. Products:

1. OBIC Armor 1000 – Aromatic Polyurea Coating

2.05 Polyurethane Surface Material

A. Products

1. OBIC Guard 1306

2.05 CONCRETE MANHOLE ADAPTERS (CMAs)

- A. CMAs manufactured by Fernco, Inc.
- B. CMAs manufactured by Indiana Seal

PART 3 - EXECUTION

3.01 PREPARATION

- A. Inspect wetwell before beginning work to identify scope of work, to confirm actual depth for payment purposes, and to confirm rehabilitation category.
- B. Chipping of smaller cracks and loose material may be necessary to provide proper placement and bonding of plugging and patching materials.
- C. Controlled diversion or by-pass pumping of the sewage flow around the wetwell being serviced shall be incorporated if required to accomplish a satisfactory rehabilitation.
- D. Sewer service shall be maintained throughout the duration of the project.
- E. Prevent extraneous materials from entering sewer lines during cleaning and rehab work.
- F. Construction Photographs
 1. Digital photographs in JPEG format shall be made of the pre-construction and post-construction conditions of the wet well scheduled for rehabilitation. All photographs shall have sufficient detail of the interior of the wet well to reveal conditions of existing defects and rehabilitated features.
 2. JPEG images shall be captured at a minimum resolution of 640x480 pixels.
 3. A hard drive or DVD(s) containing the photo files shall be submitted to the Engineer.

3.02 GROUTING AND PATCHING

- A. Manhole condition shall be agreed upon by the field representative before proceeding with repairs.
- B. Correct all leaks using products specified herein.
- C. Fill large voids using “Patching” products specified in Paragraph 2.03.
- D. Repairs may require drilling through the manhole walls. Manufacturer’s recommendations shall be followed.
- E. “Patching” also includes sealing deficient pipe connections. Use one of the specified products to seal voids associated with deficient pipe connections, stairs, lifting holes, etc. This work may also include drilling, as recommended by the manufacturer.
- F. Any necessary repairs on precast joints, should be repaired using a product specified in Paragraph 2.03.

3.03 CEMENTITIOUS LINER

- A. Clean all interior surfaces by hand and with high-pressure clean water (3,000 psi minimum) to remove all loose, deteriorated, and/or foreign materials.
- B. Wash all interior surfaces to be repaired with approved solution of muriatic or hydrochloric acid.
- C. Clean acid off wet well walls following manufacturer’s recommendations.
- D. Stairs may have to be removed and replaced during the lining process.
- E. Cementitious lining shall consist of:
 - 1. Correcting all leaks, voids, and irregularities using approved “Grouting” and/or “Patching” material.
 - 2. Drilling and pressure grouting using an approved “Patching” product, or other approved methods.
 - 3. Depressions, holes, and very rough areas shall be filled and smoothed with approved “Patching” material to provide a surface leveled to a maximum of 1/4 inch roughness.
 - 4. The lining system may be applied to damp, but not wet surfaces.
 - 5. The lining shall be applied by approved appropriate spray and finishing techniques to the interior manhole surfaces by trained/experienced technicians.
 - 6. After spraying is complete, the liner shall be lightly troweled smooth, unless otherwise recommended by the manufacturer.
 - 7. The liner placement shall be in strict accordance with manufacturer’s recommendations and, equipment and procedures approved prior to beginning the Work.

8. The finished liner thickness shall be 1" thick, unless otherwise recommended by the manufacturer.
9. If any signs of infiltration and/or surface cracking occur in newly lined manholes, these areas shall be repaired using an applicable patching or grouting material at no extra cost to the Owner.

3.04 CONCRETE MANHOLE or Wet Well ADAPTERS (CMAs)

- A. CMA rehabilitation shall include work on structures to correct inadequate pipe-to-manhole connections. Manhole condition shall be agreed upon by the field representative before proceeding with repairs.
- B. The adapters shall be installed by approved techniques in the manhole by trained/experienced technicians.
- C. The adapter installation shall be in strict accordance with the manufacturer's recommendations, and equipment and procedures approved prior to beginning the work.
- D. All voids around the adapters/invert shall be filled in using approved "Patching" material.

3.05 INVERT/CHANNEL REPAIR

- A. Use "Patching" materials to repair, reshape, or replace invert/channel. Install plugs in the upstream pipes and bypass pump, if necessary, to completely stop flow into the invert/channel. Reshaping inverts may require breaking out existing inverts. The surface may be damp but have no standing water. Apply product to a nominal thickness of ½" and trowel smooth. This work shall be done expeditiously, while upstream pipes are plugged. Wait a minimum of 30 minutes before releasing flow on the repaired invert.

3.06 BENCH REPAIR

- A. Use "Patching" materials to repair, reshape, or replace manhole benches. The surface may be damp but have no standing water. Apply product to a nominal thickness of ½" and trowel smooth.

3.07 CHIMNEY SEAL

- A. Before an approved chimney seal product is applied, correct all leaks, voids, and irregularities using approved "Grouting" and/or "Patching" material.
- B. These repairs will cover the top 24 inches of the inside of the manhole.
- C. Use "Cementitious Liner" products for sealing chimneys.
- D. Follow steps from Paragraph 3.03.

3.08 TESTING

- A. New manholes and wetwell that were rehabilitated shall be physically, and vacuum or hydrostatically tested to assure compliance with the Contract Specification and the desired workmanship of the finished rehab has been achieved.
- B. All other repairs shall be visually inspected with the owner’s representative during a high groundwater period. There shall be no infiltration or inflow.
- C. Vacuum Test:
 - 1. All manholes and wet wells shall be physically inspected, and all visible defects repaired before reinspection.
 - 2. New wetwells and manholes that were rehabilitated with a cementitious liner shall be subjected to a vacuum test of a minimum of ten (10") inches of mercury (Hg) prior to acceptance by the OWNER. The test shall be considered acceptable if the vacuum remains at nine (9") inches of Hg or higher after the following times:

Manhole I.D. (inches)	48	60	72	84	96	120
Test Time for up to 8 feet in depth (seconds)	60	70	80	90	100	120
Additional Test Time for each 4 Foot Added Depth (Seconds)	10	15	20	30	40	60

- C. Testing Sequence:
 - 1. All manholes shall be physically inspected and vacuum tested. Manholes failing the test shall be repaired by the Contractor, and retested.
 - 2. Manholes failing the vacuum test two (2) times may, at the discretion of the Owner, be testing using an exfiltration test.
 - 3. The OWNER may require complete replacement of any manhole failing three (3) leak tests. Replacement shall be at no cost to the OWNER.
- E. The CONTRACTOR shall furnish all necessary equipment and personnel to conduct the tests in the presence of the ENGINEER.
- F. Costs for all testing shall be included within and incidental to the Contract Unit Price
- G. Repairing, retesting, pressure grouting, and/or replacement of defective wet wells shall be at the sole cost and responsibility of the Contractor, and shall be pursued in a timely manner to prevent disruption to the Project and/or sewer services.
- H. Wetwell moved, displaced, and/or damaged in any way during the finishing and/or backfilling operation after successful testing shall be retested for acceptance as specified above, at the sole cost of the Contractor.

3.09 CLEAN-UP AND WARRANTY

- A. Clean-up and final completion of Work.
 - 1. Upon acceptance of the installation Work and testing, the Contractor shall reinstate the Project areas affected by the operations.
 - 2. Removal and replacement of fences, damage repair to yards, lawns, sidewalks, driveways, roads, other utilities, etc. due to movement of rehabilitation, cleaning, excavating or other equipment and/or erection of equipment and/or any other activities associated with the Work shall be the sole responsibility and at the sole expense of the Contractor unless specifically designated for payment under the Contract Unit Price Schedule.
 - 3. At a date decided upon by the Engineer after completion, preferably when the groundwater is high, the Owner's representative and engineer accompanied by the general contractor shall reinspect manholes. This shall be performed before the warranty is void.

- B. Warranty
 - 1. During the warranty period, which shall be defined as twelve (12) calendar months after acceptance by the Owner, any defects which will affect the integrity or strength of the manhole shall be repaired at the Contractor's expense, in a manner mutually agreed to by the Owner and the Contractor.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SCOPE

- A. This section includes all materials, labor, equipment, and services required for the installation of all plain and reinforced cast-in-place concrete (including formwork, reinforcement, reinforcement supports, embedded items detailed on the concrete drawings, joint fillers, joint sealers, and waterstops), and all related activities in accordance with the drawings, construction specifications, General Conditions, and other contract documents.

1.02 PUBLICATIONS REFERENCED HEREIN

- A. American Concrete Institute (ACI) as listed:
1. ACI 116R - Cement and Concrete Terminology.
 2. ACI 301 - Specifications for Structural Concrete for Buildings.
 3. ACI 305R - Hot Weather Concreting.
 4. ACI 306R - Cold Weather Concreting.
 5. ACI 315 - Details and Detailing of Concrete Reinforcement.
 6. ACI 350R - Environmental Engineering Concrete Structures.
- B. American Society for Test and Materials (ASTM) standards:
1. CRD-C 48 - Method of Test for Water Permeability of Concrete.
 2. Concrete Reinforcing Steel Institute, Manual of Standard Practice.
 3. Federal Specifications, TT-S-00227E (COM-NBS)-70, Sealing Compound, Elastomeric Type, Multi-Component.
 4. American Association of State Highway and Transportation Officials (AASHTO), Standard Specifications - Part II, T 260 Sampling and Testing for Total Chloride Ion in Concrete and Concrete Raw Materials.
 5. American Welding Society, Structural Welding Code - Reinforcing Steel (AWS D 1.4).

1.03 DEFINITIONS

- A. Embedded Items: All bolts, inserts, sleeves, conduit, fixtures, and other material placed so as to become anchored in cast-in-place concrete, as indicated and specified elsewhere in the contract documents.
- B. Testing Laboratory: An independent engineering testing laboratory engaged by the Owner (or as otherwise specified in the contract documents) to perform testing services required in this section not otherwise assigned.
- C. Concrete Design Mix: A concrete design mix in the quantities of specific ingredients which, when mixed, will yield one (1) cubic yard of concrete of a given strength, slump, and air content. Any variation in admixtures, cement or water content, or of any other ingredient, shall constitute a different design mix.
- D. Hydraulic Structures: Cast-in-place structures which have as their primary purpose the containment, conveyance or processing of liquids without other materials to provide water

tightness and are designed in accordance with ACI 350.

- E. Definitions of other terms used in this specification, not defined where used or elsewhere in the contract documents, shall be as given in ACI 116R.

1.04 SUBMITTALS

- A. General: All submittals required by this specification shall be to the persons or parties identified in the contract documents.
- B. Concrete Design Mix Reports: Design mix reports for each proposed concrete design mix shall be submitted. These submittals shall include the results of all tests performed to qualify the materials (including determination of chloride ion concentration) and to establish each design mix. No concrete shall be placed until the design mix for that concrete is accepted and approved by the Engineer.
- C. Concrete Permeability: Certified test results, showing that the water permeability of concrete proposed for use in any hydraulic structure designed to contain liquids satisfies the requirements of Paragraph 3.16, shall be submitted prior to the placement of any such concrete.
- D. Mill Test Reports: Certified test reports, showing compliance with the required standards, shall be submitted for any or all materials proposed for use on the project, as required by the Engineer. When so required, such test reports shall certify that the material tested is of the same quality as that proposed for use on this project.
- E. Reinforcing Steel Shop Drawings: Reinforcing steel shop drawings shall be submitted for review prior to fabrication. They shall conform to the requirements of ACI 315 and shall include placement plans, bar details, and bills of materials. Fabrication shall not be started until the submitted shop drawings have been reviewed and marked "Released for Production" by the Engineer.
- F. Formwork Shoring: The Contractor shall specify the type of forms that are to be used for the job and provide detailed drawings of formwork to insure compliance with ACI 301, Section 2. No concrete pours will be made prior to approval of the proposed formwork and rebar placement.
- G. Production Concrete Testing
 - 1. The Contractor and the Testing Laboratory shall report the results of all tests and inspections immediately after they are performed. Reports on strength tests shall include, in addition to the information required by ASTM C 39, the following:
 - a. Project name and project number.
 - b. Air temperature and temperature of concrete at time of sampling.
 - c. Slump of sample.
 - d. Air content of sample, percent.
 - e. Location where the concrete represented by the sample was deposited.
 - f. Name of person who molded the test cylinders.
 - g. Description of storage and curing conditions prior to testing.
 - h. Batching information (amount of concrete, time loaded or mixed, concrete design mix designation, type and brand of cement and any admixtures, total mixing water, maximum aggregate size, weights of ingredients, and

amount of added water).

PART 2 - PRODUCTS

2.01 QUALITY OF MATERIALS

- A. When selecting materials, the contractor shall confirm the availability of certified test reports showing compliance with all required standards. See Submittals, Paragraph D.1.

2.02 CEMENT

- A. All cement shall be Portland Cement conforming to ASTM C 150, Type I or Type II (normal or moderately sulfate resistant, respectively), and shall all be of one brand produced at a single cement manufacturing plant.

2.03 ADMIXTURES

- A. All admixtures shall be compatible with all other concrete mix ingredients and reinforcing steel, and with the intended use of the concrete. No admixtures shall be used without the consent of the Owner's representative.
- B. Admixtures to be used in concrete, when permitted, shall conform to the following specifications:
 - 1. Air entraining admixtures, ASTM C 260.
 - 2. Water-reducing, retarding, and accelerating admixtures, ASTM C 494.
 - 3. Pozzolanic admixtures (including fly ash), ASTM C 618, including the supplementary optional physical requirements.

2.04 WATER

- A. Mixing water shall meet the requirements of ASTM C 94 (subject to chloride limitations in Paragraph 2.06).

2.05 AGGREGATES

- A. Aggregates shall conform to the requirements of Section 4.2 of ACI 301.

2.06 CHLORIDE ION CONCENTRATION

- A. Unless otherwise specified, the maximum water soluble chloride ion concentration in hardened concrete at ages twenty-eight (28) to forty-two (42) days contributed from the ingredients of the concrete including water, aggregates, cement, and admixtures shall not exceed 0.10% by weight of the cement. The water soluble chloride ion concentration in each proposed concrete design mix shall be determined by testing in accordance with AASHTO T260.

2.07 STORAGE OF MATERIALS

- A. The storage of cement, aggregates, and admixture materials shall conform with Section 4.1 of ACI 301. Reinforcing shall be stored clear of the ground and protected from formation of rust and other damage.

2.08 FORMWORK

- A. All formwork shall conform to the requirements of Section 2 of ACI 301.

2.09 REINFORCEMENT

- A. Reinforcement material shall conform to the requirements of Section 3 of ACI 301 (all reinforcing bars shall be Grade 60 unless noted otherwise on the drawings). No coated bars shall be accepted unless otherwise noted or approved in writing by the Engineer.

2.10 WIRE BAR SUPPORTS

- A. Wire bar supports shall be plastic coated when in contact with forms for concrete that is to be left exposed. Such bar supports shall be in accordance with Class 1, maximum protection, in Chapter 3 of Manual of Standard Practice by the Concrete Reinforcing Steel Institute. All other wire bar supports shall conform to Class 2, moderate protection (or to Class 1).

2.11 PRE-MOLDED EXPANSION JOINT FILLER

- A. Pre-molded expansion joint filler material shall conform to ASTM D 1752, Type I or II, or to ASTM D 1751.

NOTE: If ASTM D 1751 joint filler material is used, backer material compatible with the joint sealer shall be used between the joint sealer and the joint filler material. Such backer material must provide a complete permanent separation of the joint filler and the joint sealer.

2.12 JOINT SEALER

- A. Joint sealer shall be a self-leveling two (2) component polysulfide material conforming to Federal Specification TT-S-00227E, Type 1, Class A.

2.13 WATERSTOPS

- A. Waterstops shall be "Waterstop RX" as manufactured by American Colloid Company or approved equal.
- B. Products proposed as an equal to those specified shall be submitted to the Engineer for review. Submittals shall include sample, specifications, and list of various installations of similar applications.

2.14 CURING MATERIALS

- A. Waterproof sheet material (such as polyethylene film) shall conform to ASTM C 171.
- B. Membrane curing compound material shall conform to ASTM C 309, Type I-D with fugitive dye. Materials containing wax, silicones, or other ingredients detrimental to subsequent floor finishes, are not acceptable.
- C. Other suitable materials, which when saturated over a period of time will not stain the concrete or otherwise be detrimental to the work may be used if approved by the Owner's representative.

2.15 GROUT

- A. All grout shall be one (1) of the following non-shrink grouts and shall be in accordance with ASTM C827, ASTM C191 and ASTM C109: Crystex (L & M Construction Chemicals), Five Star (US Grout Corporation), or Masterflow 713 (Master Builders). The installation and curing of all grout shall be in accordance with the manufacturer's recommendations. All grout shall be submitted to the Engineer for approval prior to placement.

PART 3 - EXECUTION

3.01 GENERAL

- A. All concrete shall be of the specified quality and capable of being placed without excessive segregation. When hardened, concrete shall develop all characteristics required by these specifications and the contract documents.

3.02 STRENGTH

- A. The specified compressive strength of the concrete, f_c , shall be 4,000 psi unless otherwise specified. Strength requirements shall be based on a twenty-eight (28) day compressive strength unless a different test age is specified.

3.03 WEIGHT

- A. Unless otherwise specified, the concrete shall be regular weight. When lightweight concrete is specified, the concrete proportions shall be selected to meet the specified limit on maximum air-dry unit weight as measured in accordance with ASTM C 567.

3.04 DURABILITY

- A. Air-entrainment and air content measurement for all concrete shall conform with ACI 301 (Section 4.2.2.4) requirements for concrete subject to potentially destructive exposure as follows:

Aggregate Size	Percent Air Content by Volume
#7 (1/2" max.)	5 to 9
#67 (3/4" max.)	4 to 8
#57 (1" max.)	3.5 to 6.5

- B. Measurement of air content shall conform to ASTM C 138, C 173, or C 231. Unless otherwise specified, ASTM C231 shall be used.

3.05 WATER-CEMENT RATIO

- A. Unless otherwise specified, all concrete for structures designated as hydraulic structures and or designed to contain liquids (such as chests), shall have a water-cementing material (cement plus any accepted pozzolans) ratio not to exceed 0.45 by weight. All other concrete shall have a water-cementing material ratio not to exceed 0.50 by weight.

3.06 MINIMUM CEMENT

- A. Unless otherwise specified, the minimum cementing material (cement plus accepted pozzolans) content per cubic yard for all concrete shall be as follows (from ACI 301, Table 4.2.2.1):

Nominal Maximum Aggregate Size	Minimum Cement*
1" (#57 stone)	520 pounds/cubic yard (5.5 Bags/cu.yd.)
3/4" (#67 stone)	540 pounds/cubic yard (5.7 Bags/cu.yd.)
1/2" (#7 stone)	590 pounds/cubic yard (6.3 Bags/cu.yd.)

*Maximum 20% pozzolan by weight.

3.07 MINIMUM CEMENT FOR HYDRAULIC STRUCTURES

- A. Unless noted otherwise, the minimum cementing material (cement plus any accepted pozzolans) content per cubic yard for hydraulic structures shall be as follows (from ACI 350, Section 3.5.1, and ACI 301, Table 4.2.2.1):

Nominal Maximum Aggregate Size	Minimum Cement*
1" (#57 stone)	536 pounds/cubic yard (5.7 Bags/cu.yd.)
3/4" (#67 stone)	564 pounds/cubic yard (6.0 Bags/cu.yd.)
1/2" (#7 stone)	590 pounds/cubic yard (6.3 Bags/cu.yd.)

*Maximum 20% pozzolan by weight (fly ash).

3.08 SLUMP

- A. Unless otherwise specified, all concrete, except floor slabs with specified f'c of 4,000 psi or greater, shall be proportioned and produced to have a slump of four (4") inches or less. Concrete for floor slabs with specified f'c of 4,000 psi or greater shall be proportioned and produced to have a slump of three (3") inches or less.
- B. A tolerance of up to one (1") inch above the maximum is allowed for one (1) batch in any five (5) consecutive batches tested. Concrete of lower than usual slump may be used only if it is properly placed and consolidated. The slump shall be determined in accordance with ASTM C 143.

3.09 MAXIMUM SIZES OF COARSE AGGREGATE

- A. Unless noted otherwise, the maximum nominal size of the coarse aggregate shall not be more than that of #57 stone [one (1") inch], 1/5 of the narrowest width of beams or walls, 1/3 of the depth of slabs, nor 3/4 of the minimum clear spacing between reinforcing bars. Additionally, the maximum nominal size of the coarse aggregate shall not be less than that of #7 stone (1/2").

3.10 ADMIXTURES

- A. Admixtures used shall conform to the requirements in Paragraph 2.03 and shall be subject to the following limitations.
- B. Admixtures containing calcium chloride shall not be used.
- C. All admixtures shall be used in accordance with the manufacturer's instructions.

3.11 SELECTION OF PROPORTIONS

- A. Each concrete design mix (see Definitions, Paragraph C.1.) shall be proportioned in accordance with ACI 301 (Section 4 on the basis of previous field experience or laboratory trial mixtures).

3.12 PROPORTIONING ON THE BASIS OF PREVIOUS FIELD EXPERIENCE OR TRIAL MIXTURES

- A. The determination of the standard deviation shall be in accordance with ACI 301 (Section 4).
- B. The determination of the required average compressive strength shall be in accordance with ACI 301 (Section 4).
- C. The documentation of the average strength shall be in accordance with ACI 301 (Section 4). See Submittals, Paragraph A.1.

3.13 PROPORTIONING BASED ON EMPIRICAL DATA

- A. Unless otherwise specified, concrete shall not be proportioned based on empirical data.

3.14 REDUCTION OF THE REQUIRED AVERAGE STRENGTH

- A. After sufficient data becomes available during construction, the amount by which the average strength must exceed the specified minimum strength f'_c may be reduced, subject to approval by the Owner's representative, in accordance with ACI 301 (Section 4.2).

3.15 LIGHTWEIGHT CONCRETE

- A. The ability of the selected proportions to meet the specified limits for air-dry weight shall be verified by tests made in accordance with ASTM C 567. The air-dry unit weight shall be correlated with the fresh unit weight of the same concrete to permit use of the latter as the basis for acceptance during construction.

3.16 HYDRAULIC STRUCTURE WATER PERMEABILITY

- A. The permeability of trial batch concrete proposed for use in any watertight structure indicated on the drawings shall not exceed ten (10) by ten (10) to the minus of twelve (12) when tested in accordance with CRD-C 48 (Method of Test for Water Permeability of Concrete).

PART 4 - PERFORMANCE OF WORK

4.01 FORMWORK

- A. The design and installation of all formwork shall be in accordance with ACI 301 (Section 2) except as otherwise specified (see Paragraph 4.13 for requirements for removal of forms).
- B. Chamfer strips, 3/4" x 45 degrees in size, shall be used at all edges of formed concrete to be left exposed, unless otherwise specified.
- C. Tolerances: Unless otherwise specified, formwork shall be constructed so that the concrete surfaces will conform to the tolerances given to ACI 301 (Section 2.3).
- D. The preparation of form surfaces shall be in accordance with ACI 301 (Section 2.2) except as otherwise specified.
- E. The portion of the forms in contact with concrete surfaces to receive joint sealer shall be free of any substance which will remain on these surfaces and cause the adhesion between the surfaces and the sealer to be weakened.

- F. Form tie assemblies for hydraulic structures shall be of such type as to leave no metal or other material within 1 1/2" of the surface. The assembly shall provide a cone-shaped depression at the surface of the concrete at least one (1") inch in diameter and 1 1/2" deep to allow filling and patching.
- G. When a portion of single rod ties are to remain in a liquid retaining structure, the portion that is to remain shall be provided with a tightly fitted washer at midpoint.

4.02 REINFORCEMENT

- A. Reinforcing shall not be welded unless otherwise specified. When welding of reinforcement is specified all such welding shall conform to AWS D 1.4.
- B. If welding is specified for zinc-coated or epoxy-coated reinforcement, zinc coatings shall be repaired afterwards with a zinc-rich formulation conforming to ASTM A 767 and epoxy coatings shall be repaired with a patching material conforming to ASTM A 775. Such repairs shall conform to the material manufacturer's recommendations. All welds, and all steel splice members used to splice reinforcing bars, shall be coated with the material used for repair of coating damage.
- C. The fabrication of reinforcing steel shall conform to the requirements of ACI 301 (all reinforcement shall be cold bent unless otherwise specified).
NOTE: Fabrication shall not be started until the reinforcing steel shop drawings have been reviewed and marked "Released for Production," by the Engineer. See Submittals, Paragraph E.1.
- D. Tolerances for the fabrication of reinforcing steel shall conform to Figures 4 and 5 of ACI 315.
- E. Tolerances for the placing of reinforcing steel shall conform to the requirements of ACI 301 (Section 3.3).
- F. The placing of reinforcing steel shall conform to the requirements of ACI 301 (Section 3.3), except as otherwise specified.
- G. Positioning of wire mesh shall be done in a manner that will allow lifting it off of the subgrade at least as indicated, but not closer to the surface of the concrete than one (1") inch or closer than 1 1/2" to the ground.

4.03 CONSTRUCTION AND CONTROL JOINTS

- A. Joints allowed, but not indicated on the contract documents, shall be located and constructed to minimize the impact on the strength of the structure. All locations shall be approved by the Owner's representative. In general, joints, when necessary, shall be located as near as possible to the middle of the spans of slabs, beams, and girders. Joints, when necessary in columns and walls, shall be at the underside of beams, and girders, and at the top of footings. Beams, girders, brackets, column capitals, haunches, and deep panels shall be placed at the same time as slabs.
- B. In floor slabs on grade, unless otherwise indicated on the drawings, provide construction or control joints continuously on maximum spacing of fifteen (15') feet, unless otherwise specified, in a grid pattern which coincides with column centerlines whenever feasible, and as approved by the Owner's representative.
- C. Unless otherwise specified, control joints shall be completed while the concrete is still in the plastic state.

4.04 EXPANSION AND ISOLATION JOINTS

- A. Reinforcement or other embedded metal items bonded to the concrete [except dowels in slabs on grade, bonded on only one (1) side of the joint] shall not be permitted to extend continuously through any expansion joint.
- B. Provide 1/2" wide expansion joints continuously at edges of slabs on grade abutting walls, columns, foundations, and other construction, unless otherwise indicated. Joint filler material shall extend full depth of joint except for space at top required for joint sealer, and shall be securely positioned.
- C. Exposed corners with rough edges shall be smoothed with an abrasive tool prior to sealer installation. Immediately prior to sealer installation, concrete surfaces to receive the sealer shall be clean and dry.

4.05 WATERSTOPS

- A. The design and location of waterstops shall be as shown on the drawings. See Paragraph 2.13 for waterstop material (unless specified otherwise).
- B. Each piece of pre-molded waterstop shall be of the maximum practical length in order to reduce the number of required splices.
- C. Waterstop material shall be butted at all joints to form a continuous barrier. Joints shall develop water tightness equal to that of continuous waterstop material.

4.06 OTHER EMBEDDED ITEMS

- A. All trades whose work is related to the concrete or must be supported by it shall be given ample notice and opportunity to set and/or furnish embedded items before the concrete is placed.

- B. Embedded Items
 - 1. All embedded items in any section or area in concrete which is scheduled to be placed, including anchor bolts (free of oil and other foreign matter), shall be set true within 1/8" of position shown on the drawings or as otherwise indicated, securely installed, and shall be thoroughly checked by the Contractor before concreting for that section or area is started. Voids in these items shall be filled temporarily with readily removable material to prevent the entry of concrete into these voids.

4.07 PRODUCTION OF CONCRETE

- A. The production of all concrete shall conform to the requirements of ACI 301 (Section 4).
- B. The control of admixtures shall conform to the requirements of ACI 301 (Section 4.3).

4.08 TEMPERING AND CONTROL OF MIXING WATER

- A. Concrete shall be mixed only in quantities for immediate use. Concrete which has started to harden shall be discarded and shall not be re-tempered.
- B. When concrete arrives at the job site with slump below that suitable for placing, as indicated by the specifications, water may be added only as follows:
 - 1. If approved by the concrete manufacturer and the Owner's representative, water may be added, but only once at the rate of one (1) gallon per cubic yard, and only if neither the design mix water-cement ratio nor the maximum slump for the concrete mix is exceeded. If allowed, an addition of water above that permitted by the water-cement ratio limitation shall be accompanied by addition of a quantity of cement sufficient to maintain the proper water-cement ratio.
 - 2. The additional water shall be incorporated into the mixture by mixing for a minimum of an additional thirty (30) drum revolutions in accordance with ASTM C 94. Immediately after such additional mixing, representative samples shall be taken for separate strength tests.

4.09 EXTREME WEATHER CONDITIONS

- A. During Hot Weather
 - 1. Whenever the job temperature is over, or likely to be over, 80° F, all mixing, placement, and finishing procedures shall be directed to keeping the concrete at a temperature not in excess of 85° F maintained reasonably uniform, and to maintain uniform moist conditions. Refer to ACI 305R Hot Weather Concreting.
- B. During Cold Weather
 - 1. When daily temperatures are generally below 40° F, the temperature of the concrete at the time of placing shall be above 50° F, but not higher than 85° F. Provisions shall be made for maintaining the placed concrete at a temperature above 50° F for a period of at least six (6) days. Refer to ACI 306R Cold Weather Concreting.

4.10 PREPARATION BEFORE PLACING CONCRETE

- A. General
 - 1. Immediately prior to concreting, the place of deposit and all mixing, transporting, conveying, and placing equipment shall be available for inspection. The Contractor shall give the Owner's representative twenty-four (24) hours notice before placing concrete. Access shall be provided by the Contractor to top and bottom of forms prior to inspection.
- B. The inner surfaces of conveying equipment shall be free of hardened concrete and foreign materials.
- C. Preparation of previously cast construction joint surfaces shall be completed. All laitance, soft mortar, dirt, form oil, or other foreign materials shall be removed. Except as otherwise specified, the preparation shall be as follows:
 - 1. The previously cast concrete shall be moistened thoroughly (damp but completely free of standing water or free moisture).
 - 2. The surfaces of all vertical construction joints cast against bulkheads shall be roughened to uniformly expose the aggregate, and then washed with clean water to remove all dust and loose particles.
 - 3. The surfaces of all horizontal construction joints in work designed to contain liquids (such as chests) shall be dampened (but not saturated) and then thoroughly covered with a two (2") inch thick (minimum) coat of cement grout of similar proportions to the mortar in the concrete. The fresh concrete shall be placed before the grout has attained its initial set.
 - 4. Surfaces specified to receive an adhesive shall be prepared and the adhesive applied in accordance with the manufacturer's recommendations.
- D. Formwork shall be completed; snow, ice, and water shall be removed; reinforcement shall be secured in place; expansion joint material, anchor bolts, and other embedded items shall be properly positioned.
- E. Reinforcement shall be free of dirt, loose scale, oil, ice, kinks, or bends not shown on the details, and free of rust which could be removed by moderate hand wiping.
- F. Preventing Cave-Ins
 - 1. Adequate means of preventing cave-ins of earth during placement of concrete shall be provided. All work shall conform to OSHA Standards.
- G. Preventing Absorption of Water
 - 1. Earth, against which concrete is placed, shall be sufficiently damp to prevent absorption of water from the concrete, without allowing water to stand.
- H. Grade under slabs shall conform to line and grade of slab bottom indicated.
- I. Concrete shall not be placed on frozen ground.
- J. The readiness of each place to receive concrete shall be approved by the Owner's representative before concreting is begun.

4.11 CONVEYING AND DEPOSITING CONCRETE

- A. General
 - 1. Conveying and depositing of concrete shall be in accordance with ACI 301 (Section 5) and the following additional requirements:
- B. Concrete shall be conveyed and deposited in such a manner as to prevent separation of ingredients and to minimize re-handling and flowing. In depositing concrete, the following requirements shall be observed:
 - 1. At free-fall heights of six (6') feet or less, concrete may be deposited without the use of a dropchute, if apparent separation of ingredients does not occur.
 - 2. For free-fall heights greater than six (6') feet, a dropchute shall be used.
 - 3. For hydraulic structures, the free-fall height shall not exceed four (4') feet.
- C. When concrete is placed against earth, care shall be taken to prevent mixing of earth and concrete during placing and consolidation.
- D. Concrete shall be properly consolidated at or near the place of deposit. Vibrators shall not be used to move the concrete to other parts of the form. Adequate reserve vibration equipment shall be on hand to ensure continuous consolidation of all freshly placed concrete.
- E. All concrete surfaces to receive grout, or an additional concrete pour, shall be roughened with a rake or coarse broom before the fresh concrete obtains final set.
- F. Unless otherwise specified, concrete shall not be deposited under water. If so specified, procedures for placing such concrete shall ensure that concrete enters the mass of previously placed concrete from within, causing water to be displaced with minimum disturbance at the surface of the concrete. Placing procedures and the concrete mix design shall be approved by the Engineer.

4.12 CURING AND PROTECTION

- A. Beginning immediately after placement, concrete shall be cured and protected in accordance with ACI 301 (Section 5) and as follows:
 - 1. Concrete surfaces to receive joint sealer shall be kept free of any substance which might cause the adhesion between these surfaces and the joint sealer to be weakened.
 - 2. After the concrete has been placed, anchor bolts shall be protected from corrosion by daubing the threads with grease, wrapping with burlap, and then covering bolts with wooden boxes or plastic protectors.
 - 3. Extra attention to water curing shall be given to concrete slabs exposed to the sun's rays throughout the curing period, especially on any day when the surface temperature reaches 80° F. Each surface shall be kept wet.
 - 4. Curing of floor hardened surfaces shall be in accordance with the recommendations of the manufacturer of the floor hardener.
 - 5. Housing, covering, or other protection used to maintain elevated temperature shall remain in place for at least twenty-four (24) hours after artificial heating is discontinued.

NOTE: ACI 301 requires that the curing of all concrete be continued for at

least seven (7) days, except for high-early-strength concrete for which the minimum period is three (3) days. Alternately, ACI 301 permits terminating proper moisture retention measures when properly field-cured cylinders reach 70% of f_c , or when laboratory-cured cylinders reach 85% of f_c .

4.13 REMOVAL OF FORMS AND RESHORING

- A. The removal of forms and reshoring shall conform to ACI 301 (Section 2) and the following additional requirements.
- B. Unless otherwise specified, forms and shoring supporting the weight of elevated slabs, beams, columns, and load bearing walls shall remain in place until the concrete attains at least 75% of the specified compressive strength, f_c , but not less than 3,000 psi.
- C. Unless otherwise specified, forms and shoring supporting the weight of all other concrete shall remain in place until the concrete attains at least 50% of the specified compressive strength, f_c , but not less than 2,000 psi.
- D. Unless otherwise specified, construction loads plus dead load on elevated slabs, beams, columns, and walls shall not exceed 50% of the design live load and dead load until the specified compressive strength is attained, unless shoring, designed to carry the total load is in place.
- E. For the purpose of determining when form removal is allowed, the concrete will be presumed to have reached the specified strength when either of the following conditions have been met:
 - 1. When test cylinders, field cured along with the concrete they represent, have reached the strength specified for form removal. The cylinders shall be molded and tested in accordance with Paragraph 4.22 (Testing).
 - 2. When the concrete has been cured in accordance with Paragraph 4.12 (Curing and Protection), for the same length of time as the age at test of laboratory-cured cylinders which reach the strength specified for form removal. The length of time the concrete in the structure has cured shall be taken to be the cumulative time that the concrete has been dampened or thoroughly sealed against moisture loss and the temperature has been maintained above 50° F.
- F. Forms to be reused shall be cleaned immediately after removal.
- G. **No form shall be removed prior to fort-eight (48) hours after completion of a concrete pour.**

4.14 REPAIR OF SURFACE DEFECTS

- A. Surface defects, including tie holes shall be repaired immediately after form removal in accordance with ACI 301 (Section 5), except as otherwise specified.
- B. Unless otherwise specified, all tie holes shall be plugged.

4.15 FINISHING OF FORMED SURFACES

- A. In cases of exposed concrete, all formed surfaces shall be rubbed locally to remove

loosened surface particles, to reduce misalignments of forms to not over 1/16", and to provide a uniform surface texture, immediately after removal of forms and subsequent removal of any concrete fins and after completion of any patching.

- B. In liquid retaining structures, concrete shall be rubbed to one (1') foot below the minimum liquid level (as specified by the Engineer).
- C. In cases of unexposed concrete, no further work is required after the patching is completed.

4.16 FINISHING OF UNFORMED (TOP) SURFACES

- A. All unformed surfaces shown on the plans as level or sloping planes shall be finished to a Class B finishing tolerance [1/4" in ten (10') feet as determined by a ten (10') foot straightedge placed anywhere on the slab in any direction, unless otherwise indicated (see) definition of each Class of Finishing Tolerances in ACI 301, Section 5].
- B. Any depressed surface shall be struck off to elevations noted on plans.
- C. Unless otherwise indicated, one (1) of the following finishes shall be provided, depending upon the use to which the surface will be subjected:
 - 1. Float Finish - Provide an even, level, dense surface by mechanical and/or hand floating to establish finished grades.
 - 2. Soft-Textured Broom Finish - The surface shall be thoroughly hand or mechanically floated as required for Float Finish. Following any trowelling required to meet the specified finishing tolerance, the surface shall be lightly brushed with a soft bristled broom to produce a uniform, slightly textured surface, with grooves at right angles to the direction of greater traffic.
 - 3. Rough-Textured Broom Finish - The surface shall be thoroughly hand or mechanically floated as required for Float Finish. Following any trowelling required to meet specified finishing tolerance, the surface shall be lightly brushed with a coarse bristled broom to produce a uniform roughly textured surface, with grooves at right angles to the direction of greater traffic.
 - 4. Trowel Finish - After thorough hand or mechanical floating, when no additional mortar or moisture can be drawn to the surface, and when the concrete is sufficiently hardened to bear a man's weight without imprint, the surface shall be steel trowelled smooth. Final trowelling by hand shall produce a ringing sound when the trowel is drawn across the surface. This requires a Class A finishing tolerance [1/8" in ten (10') feet as determined by a ten (10') foot straightedge placed anywhere on the slab in any direction].

4.17 METALLIC FLOOR HARDENER APPLICATION

- A. When application of a metallic floor hardener is specified on the drawings, the hardener material shall be applied to a float finished surface at the rate recommended by the manufacturer for the particular type of service to which the floor will be subjected, in accordance with procedure demonstrated in the preparation of a Floor Slab Test Panel. The finish shall match the texture and density of the Floor Slab Test Panel finish selected by the Owner's representative as the model for this work.

4.18 ARCHITECTURAL CONCRETE

- A. All concrete designated as architectural concrete on the drawings or elsewhere in the contract documents shall conform to the requirements of ACI 301 (Section 6) for architectural concrete.

4.19 MASSIVE CONCRETE

- A. All concrete with a least dimension greater than six (6') feet, or when designated on the drawings, shall be treated as mass concrete and the requirements of ACI 301 (Section 8) for massive concrete shall be satisfied.

4.20 PRECAST - PRESTRESSED CONCRETE

- A. Precast - Prestressed concrete shall be in accordance with the construction specifications.

4.21 JOB-CAST, POST-TENSIONED, PRESTRESSED CONCRETE

- A. Job-cast, post-tensioned, prestressed concrete shall conform to the special provisions of Section 9 of ACI 301 in addition to all other applicable portions of the Cast-In-Place Concrete section of the specification.

4.22 TESTING

- A. Concrete testing procedures, except as otherwise provided, shall be as follows:
 - 1. Determining Air Content - ASTM C 173 (Test for Air Content of Freshly Mixed Concrete by the Volumetric Method), or other suitable method approved by the Owner's representative.
 - 2. Determining Slump - ASTM C 143 (Test for Slump of Portland Cement Concrete).
 - 3. Making, curing, and Shipment of Test Specimens - ASTM C 31 (Making and Curing Concrete Compressive and Flexural Test Specimens in the Field), with special attention to consolidation, prevention of water evaporation, temperature control and handling.
 - 4. Compression Testing of Strength Test Specimens - ASTM C 39 (Test for Compressive Strength of Cylindrical Concrete Specimens).
- B. Unused Concrete
 - 1. Concrete in samples removed from concrete trucks for testing purposes shall be wasted on the site as directed by the Owner's representative.

4.23 EVALUATION AND ACCEPTANCE OF CONCRETE STRENGTH AND STRUCTURE

A. General

1. The evaluation of test results, acceptance of concrete, core tests (if required), and acceptance of structure shall be in accordance with ACI 301 (Section 1.6 and 1.7), and the contract documents.

B. Embedded Items

1. Embedded anchor bolts shall be installed per Section 4.06 of this specification and the Contract Documents. Anchor bolts shall be secured in place at the time of inspection with markings to identify grade and size per ASTM.

END OF SECTION

SECTION 11010

MECHANICAL EQUIPMENT - GENERAL

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. The work covered by this section and related sections, which follow, consists of providing all labor, equipment, materials, and supplies; and performing all operations required to install equipment necessary for operation of improvements to Wastewater Pumping Stations. Omission of a specific item or component part of a system obviously necessary for proper functioning of the equipment or system shall not relieve the contractor of the responsibility of furnishing the items as a part of the work at no additional cost to the Owner. This section primarily covers mechanical equipment. The work shall include complete installation of all piping systems, electrical connections, and the furnishing and installation of all appurtenances and incidentals.

1.02 RELATED WORK

- A. Section GC 1-20: General Conditions
- B. All equipment sections
- C. Section 02444: Chain Link Fences and Gates.
- D. Section 09910: Painting
- E. Section 11210: Pumping Equipment
- F. Division 15: Mechanical Work
- G. Division 16: Electrical Work
- H. All earthwork, controls, structures, and electrical and instrumentation components necessary to operate and house the equipment, shall be constructed as shown on the drawings and in accordance with all other applicable portions of the specifications and City of Kingsport

1.03 CONDITIONS

- A. The mechanical arrangements shown on the drawings may vary with different but equal equipment manufacturers. The Contractor shall, at no additional cost to the Owner, make the piping, structural, and electrical related changes necessary to accommodate the specific equipment installed. The contractor's responsibility shall include any necessary redesign and drawing revisions completed in a manner satisfactory to the Engineer and regulatory agencies.
- B. All equipment and drive units shall be accurately aligned, plumbed, and installed in a manner which will prevent imbalance and vibration in both horizontal and vertical directions. Foundations and supports which are shown on the drawings

show approximate sizes and dimensions for the proposed equipment. Contractor shall have the equipment manufacturers approve all foundations and supports for the actual equipment furnished. All rotating equipment shall be dynamically balanced at the factory and their foundations and supports designed and constructed specifically for the equipment furnished.

- C. The services of a qualified factory representative shall be furnished by each of the manufacturers of the mechanical equipment and controls for such time as is required to check out their complete installation and make the equipment operable and acceptable to the Owner and Engineer. The manufacturer's representative shall also instruct the operating personnel in the operation, care, and maintenance of the equipment. Additional requirements regarding field services shall be as specified under each equipment item.

1.04 CODES

- A. Install all work in conformance with all applicable codes, to requirements of authorities having jurisdiction, and to the regulations of related utility companies.
- B. Include in the base proposal any changes to the design to comply with these codes.
- C. When a change is required, send a copy of the applicable code to the Engineer to show the paragraphs related to the change. In no case shall any change be made if the design exceeds the minimum requirements of these codes.
- D. Some of the applicable codes referred to above consist of: NBFU; ASME Safety Code; ASHRAE; National Electric Safety Code; Standard Building Codes; and codes of state and local agencies.

1.05 CORRELATION AND COORDINATION

- A. All conflicts shall be resolved by Contractor and Engineer before installation.

PART 2 - PRODUCTS

2.01 NAMEPLATES

- A. Attach stenciled bakelite nameplates to all equipment and/or systems completely describing its function. Actual working shall be approved by the Engineer. All piping and/or conduit shall be per scheme for identification of piping systems (ASA A13.-1956) and OSHA.

2.02 VIBRATION ISOLATION EQUIPMENT

- A. Provide all vibration isolation equipment and noise control items necessary to prevent objectionable vibration and noise from machinery or piping systems as recommended by the manufacturer or is the norm for standard practice.
- B. Spring mounts shall be: Free standing; laterally stable with housing; 1/2 inch neoprene acoustical friction pads between base plate and supporting surface;

leveling bolts rigidly bolted to machinery; spring diameter not less than 8/10 of compressed height at rated deflection; one (1") inch minimum static deflection; full deflection shall be 1/2 times rated deflection.

- C. Make suitable flexible connections to all equipment to handle the temperatures and pressures of the related piping system.

2.03 LUBRICATING OIL

- A. Provide an initial charge of oil and lubricant for all motors, valves, and pumps.

PART 3 - EXECUTION

(NOT USED)

END OF SECTION

SECTION 11210
PUMPING EQUIPMENT

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. The scope of work is to install and make operational two submersible, sanitary sewer, solids handlings pump, supplied by the bidder for Tony’s Pump Station Improvements Project, complete and ready for operation, the pump and motor as further described below.
- B. The work also includes coordination with the pump supplier for start-up services by a representative of the pump manufacturer.
- C. Contractor shall provide necessary equipment and personnel to offload the pump/motor and place it in the wet well.
- D. Contractor is responsible for all materials and equipment required to provide a complete, functional system.
- E. The remainder of this Specification Section (other than Contractor requirements in PART 3) describes the equipment and services to be provided by the pump supplier for installation by the Contractor.

1.02 RELATED WORK

- A. Section 01340: Shop Drawings, Product Data and Samples

1.03 SUBMITTALS

- A. Submit shop-drawings showing materials, dimensions, special details, and method of installation.
- B. Each pump shall be fully tested on water at the manufacturer's plant. Test shall be at rated speeds, capacities, heads, efficiencies and brake horsepower and at such other conditions of head and capacity to establish performance curves. Pump tests shall be in accordance with the applicable Hydraulic Institute test codes. The pump motors shall not be overloaded in excess of their nominal horsepower at the specified design condition, nor in excess of their horsepower and nameplate rating within the limits of operation of the impeller performance curve. Six (6) certified copies of the test results shall be submitted to and approved by the Engineer before pumps are shipped. Pump design shall conform to the Hydraulic Institute standards and to the performance requirements shown on the drawings and in the specifications.
- C. Tests shall be performed utilizing the actual job motor. Tests with shop motors are not

acceptable.

- D. Six (6) certified copies of the results of final installed testing as described in paragraph 3.03.
- E. Four (4) copies of a certified complete operation and maintenance manual shall be provided prior to completion of the project.

1.04 ACCEPTABLE MANUFACTURERS

- A. This specification is written around EBARA. The Owner's decision concerning the bid that is accepted shall be final.
- B. The following specifications are provided to indicate a level of quality for the pump/ motor combination. The Owner will review information provided with the equipment bids and choose the product that will best fit their needs for this application.

PART 2 - PRODUCTS

2.01 Submersible Pump

- A. Furnish for installation by others two (2) submersible solids handling centrifugal pump for waste water service.
- B. Pump shall meet the following performance requirements.

	Pump #1
Capacity (GPM)	180
Secondary Capacity (GPM)	
TDH (ft)	170
Secondary TDH (ft)	
Shutoff Head (ft)	180
Maximum RPM	1800
Maximum Horsepower	40
No. Units Required	2
Minimum Efficiency at design point (%)	--

- C. Pump Construction:

1. All major parts of the pumping unit(s) including casing, impeller, suction cover, wear rings, motor frame and discharge elbow shall be manufactured from gray cast iron, ASTM A-48 Class 30. Castings shall have smooth surfaces devoid of blow holes or other casting irregularities. Casing design shall be centerline discharge with a large radius on the cut water to prevent clogging. Units shall be furnished with a discharge elbow and 125 lb. flat face ANSI flange. All exposed bolts and nuts shall be 304 stainless steel. All mating surfaces of major components shall be machined and fitted with NBR O-rings where watertight sealing is required. Machining and fitting shall be such that sealing is accomplished by automatic compression of O-rings in two planes and O-ring contact is made on four surfaces without the requirement of specific torque limits. Internal and external surfaces are prepared to SSPC-VISI-3-63 then coated with a zinc-rich epoxy primer. The external surfaces are then coated with a H.B. Teneme-Tar 46-413 coal tar epoxy.
2. For high head units, 4" discharge, 40 to 60 HP shall have a radial multi-vane, enclosed impeller design. It shall be dynamically balanced and shall be designed for solids handling with a long thrulet without acute turns. The inlet edge of the impeller vanes shall be angled toward the impeller periphery so as to facilitate the release of objects that might otherwise clog the pump. A lip seal shall be located behind the impeller hub to reduce the entry of foreign materials into the mechanical seal area. Impellers shall be direct connected to the motor shaft with a slip fit, key driven, and secured with an impeller bolt. The design shall include a replaceable casing wear ring at the pump suction to maintain working clearances and hydraulic efficiencies.
3. Mechanical Seals

Units 7 1/2 to 60 HP shall be designed to include a double mechanical seal in a tandem arrangement. Each seal shall be positively driven and act independently with its own spring system. The upper seal operates in an oil bath, while the lower seal is lubricated by the oil from between the shaft and the seal faces, and in contact with
4. Motor Construction

The pump motor shall be an air filled induction type with a squirrel cage rotor, shell type design, built to NEMA MG-1, Design B specifications. Stator windings shall be copper, insulated with moisture resistant Class H insulation (Class F for 2-5HP). The stator shall be dipped and baked three times in Class H varnish (Class F for 2-5HP) and heat shrunk fitted into the stator housing. Rotor bars and short circuit rings shall be manufactured of cast aluminum. Motor shaft shall be one piece AISI403 for 2 to 5 HP, AISI420 for 7 1/2 to 60 HP, rotating on two permanently lubricated ball bearings designed for a minimum B-10 life of 60,000 hours. Motor service factor shall be 1.15 and capable of up to 20 starts per hour. The motor shall be designed for continuous duty pumping at a maximum sump temperature of 104°F. Voltage and frequency tolerances shall be a maximum 10 / 5% respectively. Motor over temperature protection shall be provided by

miniature thermal protectors embedded in the windings. Mechanical seal failure protection shall be provided by a mechanical float switch located in a chamber above the seal. This switch shall be comprised of a magnetic float that actuates a dry reed switch encapsulated within the stem. Should the mechanical seal fail, liquid shall be directed into the float chamber, in which the rising liquid activates the switch opening the normally closed circuit. For units 2 to 30 HP the float body and float shall be a polypropylene material with a 316SS stopper. Units 40 HP and greater, the float switch components shall be 304SS. The motor shall be non-overloading over the entire specified range of operation and be able to operate at full load intermittently while unsubmerged with out damage to the unit.

Power cable jacket shall be manufactured of an oil resistant chloroprene rubber material, designed for submerged applications. Cable shall be watertight to a depth of a least 65'. The cable entry system shall comprise of primary, secondary, and tertiary sealing methods. The primary seal shall be achieved by a cylindrical elastomeric grommet compressed between the motor cover and a 304SS washer. Secondary sealing is accomplished with a compressed O-ring made of NBR material. Compression and subsequent sealing shall preclude specific torque requirements. The system shall also include tertiary sealing to prevent leakage into the motor housing due to capillary action through the insulation if the cable is damaged or cut. The cable wires shall be cut, stripped, re-connected with a copper butt end connector, and embedded in epoxy within the cable gland. This provides a dead end for leakage through the cable insulation into the motor junction area. The cable entry system shall be the same for both the power and control cables

5. Guide Rail System

System shall include two (2) 304SS schedule 40 guide rails sized to mount directly to the quick discharge connector, QDC, at the floor of the wetwell and to a guide rail bracket at the top of the wetwell below the hatch opening. Intermediate guide brackets are recommended for rail lengths over 15 feet.

The QDC shall be manufactured of cast iron, ASTM A48 Class 30. It shall be designed to adequately support the guide rails, discharge piping, and pumping unit under both static and dynamic loading conditions with support legs that are suitable for anchoring it to the wetwell floor. The face of the inlet QDC flange shall be perpendicular to the floor of the wetwell. The discharge flange of the QDC shall conform to ANSI B16.1 Class 125. The pump design shall include an integral self-aligning sliding bracket. Sealing of the pumping unit to the QDC shall be accomplished by a single, linear, downward motion of the pump. The entire weight of the pump unit shall be guided to and wedged tightly against the inlet flange of the QDC, making metal to metal contact with the pump discharge forming a seal without the use of bolts, gaskets or O-rings. A stainless steel lifting chain of adequate length for removing and installing the pump unit is required. The chain shall have a round link with a 2-1/4" inside diameter every two feet. This link will allow for a sliding pinch bar through the link to pick the chain,

more than once if necessary, at multiple intervals during pump removal and installation.

D. Nameplates and Data Plates

1. Nameplates and data plates shall be stainless steel and securely mounted to the pump. A second nameplate and data plate shall be provided with the O&M manual.

E. Motor Requirements

1. Motor shall be selected in accordance with the pump's non-overloading performance characteristics. Motor horsepower rating shall be chosen to be greater than the pump's peak horsepower requirement throughout the operating range.
2. The motor shall be designed, manufactured and tested in accordance with the following industry standards:
 - a. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
 - b. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
 - c. IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.
 - d. NEMA MG 1 - Motors and Generators.
 - e. NFPA 70 - National Electrical Code.
 - f. UL – Underwriters Laboratories
3. Nameplates and other data plates shall be stainless steel and securely mounted to the motor. A second copy of nameplates and data plates will be provided with the O&M manual.

PART 3 – EXECUTION

1.01 INSTALLATION

- A. Pumps shall be installed (by the Contractor), tested and placed into operation in strict accordance with all Owner and manufacturer's requirements.
- B. To assure proper fit of mating parts and proper machining of components, the pump manufacturer shall completely assemble all pump/motor combinations in his facility. The unit shall then be shipped completely assembled in accordance with the manufacturer's recommended procedure.

1.02 SERVICE

- A. Provide the services of a factory representative to check the installation, supervise start-up, and instruct Owner's personnel in the proper use and maintenance of the equipment. Service shall be a minimum of one (1) eight (8) hour working day of on-site time and shall not include travel or preparation time.

1.03 TESTING

- A. Each pump shall be performance tested in the manufacturer's shop in accordance with the procedures of the Hydraulic Institute Standards.
- B. Each pump shall be tested at design speed and a minimum of three (3) additional speeds to develop performance curves over a range of operational parameters.
- C. Test readings shall be made for at least eight (8) points over the range from shut-off to pump run-out flow. Copies of the test data shall be provided for approval by the Engineer prior to shipment from the factory to the jobsite. Test reports shall include test arrangement, instrumentation, and calibration data, test procedures, test data, and data reduction calculations. Performance test data shall be plotted in curve form with the guaranteed design point shown. Approved copies of the data shall be returned by the Engineer following review.
- D. Vibration tests shall be performed on each pump after installation and initial start-up has been successfully completed.
- E. Vibration testing shall be conducted in strict accordance with the "Hydraulic Institute Standards" for centrifugal, rotating and reciprocating pumps. Vibration testing shall be performed at the Contractors expense by a qualified individual, agreed upon by the Owner and Contractor.
- F. Pumps failing the vibration test shall be corrected in a timely manner and at no cost to the Owner, and retested. Pumps failing two (2) consecutive tests may be considered for replacement of components, and/or complete replacement if correction of standard components or balancing fails to correct the problem. Pumps in this category shall be accepted only with an additional one (1) year written warranty by the manufacturer.

END OF SECTION

SECTION 15001

MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 REFER TO SECTION – 01010 SUMMARY OF WORK

1.02 MECHANICAL SCOPE OF WORK

- A. Piping systems as specified, complete and in operating order.
- B. Installation of all mechanical control components which require mechanical connections only, both mechanical and electrical connections, penetrations of air plenums and ducts, or installations into piping systems.
- C. All low voltage and line voltage control wiring, conduit, and devices for systems furnished under this division.
- D. Excavation and back filling for mechanical work.
- E. Rough-in for equipment using approved rough-in drawings.
- F. Counterflashing of penetrations of roof or exterior walls by pipes, ducts, or other Work under this Division.
- G. Cutting and patching required due to omissions in the installation of Work under this Division, or due to failure to properly coordinate Work with other Divisions.
- H. Painting and labeling of pipe, equipment, and devices furnished under this Division.
- I. Furnish starters for motors furnished and installed under this Division.
- J. Furnish access panels required for equipment furnished and installed under this Division.

1.03 RELATED ELECTRICAL WORK

- A. Wiring and conduit for electrical power shall be furnished and installed under Division 16.
- B. Starters for motors shall be installed under Division 16.
- C. Disconnects shall be furnished and installed under Division 16.

1.04 OTHER RELATED WORK UNDER OTHER DIVISIONS

- A. Flashing of ducts and pipes into roofs and outside walls.
- B. Holes, chases, and recesses required for mechanical work.
- C. Installation and painting of access panels.

- D. Miscellaneous steel including equipment supports.
- E. Concrete housekeeping pads at equipment.
- F. Refer to Division 1 for other requirements.

1.05 CONFLICTS

- A. Engineer shall be notified in writing at least ten (10) days prior to the Bid Date of any conflicts or items requiring clarification. Resolution shall be only by written notice from the Engineer. Oral clarifications shall be confirmed in writing.

1.06 REQUIREMENTS OF REGULATORY AGENCIES

- A. The requirements listed below are given as a supplement to those in Division 1 and do not relieve the Contractor of complying with any and all applicable regulatory requirements set forth in this Specification.
- B. Obtain and pay for the required permits, inspection fees, tapping fees, connection charges, and utility company service charges.
- C. The mechanical work installation shall comply with State and local Health Departments and Building Codes, applicable Life Safety Code, State and local ordinances, and with NFPA Standard 90A and 90B.
- D. Equipment shall be U.L. listed. All installations shall comply with U.L. standards, where applicable.
- E. Equipment and Work shall comply with existing noise and safety standards.
- F. Certificates of compliance from authorities having jurisdiction shall be transmitted to the Engineer and the Owner. Complete all work, pay all fees, and arrange for tests to obtain certificates of compliance.

1.07 SUBMITTALS

- A. Submit to the Engineer for review, in accordance with Section 01340, certified shop drawings on material furnished under this division as listed below. Submittal data shall be checked and stamped approved by the Contractor prior to his transmitting to the Engineer. Refer to Division 1 for additional requirements.
- B. Submittals shall be bound and indexed with a table of contents for each indexed section. Table of contents shall list item, manufacturer, and model number. Large drawings shall be attached to binder or inserted in pockets of binder.
- C. Submittal books shall be complete with all information required for this project prior to submittal. Submittals will be reviewed two (2) times only. The first review will include all items submitted. The second review will verify that comments noted on the first review have been resolved. Additional reviews required due to failure of Contractor to comply with Contract documents shall be at the Contractor's expense.

- D. Submittals required under this Division shall consist of the items listed below. Refer to individual sections for additional information required. Equipment submittals shall include equipment dimensions, locations, maintenance clearances as required by manufacturer or by accepted practice when not specified and, manufacturer's installation instructions.
1. The following mechanical items:
 - All mechanical equipment specified by Owner or Engineer
 - Piping
 - Valves
 - Pumps & Pumping Equipment
 - Pump controls
 - Meters
 - Guides
 - Hatches
 - Gates
 - Rails
 - Panels
- E. Submittals shall contain rating data, accessories, and features, the same as listed in specifications and capacities, shall be stated in the terms specified. Deviations from specifications and drawings shall be noted on the submittal. If none are noted, it shall be assumed the material meets the specified requirements fully.
- F. Where preprinted manufacturer's data describes more than one (1) product, mark submittals to indicate the specific product to be provided for this Project. Delete or mark out significant portions of pre-printed data which is not applicable. Where operating curves, graphs, etc. are required, mark the operating point or range for the Project.
- G. Requests for substitution of products not specifically named shall be submitted in writing a minimum of fourteen (14) calendar days prior to the bid date. Requests shall include section number, items, name of manufacturer to be substituted, and catalog data. Requests shall be reviewed only to approve or reject submission of detailed submittals as noted in other paragraphs of this Section.
- H. Acceptable manufacturers are noted in each section. Do not substitute materials, equipment, or methods unless such substitution has been approved in writing. Where the phrase "approved equal" appears, do not assume that materials, equipment, or methods will be approved until specific written approval has been given. The burden of proof for requested substitutions rests with the Contractor.
- I. Approved substitution requiring variations in quantity or arrangement of materials, or equipment from that specified, or indicated on drawings shall be furnished and installed by the Contractor at no additional cost to the Owner.
- J. Work shall not proceed until submittals for equipment and shop drawings have been approved. Work installed using unapproved substitutions shall be replaced at no

additional cost to the Owner.

K. Submittals may be made in electronic (color .pdf) format.

1.08 GUARANTEE, MAINTENANCE, AND OPERATING INSTRUCTIONS

A. Guarantee: Refer to Division 1 for additional requirements for guarantees.

1. Equipment shall be turned over to Owner clean and in complete working order with manufacturer's warranty as specified for the equipment.

B. Maintenance

1. Work furnished and installed under this Division shall be maintained including inspection, lubrication, etc., in accordance with manufacturer's recommendations until acceptance of system by Owner.

C. Operating Instructions:

1. Furnish to the Owner, one (1) bound and indexed set and three (3) Electronic copies of operation and maintenance instructions on mechanical equipment. Instructions shall also include recommended spare parts lists.

2. Training on the operation and maintenance of the mechanical equipment shall be provided for the Owner's representative. The number of required hours shall be provided as specified for the equipment.

1.09 RECORD DRAWINGS

A. At completion of Work, prepare mechanical record drawings to accurate scale. Drawings shall indicate piping connections, other service connections, and interfaces with other Work including structural supports.

B. Indicate portions of mechanical Work shown on record drawings which deviate from Work as indicated in the contract drawings and note the reasons for such deviations.

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION

SECTION 15060

PUMP STATION PIPING, VALVES, AND APPURTENANCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Section GC 1-20: General Conditions
- B. Section 01340: Shop Drawings, Product Data and Samples
- C. Section 02100: Erosion Control
- D. Section 02220: Foundation, Excavating, and Backfilling
- E. Section 02221 Trenching, Backfilling and Compacting
- F. Division 15 – Mechanical Work
- G. Division 16 – Electrical Work

1.02 QUALITY ASSURANCE

- A. The Contractor shall install, test, and disinfect lines, fittings, valves and appurtenances in accordance with regulations issued by the Tennessee Department of Environment and Conservation and the Town of Mosheim.
- B. 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 in this section shall be used.
- C. Use equipment adequate in size, capacity and numbers to accomplish the work in a timely manner.

1.03 REFERENCES

- A. ASTM B88: Seamless Type K Copper Water Tube.
- B. ASTM 2241: Poly(Vinyl Chloride) (PVC) Pipe (SDR-PR).
- C. AWWA C104: Cement-Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fittings for Water.
- D. AWWA C110: Gray Iron and Ductile-Iron Fittings, 3 in. through 48 in. for Water and other Liquids.
- E. AWWA C111: Rubber Gasket Joints for Cast-Iron and Ductile-Iron Pressure

Pipe and Fittings.

- F. AWWA C151: Ductile-Iron Pipe Centrifugally Cast, in Metal Molds or Sand-Lined Molds, for Water or other Liquids.
- G. AWWA C153: Ductile Iron Compact Fittings.
- H. AWWA C220: Stainless Steel Pipe ½ inch and Larger
- I. AWWA C228: Stainless Steel Pipe Flange Joints for Water Service – Sizes 2-inch through 72-inch.
- J. AWWA C500: Gate Valves.
- K. AWWA C508: Swing Check Valves.
- L. AWWA C700: Cold Water Meters - Displacement Type.
- M. AWWA C701: Cold Water Meters - Turbine Type for Customer Service.
- N. AWWA C800: Threads for Underground Service Line Fittings.
- O. AWWA C901: Polyethylene Tubing.
- P. AWWA C504: Butterfly Valves.
- Q. AWWA C502: Fire Hydrants.
- R. AWWA C509: Tapping Sleeves and Valves.
- S. ASTM D2241: Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)

1.04 SUBMITTALS

- A. Submittals shall be submitted promptly and in accordance with approved schedule, in such a sequence that no delay to the work or to the work of other Contractors is caused.
- B. Product data shall be submitted as required.
- C. Submit certification signed by manufacturer and Contractor that pipe, fittings and appurtenances meet specification requirements.
- D. Submit six (6) certified copies of disinfection test results for potable water lines.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protect ductile iron pipe from damage to coating and lining.

- B. PVC piping shall be stored to protect from long term exposure to direct sun light and shall be stacked in suitable support systems to prevent buckling and deformation.
- C. Immediately prior to lowering pipe or fittings into the trench, clean interior and mating surfaces of dirt and foreign material.
- D. Carefully examine each pipe and fitting for cracks and other defects while suspended above the trench immediately before installation.

1.06 JOB CONDITIONS

- A. Whenever pipe laying is not actively in progress, open ends of all installed pipe and fittings shall be fitted with a watertight plug.
- B. Separation of Potable Water Mains and Sewers:
 - 1. New water mains have been located so that the proper horizontal and vertical separation from new or existing sewers has been provided where the water line parallels a sewer line. However, in the event field conditions reveal that a horizontal separation of ten (10') feet cannot be obtained, the potable water line shall be laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer, so that the bottom of the water main is at least eighteen (18") inches above the top of the sewer pipe.
 - 2. Whenever the water main crosses a sewer main, a minimum vertical distance of eighteen (18") inches shall be provided between sewer pipe. This distance shall be provided whether the water main is above or below the sewer pipe. At crossings one full length of water pipe must be located so both joints will be as far from the sewer line as possible. Special structural support for the water and sewer lines shall be provided.
 - 3. Potable water lines shall not pass through or come in contact with sewer manholes.
- C. Inside pipe shall be properly supported and aligned.
- D. Air piping shall have proper expansion/contraction provisions.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

- A. Ductile-Iron Pipe: AWWA C151, Minimum thickness class 52 for flanged piping and minimum pressure class 350 for buried pipe.
 - 1. Fittings: Ductile, AWWA C110, Mechanical joint or flanged as shown.
 - a. 4" - 24", pressure rated at 350 psig.
 - b. 30"- 36", pressure rated at 250 psig.
 - c. Joints meeting AWWA C111.
 - 2. Joints: Flanged (interior), Mechanical Joint (under structures and buried fittings)

- or, slip joint (buried yard piping) as required.
3. Lining:
 - a. Cement Mortar AWWA C104, for pipe and fittings on the downstream side of the check valves, and for potable water lines.
 4. Ductile Iron pipe shall be internally lined with "Protecto 401", ceramic epoxy lining meeting the following:
 - a. 40-mil dry film thickness lining manufactured under the name of Protecto 401.
 - b. Line interior of bell and exterior of spigot in joint sealing areas with 6 to 10 mils of specified lining.
 - c. Surface preparation: SP10 near white blast.
 - d. Pinhole detection: 2,500 volts minimum over 100 percent of lined surfaces.
 5. Coating:
 - a. Pump-vault to be painted; primed in accordance with Section 09900.
 - b. Buried pipe; minimum one (1) mil bituminous coating over entire outer surface.
 - c. Clearly marked with the manufacturer's name, D.I. or Ductile, weight, working class or nominal thickness, and casting period.
 - d. Wet well piping to be coated with Raven spray on coating.
- B. Stainless Steel Pipe: AWWA C220, Schedule 40.
1. Fittings: Stainless Steel, AWWA C228, Flanged or threaded as shown.
 - a. Joints meeting AWWA C228.
 2. Joints: Flanged and Threaded (interior).
- C. Potable water piping two (2") inch diameter and smaller shall be suitable for 200 psi working pressure and shall be hard drawn Type "K" copper tubing conforming to ASTM B-88. Copper tubing used under slabs shall be soft drawn Type "L".
1. Joints & Fittings - Shall be copper or brass, soldered type.
 2. Solder shall be non-lead approved for potable water supply.
- D. Polyvinyl Chloride (PVC) Pressure Pipe:
1. Joints shall be slip joint.
 2. Fittings shall be ductile iron mechanical joint as outlined in 2.01A.
 3. Pipe shall have an SDR of 17.

2.02 WALL SLEEVES OR WALL PIPE

- A. Where a pipe passes through a concrete wall, furnish and install mechanical joint cast iron wall sleeve, mechanical joint, or flanged wall pipe as shown on the Drawings. Where wall sleeves are used, run pipe continuously through walls, and provide a joint within three (3') feet outside the wall. Formed openings in concrete walls for inserting ductile iron piping will not be allowed. Accurately locate and

securely fasten wall pipe sleeves in place before pouring concrete. Use wall sleeves in locations where small piping and electric wiring connects with or passes through concrete walls, and caulk watertight.

2.03 SCHEDULE 40 AND SCHEDULE 80 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. This specification covers requirements for Schedule 40 and Schedule 80 PVC pipe and fittings made from Type 1 PVC. Standard valves are also included. Service temperatures shall not exceed 140 degrees F.
- B. Materials:
 - 1. Pipe, fittings, and valves shall be manufactured from a PVC compound which meets the requirements of Type 1, Grade 1 PVC as outlined in ASTM D1784. A Type 1, Grade 1 compound is characterized as having the highest requirements for mechanical properties and chemical resistance.
 - 2. The compound from which pipe, fittings, and valves are manufactured shall have been tested and approved for conveying potable water by the NSF.
- C. Pipe shall conform to the requirements of ASTM D1785, Figure 0011210.
- D. Fittings shall conform to the requirements of ASTM D2467 for socket type and ASTM D2464 for threaded type.
- E. All socket type connections shall be joined with primer, Figure 411, and PVC solvent cement, Figure 401, complying with ASTM D2564 by Plastic Piping Systems, Inc., Piscataway, New Jersey.
- F. Installation practices, including support spacing, compensation for expansion and contraction and solvent welding, shall comply with the manufacturer's printed recommendations.
- G. Pipe, fittings, and valves shall be listed by NSF indicating that they have been tested and approved by NSF for conveying potable water. Pipe and fittings must bear the NSF seal.
- H. To ensure installation uniformity, all piping system components shall be the products of one manufacturer.

2.04 SWING CHECK VALVES

- A. Check valve shall be designed to be non-clog, fully automatic, maintenance free and specifically designed for operation in sewer where solids, fibers, grit, or highly viscous materials are encountered.
- B. Valves shall conform to AWWA Section C508.
- C. Valves shall be flanged type with outside lever and weight.

- D. A removable cover shall be provided for the removal of the internal parts without necessitating the removal of the valve from the line. All check valves shall be of ANSI 125 drilled and faced as shown.

2.05 AIR RELEASE VALVES

- A. Air Valves shall be two (2") inch A.R.I. Model D-025-ST with stainless steel body, threaded, and with complete accessory package, or pre-approved equal.

2.06 ECCENTRIC PLUG VALVES

- A. Plug valves shall be as manufactured by Milliken or approved alternate and be of the full port (round) opening type capable of passing line "pigging" equipment. Valve shall be capable of bi-directional shutoff.
- B. Plug valves shall be mechanical joint type for buried application and flanged for interior installation.
- C. Body shall be ASTM A-126, Class B, with nickel seat. Valve shall have Nitrile trim.
- D. Plug shall be ASTM A-536 ductile iron or solid one piece cast iron with resilient coating to resist corrosion and damage.
- E. Valves shall be equipped with gear operators including a 2" square operating nut for buried service, or handwheel operator for pump station/vault piping.

2.07 RESILIENT - SEATED GATE VALVES

- A. Resilient-Seated Gate Valves shall be iron body, Resilient-Seat design, non-rising stem turning counter-clockwise to open. Valves shall meet the requirements of AWWA C-509. Valves shall be furnished with standard operating nut for yard installations and operating handwheel for all interior installations unless otherwise specifically noted. Valves shall operate smoothly through the entire lift and shall have an unobstructed waterway with a diameter not less than a full nominal diameter of the valve.
- B. Valve boxes shall be standard design cast-iron with cover. Boxes shall have an outside diameter of not less than four inches (4") with a minimum thickness of metal at any point of not less than 0.1875 inches. Boxes shall be set in a concrete pad of minimum dimensions 18" x 18" x 6" with 4, #4 bars at fourteen inches (14") long each centered in the pad.
- C. All Resilient-Seated Gate Valves shall be mechanical joint type for yard installations and flanged joint type for all interior installations unless otherwise specifically noted.
- D. Gate valves for two inches (2") and smaller water service shall be iron body, bronze trim, non-rising stem, with operating nut for underground installations and hand-wheel for above ground installation.

2.08 STEEL AND RUBBER COUPLINGS

- A. Steel couplings, where shown on the Drawings, shall be Dresser Type 38, Smith and Blair Type 421, steel couplings for ductile iron pipe, or equal.

2.09 RUBBER EXPANSION JOINT/COUPLINGS

- A. Where shown on the Drawings, these shall be suitable for the service pressure in the line where used and for normal temperatures. Rubber expansion joints shall be supplied complete with steel retaining rings and shall be drilled for coupling to the pipe flanges they are used with. Rubber expansion joints shall be standard single arch joints and shall be filled arch type when used for wastewater service.

2.10 CONCRETE MATERIALS

- A. Class A

2.11 THRUST BLOCKS

- A. Mix and Details for Concrete for thrust blocks for yard piping shall be submitted for approval prior to being placed and shall be placed in accordance with the Typical Details.

2.12 CASTING FOR MANHOLE FRAMES AND COVERS

- A. Gray iron, Class 30 unless otherwise specified, meeting AASHTO M-108.
- B. Cleaned and coated with bituminous paint that will produce an acceptable finish that is not affected by exposure to hot or cold weather.
- C. Rings and covers for use on watertight manholes shall be machined smooth uniform bearing that will provide a watertight seal.
- D. Frame and cover shall be capable of supporting 16,000 pounds wheel load, combined weight shall be as shown on the Typical Details.
- E. Cover shall have concealed pickhole.
- F. The words SANITARY SEWER shall be cast into the cover.
- G. Horizontal and vertical mating surfaces shall be machined.
- H. A twenty-four (24") inch (minimum) clear opening shall be provided in all castings.

2.13 PRE-CAST MANHOLES OR WET WELLS

- A. AASHTO M-199 SR or ASTM C-478, in accordance with the Typical Details.
- B. Openings shall be provided for the required number and size pipes and shall be marked to insure installation at proper locations.
- C. Lift loops shall be ASTM A416 steel strand. Lifting loops made from deformed bars are not allowed.

- D. Flexible Joint Sealants shall be butyl rubber based conforming to Federal Specification SS-S-210A, AASHTO M-198, Type B - Butyl Rubber and as follows: maximum of 1% volatile matter and suitable for application temperatures between 10 and 100 degrees F. Material shall be RV-30 as manufactured by RuVan Inc. (or approved equal) with a minimum cross section 1 1/4 inches.
- E. Epoxy Gels for interior patching of wall penetrations when used as approved by the Engineer shall be a 2-component, solvent-free, moisture-insensitive, high modulus, high-strength, structural epoxy paste adhesive meeting ASTM C-881, Type I and II, Grade 3, Class B and C, Epoxy Resin Adhesive.
- F. Precast Component Fabrication and Manufacture shall be as described in the following paragraph:
1. Precast Manufacturing shall be in conformance with ASTM C478. Wall and inside slab finishes resulting from casting against forms standard for the industry shall be acceptable. Exterior slab surfaces shall have a float finish. Small surface holes, normal color variations, normal form joint marks, and minor depressions, chips and spalls will be tolerated Dimensional tolerances shall be those set forth in the appropriate References and specified below.
 2. Joint Surfaces between Bases, Risers and Cones shall be manufactured to the joint surface design and tolerance requirements of ASTM C361. The maximum slope of the vertical surface shall be 2°. The maximum annular space at the base of the joint shall be 0.10 inches. The minimum height of the joint shall be four (4") inches.
 3. Lift Inserts and Holes shall be sized for a precision fit with the lift devices, shall comply with OSHA 1926.704, and shall not penetrate through the manhole wall.
 4. Step Holes: Step holes shall be cast or drilled in the Bases, Risers and cones to provide a uniform step spacing of sixteen (16") inches. Cast step holes shall be tapered to match the taper of the steps.
- G. Precast Base Sections shall be cast monolithically without construction joints or with an approved galvanized or PVC waterstop in the cold joint between the base slab and the walls. The bottom step in base sections shall be a maximum of twenty-six (26") inches from the top of the base slab. The width of the base extensions on Extended Base Manholes shall be no less than the base slab thickness.
- H. Precast Riser Sections shall have a minimum lay length of sixteen (16") inches.
- I. Precast Concentric and Eccentric Cone Sections shall have an inside diameter at the top of twenty-six (26") inches. The width of the top ledge shall be no less than the thickness required for the cone section. Concentric cones shall be used only for Shallow Manholes.
- J. Precast Transition Cone Sections shall provide an eccentric transition from sixty (60") inches and larger manholes to forty-eight (48") inches diameter risers, cones and flat slab top sections. The minimum slope angle for the cone wall shall be 45 degrees.

- K. Precast Transition Top Sections shall provide an eccentric transition from sixty (60") inches and larger manholes to forty-eight (48") inch diameter risers, cones and flat slab top sections. Transition Top sections shall be furnished with vents as shown on the manhole details. The maximum amount of fill over the transition top section shall be twenty (20') feet. Transition Tops shall not be used in areas subject to vehicle traffic.
- L. Precast Flat Slab Top Sections shall have an inside diameter at the top of twenty-six (26") inches and shall be designed for HS-20 traffic loadings as defined in ASTM C890. Items to be cast into Special Flat Slab Tops shall be sized to fit within the manhole ID and the top and bottom surfaces.
- M. Precast Grade Rings shall be used to adjust ring and covers to finished grade. No more than ten (10) vertical inches of grade rings will be allowed per manhole. Grade Rings shall conform to ASTM C478 and shall be no less than four (4") inches in height.
- N. Precast Inverts shall meet the following requirements.
1. Pipe openings shall provide clearance for pipe projecting a minimum of two (2") inches inside the manhole. The height of the transition from the pipe opening to the invert trough shall be equal to $1/2$ of the Opening ID minus Pipe ID, plus or minus $1/4$ ". The crown of small I.D. pipe shall be no lower than the crown of the outlet pipe. When the fall between the inlet and the outlet holes is greater than (4") four inches, the inlet end of the trough shall be below the inlet pipe invert and aligned horizontally within one (1") inch.
 2. Invert Troughs shall be formed and finished to provide a consistent slope from the pipe outlet to the inlets up to four (4") inches tall. The minimum fall shall be one (1") inch. The minimum outside bending radius from influent to effluent shall be 1.5 times the pipe I.D. A $1/2$ " radius shall be provided at the intersection of two (2) or more channels. The minimum concrete thickness from the bottom of the trough to the bottom of the base shall be seven (7") inches.
 3. Invert Benches shall have a float finish with a uniform $2\ 1/2$ " slope, plus or minus one (1") inch, from the high point at the manhole wall to the low point at invert trough. A $1/4$ " radius shall be provided at the edge of the bench and trough.
 4. Depressions, high spots, voids, chips, or fractured over $1/4$ " in diameter or depth shall be filled with a sand cement paste and finished to a texture reasonably consistent with that of the formed surface.
- O. Precast Components and grade rings shall be sealed around the external perimeter as follows:
1. External Seals shall consist of a polyethylene backed flat butyl rubber sheet no less than $1/16$ " thick and six (6") inches wide applied to the outside perimeter of the joint. Material to be RV-40-PW (or approved equal) as manufactured by RuVan, Inc.
 2. Internal Seals shall consist of a plastic or paper backed butyl rubber rope no less than fourteen (14') feet long and having a cross-sectional area no less than the annular space times the height of the joint.

- P. Lifting devices for handling Pre-cast Components shall be provided by the Pre-cast Manufacturer and shall comply with OSHA Standard 1926.704.
- Q. Coating and Sealing Materials:
1. AQUATAPOXY Coating "A-6" as manufactured by American Chemical Corporation.
 2. QR-304 as manufactured by QUADDEX, Inc.
 3. Color to be white or other manufacturer's standard colors, to be selected by the Owner.
 4. Coating shall be applied to structures as shown on the Plans.
 5. Prepare structures for coating in accordance with manufacturer's recommendations.

2.14 MANHOLE STEPS

- A. Steps shall be provided in Bases, Risers, Cones, Transition Cones, and Transition Top sections aligned vertically on sixteen (16") inch centers. Steps shall be secured to the wall with a compression fit in tapered holes or cast in place. Steps shall not be vibrated or driven into freshly cast concrete or grouted in place. The steps shall be Copolymer Polypropylene Plastic reinforced with a 1/2" diameter grade 60 bar and have serrated tread and tall end lugs. Step pullout strength shall be 2,000 lbs. minimum when tested according to ASTM C497.

2.15 PIPE ENTRANCE COUPLINGS FOR MANHOLES

- A. Pipe to Manhole Connectors shall conform to ASTM C923, and to ASTM C-425. The location of the pipe connectors shall vary from the location shown on the Project Plans no more than 1/4 inch vertically and 5° horizontally. Provide for control of the OD to within the tolerances of the connector on flexible pipes larger than twelve (12") inches.
- B. Rigid cement or synthetic type grouts are not acceptable as a seal between the manhole and entry pipe.
- C. The manhole entrance coupling with the entry pipe shall be fitted with a Neoprene Boot insert, "KOR-N-SEAL", PSX, or approved equal.
- D. Other specially designed flexible products may be approved for use in adding a pipe entrance to an installed manhole and for other uses where available and where materials meet the requirements of ASTM C-425.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Install barriers and other devices to protect areas adjacent to construction.

- B. Protect and maintain all benchmarks and other survey points.
- C. Protect and maintain all pipe and equipment not scheduled for replacement, and/or all pipe and equipment scheduled for operation during the construction period of the new components.
- D. Prior to laying pipe, prepare a suitable bedding according to Section 02221.
- E. Before placing pipe in the trench, field inspect for cracks or other defect; remove defective pipe from the construction site.
- F. Swab the interior of the pipe to remove all undesirable material.
- G. Prepare the bell end and remove undesirable material from the gasket and gasket recess.
- H. Establish line and grade for pipe and appurtenances. Verify location and elevation of other utilities and manholes for gravity sewers.

3.02 INSTALLATION OF PRESSURE PIPE

- A. Trenching and backfill for yard and under slab piping shall meet the requirements of Section 02221.
- B. During pipe installation Contractor shall take every precaution to prevent foreign material from entering the pipe or fittings. The Contractor shall place a heavy, tightly woven canvas bag over each end of joint of pipe before lowering it into the trench.
- C. Jointing procedures, including cleaning of ends of pipe, and lubrication shall be in accordance with the manufacturer's recommendations. All push-joint and/or mechanical joint pipe shall be laid with the bells pointing in the direction of laying.
- D. Field cutting of pipe shall be done according to the manufacturer's recommendations. Cut end shall be smooth and at right angles to the axis of the pipe. Field cuts shall be filed or trimmed to resemble the spigot end of the pipe as manufactured. Depth marks shall be placed on the pipe to assure pipe is inserted to the full depth when joint is made.
- E. Unless otherwise shown on the Drawings, thrust blocking shall be provided at all bends (of 11-1/4 degrees or greater) and tees and valves. Blocking shall be poured against undisturbed earth, be a minimum of twelve (12") inches thick and constructed so that the pipe and fitting joints will be accessible for repairs.
- F. All yard valves shall be installed plumb and true in a workmanlike manner.
- G. All interior valves shall be installed plumb and true in a workmanlike manner with operator positioned to allow ease of operations.

3.03 INSTALLATION OF GRAVITY SANITARY SEWERS

- A. Lay pipe true to the lines and grades from the grade and alignment stakes, or equally usable reference.
 - 1. Where laser equipment is used, provide offset hubs at every manhole location for purposes of checking grade between sections.
 - 2. Where batter boards are used, furnish stakes at intervals of fifty (50') feet along the route of the pipeline.
 - 3. Set stakes at such distance from centerline of excavation as is suitable for the excavating method and machinery used.
 - 4. Provide and use accurately set batter boards at each fifty (50') foot interval in establishing the bottom invert of each pipe laid.
- B. Lay pipe progressively up grade, with bell upstream, in such a manner as to form close, concentric joints with smooth bottom inverts. Joining of all pipe shall be in accordance with manufacturer's specifications.
- C. Bed each pipe section in accordance with Section 02221.
- D. Unless otherwise specified, provide all gravity sewer lines with a minimum of four (4') feet of cover in roadways and 2 1/2 feet of cover in open areas, unless ductile iron pipe or concrete encasement is used.
- E. Do not allow walking on complete pipelines until backfill has been placed to a depth of at least six (6") inches above the crown of the pipe.
- F. Keep the interior of the pipe free of all unneeded material, and upon completion of a section between any two manholes it shall be possible to view a complete circle of light when looking through the pipe.
- G. When laying pipe ceases, close the open ends of the pipe with a suitable plug for preventing the entrance of foreign materials.
- H. Couplings and adapters used for joining dissimilar gravity pipe materials, for repairing and rejoining sections of gravity sewer, and for connecting the first full joint of pipe to a short stub through a manhole wall shall meet the requirements of ASTM C-425.
- I. All couplings and adapters for gravity sewer pipe shall be of rubber, plastic and metallic materials that will not be attacked by municipal wastewaters or aggressive elements in the soil and conform to ASTM - 425, Section 5.

3.04 INSTALLATION: SEWER MANHOLES - GENERAL

- A. Unless otherwise specified, all manholes shall have inside diameter or not less than four (4') feet and a vertical wall height of not less than 2.5 feet.
- B. The clear opening in the manhole shall be not less than twenty-six (26") inches.
- C. Depth of the manhole shall be the vertical distance from the lowest invert in the manhole to the base of the ring.
- D. Backfill manholes with the same material used for pipeline.

3.05 INSTALLATION: STANDARD PRE-CAST CONCRETE MANHOLES

- A. Manhole shall be installed in accordance with ASTM C-478.
- B. Excavate to the required depth and remove materials that are unstable or unsuitable for a good foundation. Prepare a level, compacted foundation extending six (6") inch beyond the manhole base.
- C. When wet or unconsolidated material occurs or when over excavation of the base occurs, provide a sub-base with a minimum of twelve (12") inch of Class I, granular material, well compacted with mechanical tamping equipment.
- D. Set base plumb and level, aligning manhole invert with pipe invert.
- E. Secure Pipe Connectors to Pipe according to the Connector Manufacturer instructions. When pipe stub outs are installed, provide restraint from longitudinal movements before backfill.
- F. Inlets and outlets from each manhole shall be finished smooth and flush with the sides of manholes walls so as not to obstruct the flow of liquid through the manhole.
- G. Thoroughly clean bells and spigots to remove dirt and other foreign materials that may prevent sealing. Unroll the Butyl Sealant rope directly against base of spigot. Leave protective wrapper attached until sealant is entirely unrolled against spigot. Do not stretch. Overlap from side to side - not top to bottom.
- H. Set risers and cones so steps align, taking particular care to clean, prepare and seal joints.
- I. After joining manhole sections, apply the butyl sealant sheet around the outside perimeter of the joint.
- J. Lift Holes leaving less than two (2") inches of wall thickness shall be plugged from the outside using a sand cement mortar, then covered with butyl sealant sheet. Should Lift Holes penetrate the wall they shall be additionally sealed with an interior application of an epoxy gel 1/2" thick extending two (2") inches beyond the penetration.
- K. Perform the final finishing to the manhole interior by filling all chips or fractures greater than 1/2" in length, width or depth and depressions more than 1/4" deep in inverts with an approval hydraulic cement. Do not fill the joints between the precast concrete sections. Clean the interior of the manhole, removing all dirt, spills or other foreign matter.

3.06 INSTALLATION: MANHOLE RINGS AND COVERS

- A. Grout and anchor manhole rings and covers in place with butyl sealant rope and bolts in accordance with the Project Details.
- B. The bearing surfaces between cast rings and covers shall be machined, fitted together, and match marked to prevent rocking.
- C. All casting shall be of the types, dimensions, and weights as shown on the plans and shall be free of faults, cracks, blow-holes, or other defects.

- D. Set the manhole frames to the required elevation using no more than ten (10") inches of precast concrete grade rings, sealing all joints between cone, adjusting rings, and manhole frame.
- E. Standard manhole frames set above grade and all watertight frames shall be held in place by four (4) threaded anchors. Anchors shall consist of:
 - 1. Four (4) 3/4" diameter by eight (8") inches long stainless steel all-thread rod.
 - 2. Set all-thread rod into 3/4" holes six (6") inches deep into the precast manhole with approved two (2) component epoxy anchor bolt setting compound.
 - 3. Secure ring with stainless steel washers and nuts after setting compound has cured.

3.07 INSTALLATION: DROP MANHOLE ASSEMBLIES

- A. Drop manhole assemblies shall be constructed as outlined in the Standard Details and on the plans.
- B. The material used in the drop pipe construction shall be Ductile Iron Pipe and Class B concrete.

3.08 FIELD TEST - INITIAL PROOF TESTING OF SANITARY SEWERS

- A. It is the intent to specify a "test as you go" procedure in order to establish confidence in the installation and avoid the necessary delay of final acceptance.
- B. Before a reach of pipeline is approved for payment, successfully proof test that reach for grade, alignment, cleanliness, and leakage.
- C. In the event that four or more reaches fail to satisfactorily pass proof testing procedures, cease pipe laying until deficiencies are identified and corrected.
- D. The basis for grade, alignment and cleanliness testing will be visual inspection. Leakage testing will be by means of low pressure air or exfiltration or infiltration as deemed by the Engineer.
- E. Proof test flexible pipeline installation for deflection by pulling a "go, no-go" test mandrel through the line after the initial backfill is complete to avoid unnecessary dig-ups.

3.09 FIELD TEST - FINAL GRAVITY SEWER TESTING

- A. Before the Work is accepted and before any house services are connected, a final testing procedure is to be followed.
- B. Perform a visual inspection when groundwater levels are above the pipeline if possible. All visible leaks shall be repaired.
- C. The standard leak test for all gravity sewers shall be a low pressure air exfiltration test. Other exfiltration tests, if approved by the Engineer, will be conducted in accordance

with ASTM C-828 or latest revision.

- D. If flexible pipe is used, pull an approved go-no go deflection mandrel of 95/100 pipe diameter through all reaches of gravity sewer main. This test shall be conducted no sooner than twenty-four (24) hours after completion of backfilling of the tested reach. No sections will be accepted that exhibits a deflection of more than 5%.

3.10 LOW PRESSURE AIR EXFILTRATION TEST - GRAVITY SEWERS

- A. Calculate the pressure drop as the number of minutes for the air pressure to drop from a stabilized pressure of 4.0 to 3.0 PSIG.
- B. Times for mixed pipe sized of varying lengths should be calculated as described in ASTM, C828-76T using formula $t = K d/q$ ($q = .0020$).
- C. Lengths of sections under test shall not exceed 500 linear feet.
- D. The following items are for one (1) pipe size only:

**AIR TEST TABLE
SPECIFICATION TABLE (MIN:SEC) REQUIRED
WHEN TESTING ONE PIPE DIAMETER ONLY
PIPE DIAMETER, INCHES**

	4	6	8	10	12	15	18	21	24	27	38	33	36	39	42
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25	0:04	0:10	0:18	0:28	0:40	1:02	1:29	2:01	2:38	3:20	4:08	4:59	5:56	6:58	8:05
50	0:09	0:20	0:35	0:55	1:19	2:04	2:58	4:03	5:17	6:41	8:15	9:59	11:53	13:57	16:10
75	0:13	0:30	0:53	1:23	1:59	3:06	4:27	6:04	7:55	10:01	12:23	14:58	17:00	18:25	19:50
100	0:18	0:40	1:10	1:50	2:38	4:08	5:56	8:05	10:34	12:45	14:10	15:35			
125	0:22	0:50	1:28	2:18	3:18	5:09	7:26	9:55	11:20				20:25	19:58	23:06
150	0:26	0:59	1:46	2:45	3:58	6:11	8:30			13:24	16:32	17:09	23:49	23:57	27:43
175	0:31	1:09	2:03	3:13	4:37	7:05			12:06	15:19	18:54	20:01	27:13	27:57	32:20
200	0:35	1:19	2:21	3:40	5:17			10:25	13:36	17:13	21:16	22:52	30:37	31:56	36:58
225	0:40	1:29	2:38	4:08	5:40		8:31	11:35	15:07	19:08	23:38	25:44	34:01	35:56	41:35
250	0:44	1:39	2:56	4:35			9:24	12:44	16:38	21:03	25:59	28:35	37:25	39:56	46:12
275	0:48	1:49	3:14	4:43		8:16	10:12	13:53	18:09	22:58	28:21	31:27	40:49	43:55	50:49
300	0:53	1:59	3:31		6:03	9:27	11:54	16:12	21:10	26:47	33:05	34:16	47:38	47:55	55:26
350	1:02	2:19	3:47		6:48	10:38	13:36	18:31	24:12	30:37	37:48	40:01	54:26	55:54	64:41
400	1:10	2:38			7:34	11:49	15:19	20:50	27:13	34:27	42:32	45:44	61:14	63:53	73:55
450	1:19	2:50		5:14	8:19	13:00	17:01	23:09	30:14	38:16	47:15	51:27	68:02	71:52	83:10
500	1:28			5:45	9:04	14:11	18:43	25:28	33:16	42:06	51:59	57:10	74:51	49:51	92:24
550	1:37		4:02	6:17	9:50	15:21	20:25	27:47	36:17	45:56	56:42	62:53	81:39	87:50	101:3
600	1:46	2:50	4:22	6:48			22:07	30:06	39:19	49:45	61:26	68:36	88:27	95:49	8
650	1:54											74:19		103:4	110:5
														8	3
															120:0
															7

3.11 FIELD TEST - PRECAST MANHOLES

- A. Manholes shall be physically, and vacuum tested to assure compliance with the Contract Documents and the desired workmanship of the finished work has been achieved.
- B. Manhole Vacuum Test:
 1. Backfill shall be placed around the base of the manhole to a depth of one (1') foot over the top of the sewer pipe before the vacuum test is performed.
 2. The maximum vacuum applied to a manhole shall be twelve (12") inches of mercury (Hg).
 3. All manholes shall be subject to a vacuum test of a minimum of ten (10") inches Hg prior to acceptance by the Owner. The test shall be considered acceptable if the vacuum drops no more than one (1") inch within the time specified in the following table:

Manhole I.D. (inches)	48	60	72	84	96	120
Test Time for up to 8 feet in depth (seconds)	60	70	80	90	100	120
Additional Test Time for each 4 Foot Added Depth (Seconds)	10	15	20	30	40	60

- 4. Testing Sequence:
 - a. All manholes shall be physically, and vacuum tested. Manholes failing the test shall be repaired by the Contractor, and retested.
 - b. Manholes failing the vacuum test two (2) times may, at the

discretion of the Owner, be allow to be hydrostatically tested by an exfiltration test for acceptance.

c. The OWNER may require complete replacement of any manhole failing three (3) leak tests. Replacement shall be at no cost to the OWNER.

5. The CONTRACTOR shall furnish all necessary equipment and personal to conduct the tests in the presence of the ENGINEER.

6. Costs for initial testing shall be included within and incidental to the Contract Unit Price for manhole construction or rehabilitating.

7. Repairing, retesting, pressure grouting and/or replacement of defective manholes shall be at the sole cost and responsibility of the CONTRACTOR and shall be pursued in a timely manner to prevent disruption to the Project and/or sewer services.

8. Manholes moved, disturbed, displaced and/or damaged in any way during the finishing and/or backfilling operation subsequent to successful testing shall be retested for acceptance as specified above, at the CONTRACTOR's expense.

3.12 PRESSURE SEWER TESTING

- A. Tests are to be conducted on lengths between valves or plugs and in no case on more than 3,000 linear feet of pipe in any one (1) section.
- B. After the pipe has been laid, it shall be subjected to a hydrostatic pressure of 200 psi, based on the elevation of the lowest point in the line or section under test and corrected to the elevation of the test gauge.
- C. The duration of each pressure test shall be at least two (2) hours when joints are exposed and four (4) hours where any joints in the line are covered or backfilled. The pressure shall not drop more than five (5) psi during the test period.
- D. Each valved section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connection to the line. The pump, pipe connection, all necessary apparatus, and the gauges for the test, all taps into the pipe, and all necessary personnel for conducting the tests shall be furnished by the contractor and approved by the Engineer.
- E. Where any section of a main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least seven (7) days have elapsed after the concrete reaction backing was installed.
- F. Before applying the specified test pressure, all air shall be expelled from the pipe. If release valves are not available at high points, the Contractor shall, at his own expense, make the necessary taps at points of highest elevation before the test is made and provide corporation stops to seal the taps after the test has been completed.
- G. All exposed pipes, fittings, and joints will be carefully examined during the pressure test. Leaking joints shall be disassembled, cleaned, and reassembled and/or defective

material replaced until all leakage is stopped.

- H. Any cracked or defective pipe or fittings discovered in consequence of this pressure test, shall be removed and replaced with sound material, and the test shall be repeated until satisfactory results are obtained.
- I. A leakage test shall be conducted concurrently with the pressure test. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.
- J. The Contractor shall furnish the pump, pipe, connections, gauges, measuring devices, and all other necessary apparatus and shall furnish all necessary assistance to conduct the test.
- K. The duration of each leakage test shall equal the duration of the pressure test. No pipe will be accepted until the leakage during the test period is less than 0.67 gallons per 1,000 feet of pipe under test.
- L. If any test discloses leakage greater than the allowance, the Contractor shall, at his own expense, locate and repair defects until the leakage is within the specified allowance. Following repairs, the line shall be retested.
- M. Any visible leaks at exposed joints or leaks evident at the surface where joints are covered shall be repaired by rejoining regardless of the total leakage shown by any test.
- N. The Owner will provide water for testing of new lines; however, should any section of line have to be retested due to failure of such lines to test up to specification, the water used will be furnished by the Contractor and may be purchased from the Owner.

END OF SECTION

SECTION 15911

CONTROLS AND INSTRUMENTATION

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. This section covers work necessary for the design, testing, installation, field testing, and startup and final documentation for the Pump Control Panel, associated instrumentation, and software for the Town of Mosheim, Tennessee – Tony’s Pump Station as described in this specification and shown on the drawing(s).
- B. The work shall include the complete testing, recommended by respective equipment manufacturers, of all equipment and shall also include any changes or adjustments necessary for the proper functioning of the system and equipment.
- C. It shall be the responsibility of the Contractor to coordinate the work and equipment, as set forth in this section, with work and equipment specified under other sections of the Specifications in order to provide a complete and satisfactory installation. No changes in the work shall be made without written approval of the Engineer.
- D. Major components of this system shall include the specified materials, equipment and installation required to implement a complete and operational Control System along with associated instrumentation and control functions.
- E. Equipment and installation covered under Section 15911.
 - 1. **Pump Control Panel** – For operation of the pump station.
 - 2. **Programmable Logic Controllers (PLCs)** - Hardware and software required for the various data acquisition and control sub-systems.
 - 3. **Pump Controller**
 - 4. **SCADA RTU** – Pump Station Telemetry
 - 5. **Field Instruments** - Process measurement and control devices.
 - 6. **Execution** – Labeling, wiring, and calibration requirements.
- F. Supplier shall submit his bid on the basis of the equipment (installed by Electrical Contractor) herein described in order to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer’s service with the Town of Mosheim Wastewater system.

1.02 SCOPE OF WORK

- A. The Supplier shall:
 - 1. Provide all required submittals for the Pump Control Panel.
 - 2. Provide all required submittals for the field instruments.

3. Provide complete shop drawings for the control panel.
4. Integrate the control System and ensure proper functionality as specified in this section.
5. Provide the Pump Controller as specified in this section.
6. Coordinate with the Contractor to ensure proper installation of the Control System components.
7. Provide on-site startup of the Pump Control Panel.
8. Provide all required testing and calibration.
9. Troubleshoot and correct any issues that arise during the installation, testing, and startup of the installed monitoring, communication, and other equipment and systems.
10. Provide five (5) copies of the Operation and Maintenance manuals. Four (4) paper copies and one (1) color .pdf electronic copy are required.

B. Codes and Standards

1. NFPA 70 - National Electrical Code (NEC)
2. ANSI C84.1 – Electric Power Systems and Equipment - Voltages Ratings (60Hz).
3. CSA C22.2 No. 14-05 - Industrial Control Equipment.
4. NEMA ICS 1 – Industrial Control and Systems General Requirements
5. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
6. UL 508 - UL Standard for Safety Industrial Control Equipment.
7. UL 508A - UL Standard for Safety for Industrial Control Panels.
8. UL 50 - UL Standard for Safety for Enclosures for Electrical Equipment.

1.03 SUBMITTALS

- A. Complete electronic submittals shall be provided for review and approval prior to fabrication.
- B. The submittal package shall include complete wiring diagrams, scaled layout drawings of the subpanel and inner doors (when applicable), complete bill of materials and component data sheets.
- C. The wiring diagrams shall include terminal strip layouts to assist the installer with field devices connections including torque requirements per manufacturer's recommendations.
- D. Contact usage of control devices such as controller and relays shall be identified by the components coil and identified as either normally open or normally closed.
- E. The schematics must contain all markings required by the UL508A standard and functional descriptions of the devices. All ladder rungs shall be numbered in the left margin.

- F. Manufacturer's data sheets showing dimensions, mounting, and external connecting details. Data sheets shall be marked indicating pertinent data and identifying each component by item number and nomenclature.
- G. Field Instrument manufacturer's data sheets showing dimensions, mounting, and external connecting details. Data sheets shall be marked indicating pertinent data and identifying each component by item number and nomenclature.
- H. Acceptance Test procedures descriptions shall be in sufficient detail to fully describe the specific tests to be conducted to demonstrate conformance with this specification.
- I. Submittals shall be in electronic format such as PDF or native application. The submitted documents must be legible. If documents are scanned in order to provide electronic submittal, the scan MUST be of high quality so as to be legible. Illegible documents will be rejected as non-compliant.

1.04 PROJECT RECORD DOCUMENTS

- A. Following Site Acceptance, the Contractor shall furnish three (3) complete sets of hard-covered ring bound loose-leaf Operation & Maintenance Manuals and one (1) color .pdf copy required by relevant paragraphs in Sections 01340 and 01720, containing the following:
 - 1. "As Built" drawings showing all equipment as actually installed. This set of drawings shall include all installed change orders, field condition changes, and other departures from the original plans and Specifications.
 - 2. Shop drawings and other data required by the Specifications reflecting the manufacturer's shop fabrication of the materials and equipment as installed. Data sheets shall be provided for all instruments, controllers, and computers detailing as-installed hardware configuration and setup.
 - 3. Instruction manuals detailing operation procedures, computer user interface, and special maintenance. Manuals shall give thorough attention to system management from an operator's viewpoint, including normal operation and adjustments, access to "Help" functions, emergency procedures, and failure recovery.
 - 4. The submitted literature shall be in sufficient detail to facilitate the operation, removal, installation, programming and configuration, adjustment, calibration, testing and maintenance of each component and/or instrument.

- B. The contents of the O&M manuals shall be generally organized as follows:
 - 1. System Hardware/Installation
 - 2. Operation
 - 3. Maintenance and Troubleshooting

1.05 ON SITE SUPERVISION

- A. The Supplier shall provide experienced personnel to supervise, perform, and coordinate the installation, adjustment, testing, and startup of the Pump Control Panel and Field Instrumentation. The personnel shall be present on-site as required to affect a complete and operating system.

1.06 TESTING AND STARTUP

- A. All elements of the control panel shall be tested to demonstrate that the complete control panel meets all of the requirements of this Specification. All special testing materials and equipment shall be provided by the Contractor. The Contractor shall coordinate and schedule all of his testing and startup work with the Owner. Testing requirements are as follows:
 - 1. The control panel supplier must apply a systematic and documented testing procedure to each and every panel manufactured in their facilities.
 - 2. Evidence of such testing shall be available to the customer upon request and it shall include all test steps and identification of testing and inspecting personnel.
 - 3. All system components shall be checked to verify that they have been installed properly and that all terminations have been made correctly.

1.07 TRAINING

- A. The training program shall educate operators, maintenance, engineering, and management personnel with the required levels of system familiarity to provide a common working knowledge concerning all significant aspects of the system being supplied. The training program shall consist of one (1) hour. At least two weeks prior to the requested start of the program, the proposed date of training shall be submitted to the Owner for approval.

1.08 WARRANTY

- A. The Pump Control Panel warranty shall be for a period of 1 year from commissioning of the station. Warranty excludes incidental or consequential damages and surge/transient damages. The warranty is effective against all defects

in workmanship and/or defective components. The warranty is limited to replacement or repair of the defective equipment.

1.09 QUALIFICATIONS

- A. The Supplier shall have been regularly engaged in the type of work called for under these Specifications for at least ten years to date and shall have recent and pertinent experience with systems of comparable scope and complexity.
- B. The Supplier shall demonstrate systems capabilities by having the resources to successfully complete the work as called for in the Specifications.
- C. The Supplier shall be fully certified according to Underwriters Laboratories Subject 508A at the time of contract award.

1.10 DEFINITION OF ACCEPTANCE

- A. System acceptance shall be defined as that point in time when the following requirements have been fulfilled:
 - 1. All O&M documentation has been submitted, reviewed, and approved.
 - 2. The complete Control System and instrumentation has successfully completed all testing requirements specified herein and have successfully been started up.
 - 3. All Owners' staff personnel training programs have been completed.
 - 4. Owner/Engineer sign a document indicating Pump Control Panel has formally been accepted.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The functions and features specified hereunder are the minimum acceptable requirements for the control system. The provided system shall equal or exceed each requirement.
- B. In some cases, the specifications may allow the accomplishing of certain functions by means of more than one hardware/firmware/software approach. Any approach that is proposed shall equal or exceed all functional, operational, convenience and maintenance aspects of the one described.
- C. Major equipment, component and software items are specified; however, the Supplier shall, at no additional cost, provide all appurtenant items, whether specifically referenced herein or not, but which may be required for operation as hereinafter specified.

2.02 CONTROL REQUIREMENTS

- A. The pump control circuit shall be provided such that operation of the pumps is as required by the Owner. The following description of operation is general and preliminary. All setpoints and detailed operation will be as required by Engineer and Owner.
- B. The control function shall provide for the operation of the pumps under normal conditions and shall alternate the pumps on each pump down cycle to equalize the run time.
- C. Pumps shall operate on a "lead", "lag" alternate sequence.
- D. The station will operate based on the Wet Well Level signal input to the pump controller.
- E. Setpoints:

Pumps	Wet well Level *
Lead Pump Start	(To Be Determined)
** Lag Pump Start	(To Be Determined)
All Pumps Off	(To Be Determined)
High-High Wet Well Float	(To Be Determined)
Low-Low Wet Well Float	(To Be Determined)

NOTE: All setpoints are PRELIMINARY and must be coordinated with Owner.

* Field verify with Owner's Representative

** NOTE: Once the lag pump is started, both pumps will run until the "OFF" level is reached.

- F. The pump control panel shall have two control modes: 1) Automatic and 2) Float. Each mode is briefly described below:
 - 1. Automatic Mode – This mode is activated by the 2-position switch on the deadfront of the control panel. When the switch is in Automatic, the system will alternate the lead and lag pumps to satisfy the duplex pump controller preset level setpoints. The analog level transducer will deliver a signal to the duplex pump controller to operate pumps.
 - 2. Float Mode – This mode is activated by the 2-position switch on the deadfront of the panel. When the switch is in Float, the circuit is completely hard wired. Pump #1 will be the lead pump and pump #2 will be the lag pump. Pump alternation is not required in Float Mode. Float mode will be the backup mode for when the duplex pump controller is out of service.
- G. When the HOA switch is in the "OFF" position, the pump will NOT operate.

- H. When the HOA is in the “HAND” position, the pump will run.
- I. When the HOA switch is in the “AUTO” position, the pump will operate from the controller based on the Wet Well level.
- J. The pump will trip, or be prevented from starting, when any of the following conditions exist:
- PHASE FAULT
 - MOTOR OVERLOAD
- K. SCADA Interface
1. The supplier shall furnish and install a SCADA RTU in the Pump Control Panel.
 2. Furnish a Mission Communications MyDro Series RETROFIT UPGRADE Wireless Real-Time Alarm System with Steaming RTU unit in a Flatpak enclosure.
 3. The RTU package shall include all parts for standard installation and be installed in the pump control panel in accordance with manufacturer’s installation instructions.
 4. This is a retrofit installation. The NEW MyDro 850 RTU will be replacing the existing Mission Communication RTU. The Owner’s existing Mission Communications Service Agreement Package will be transferred to the NEW RTU unit. After the existing RTU is taken out of service, the RTU and all associated equipment that is no longer in use shall be turned over to the Owner.
 5. Mission Communications shall update the data collection, alarm notification, data presentation web pages, etc to reflect the new installation for this pump station.
 6. The Engineer has worked with the following representative/distributor/vendor in the development of the Specifications for this equipment. This person is identified solely as a potential convenience with no intended or implied restriction, recommendation, endorsement, etc.:
 - Kazmier and Associates Inc.
 - Contact Person: Alex Tweel
 - 210 S. Cherry Street
 - Lenoir City, TN 37771
 - Office Phone: 865-948-9941

Cell Phone: 865-719-3602

Email: Alex@kazmierinc.com

7. The Mission Communications system shall include a minimum of eight on-board digital inputs (dry) and two on-board analog inputs with four alarm set points each.
8. Furnish all necessary contact relays to monitor the pump station fault conditions listed below and automatically report these fault conditions by cell phone signal to the programmed phone numbers.
9. MONITORING POINT SCHEDULE
 - a. RTU-1 Inputs and Outputs:
 1. Digital Inputs:
 - a. DI-1: Pump #1 Running Status
 - b. DI-2: Pump #2 Running Status
 - c. DI-3: Pump #1 Failure
 - d. DI-4: Pump #2 Failure
 - e. DI-5: LOW-LOW Wet Well Level (Float)
 - f. DI-6: HIGH-HIGH Wet Well Level (Float)
 - g. DI-7: Phase Failure
 - h. DI-8: Spare
 2. Analog Inputs (4-20 mA signal)
(with four (4) high/low threshold alarms):
 - a. AI-1: Wet Well Level
10. INSTALLATION
 - A. Install remote terminal units in accordance with Manufacturer and Supplier's recommendations.
 1. Delineate timing of RTU installation and commissioning.
 2. Conform to National Electric Code and local codes.
 3. Label inputs as to their purpose on enclosure lid schematic.
 4. Terminations inside RTU enclosure: Low voltage.
 5. Provide Manufacturer's Representative inspection of sites prior to completion.
 6. Test inputs for successful transmission prior to municipality acceptance.
 7. Adjust antenna placement or elevation to obtain consistent, stable system operation.
11. Startup & training provided by Mission Communications, or their representative shall be included.

2.03 COMPONENTS

- A. The Pump Controller shall be a NE152 duplex pump controller as manufactured by:
 - NE Controls, L.L.C.
 - 7048 Interstate Island Road
 - Syracuse, NY
 - Phone: 315-299-5161
 - www.necontrols.com
- B. An alternate Pump Controller may be allowed with written approval by Engineer and Owner.
- C. Miscellaneous Materials:
Provide all required relays, terminal blocks, fuses, jumpers, wiring, labels, and other miscellaneous materials for completion of the pump control panel.

2.04 PUMP CONTROL PANELS

- A. This project includes one (1) Pump Control Panel.
- B. It is the responsibility of the Supplier to provide the detailed panel design, panel component bill of material and panel wiring design. The Supplier shall furnish all required control panel components and completely assemble the panel with the specified components. The Engineer will review all panel component selections. The Engineer must approve any deviation from the specified components.
- C. The Supplier shall prepare detailed design drawings for the Pump Control Panel and submit them to the Engineer for review prior to commencing fabrication.
- D. ELECTRICAL RATINGS
 - 1. The power supply to the Pump Control Panel will be 120/240 VAC (+/-10%), 3-Phase, 4-Wire, 60 Hz (+/-5%).
 - 2. The Pump Control Panel will have a short circuit current rating (SCCR) of 35kA.
 - 3. The Pump Control Panel output current ratings shall be capable continuous operation at a minimum of 100% rated motor full-load current in accordance with NEC Table 430.150.
- E. ENCLOSURE – NEMA 4X-SS
 - 1. The enclosure shall be a NEMA 4X rated enclosure manufactured from stainless steel with white polyester powder coating. The enclosure shall be a minimum depth of 16” sized adequately to house all the components. The door gasket shall be formed in place rubber composition and shall assure a positive weatherproof seal. The door shall open a minimum of 180 degrees. Devices

mounted on the external surface of the enclosure shall maintain the NEMA rating on the enclosure. Manufacture is Hoffman or approved alternate.

2. A stainless steel dead front door shall be mounted on a continuous aluminum aircraft type hinge and shall contain cutouts for the protrusion of the circuit breakers and provide protection of personnel from internal live voltages. The pump controller and all control switches, pilot indicator lights, elapsed time meters, duplex receptacle and other operational devices shall be mounted on the external surface of the dead front. The dead front door shall open a minimum of 150 degrees to allow for access to the equipment for maintenance. A 3/4" break shall be formed around the perimeter of the dead front to provide rigidity. Painted steel or other materials are not acceptable.
3. The back plate shall be manufactured of 12-gauge sheet steel and be finished with a primer coat and two (2) coats of baked on white enamel. All hardware mounted to the sub panel shall be accomplished with machine thread tapped holes. Sheet metal screws are not acceptable. All devices shall be permanently identified with engraved legends.
4. The panel shall be separated into two sections. One section shall be dedicated to the 240 volt power equipment and wiring and the other section shall contain the control equipment, wiring, and terminals.

F. INCOMING POWER – Power Distribution Block

1. The incoming power supply shall terminate on the Main Power Distribution Block circuit breaker shall be supplied in its own section for the bottom fed
2. The panel shall be equipped with a Panduit VeriSafe Absence of Voltage Tester (AVT). The AVT shall be connected to the supply at the main power distribution block .

G. SURGE PROTECTION

1. The Pump Control Panel shall be equipped with a Surge Protection Device (SPD) to minimize damage to the control equipment from transient voltage surges. The suppressor shall utilize thermally protected silicon-oxide varistors encapsulated in a non-conductive housing. Mechanical indicators shall be provided on each phase to indicate protection has been lost. The suppressor shall have a surge current rating of 80,000 Amps per phase. The SPD shall be equipped with a dry contact for remote monitoring. A separate circuit breaker shall be supplied for the SPD. The SPD shall be an Eaton Model PTX160-3D101 or approved alternate.
2. Analog (4-20mA) signal lines that leave the control panel shall be equipped with surge protection devices. Instrumentation surge protection devices shall be Emerson SolaHD model number STC-DRS-036 or approved alternate.

H. MOTOR CIRCUIT BREAKERS

1. The panel power distribution shall include all necessary components and be completely wired with stranded copper conductors rated at 90°C.
2. Motor Circuit Breakers:
 - a. Motor circuit breakers shall be thermal magnetic, Square D PowerPact™ circuit breaker or approved alternate.
 - b. Breakers shall be indicating type, providing on-off-tripped at positions of the handle. They shall be quick make-quick break on manual and automatic operation and have inverse time characteristics.
 - c. Each motor controller shall have its own breaker disconnect.
 - d. All circuit breakers shall be sealed by the manufacturer after calibration to prevent tampering.
3. All motor branch and power circuit components shall be of highest industrial quality. The short circuit current rating of all power circuit devices shall be a tested combination or evaluated per the National Electrical Code Article 409. The lowest rated power circuit component shall be the overall motor control panel short circuit rating and shall not be less than the fault current available. The minimum motor control panel rating shall not be less than 35 kA, rms symmetrical. Control assemblies operating at 120 volts nominal or less may be provided with transformers which limit the fault current and may be rated less than the minimum required short circuit rating.

I. MOTOR CONTROLLERS – RVSS Starters

1. Provide a reduced voltage, solid-state starter for each pump motor. Each RVSS starter shall be sized to operate a 40 HP motor (TO BE CONFIRMED). The RVSS shall be Motortronics VMX Series or approved alternate. The RVSS shall have an integral bypass contactor. The RVSS shall be provided complete with a digital display/keypad for programming/configuration, indication/display, and operational interface. The display/keypad shall be mounted on the inner door.

J. CONTROL POWER

1. 120 VAC for the auxiliary and control circuits is provided from the incoming power. The Supplier shall provide any 24 VDC power supplies required.
2. The auxiliary and control circuits shall be protected by a normal duty thermal-magnetic air circuit breaker which shall be connected in such a manner as to allow control power to be disconnected from all control circuits.

K. CONTROL OPERATOR INTERFACE

1. The control panel shall be equipped with the following switches. A position indicating legend plate shall be provided for each switch.
 - a. A three-position HOA switch shall be provided for each pump.
 - b. A two-position SOFT-LINE switch shall be provided for each.
 - c. A RESET pushbutton shall be provided for each pump.
 - d. A two-position AUTO-FLOAT switch.
2. The control panel shall be equipped with the following indicators:
 - a. One (1) green pilot light for each pump to indicate RUNNING.
 - b. One (1) red pilot light for each pump to indicate ALARM.
3. Indicating lights shall be heavy duty, 30mm diameter push-to-test, LED Type.
4. The lights and switches shall be GE 30mm 104 series or approved alternate.
5. One (1) six-digit elapsed time indicator (non-reset type) shall be connected to each motor run feedback circuit to indicate the total running time of each pump in "hours" and "tenths" of hours.

L. PUMP PROTECTION

1. Pump Monitor Relay
 - a. One plug-in solid-state Pump Monitor Relay unit shall be supplied for each pump to monitor the pump for over-temp and leakage.
 - b. The unit shall have an 11-pin, round base to mate with a standard 11-pin socket.
 - c. The unit shall also be flanged in order to allow dead front door mounting.
 - d. The unit shall be powered by 24VAC, 24VDC, or 120VAC.
 - e. LED indication shall be provided for power on, over-temp, and leakage conditions. An over-temp reset push-button shall be provided to allow reset of unit.
 - f. Dry contacts shall be furnished for each pump for thermal/moisture shutdown. These contacts shall be wired to the starter control circuit.

- g. The sensor input circuitry is to contain both hardware and software filters to provide noise immunity, as well as sensor input short circuit protection.
- h. The Pump Monitor Relay unit shall of a type approved by the pump manufacturer as to not void any pump manufacturer's warranties.
- i. Manufacture is MPE or approved alternate.

2. Phase Monitor

- a. A line voltage rated, adjustable phase monitor, undervoltage/overvoltage relay shall be installed to sense low voltage, loss of power, reversed phasing and loss of a phase.
- b. The control circuit shall de-energize upon sensing any of the faults and shall automatically restore service upon return to normal power.
- c. The phase monitor shall be dual voltage and be of an 8-pin and utilize an 8-pin relay base.
- d. The phase monitor relay shall have a 20 second delay to normal after a fault reset. Phase monitor to be Macromatic Phase Monitor Relay product number PMPU240 or engineer approved alternate.

M. ADDITIONAL 120VAC CIRCUITS

- 1. In addition to the internal 120VAC control panel circuits, the Pump Control Panel shall be equipped with one (1) 120VAC circuits with 20 AMP circuit breaker for external use. The circuits shall be assigned as follows:
Circuit #1 = SCADA RTU
- 2. A duplex ground fault interrupting utility receptacle providing 115 VAC, 60 Hertz, single phase current, shall be mounted on the door panel of the control enclosure. Receptacle circuit shall be protected by a 20 ampere thermal-magnetic circuit breaker.
- 3. A Hoffman Model A-LF16M12R fluorescent fixture and switch, or approved alternate shall be mounted inside the control panel to illuminate the controls.

N. CLIMATE CONTROL

- 1. The Pump Control Panel will be installed outdoors.
- 2. The design ambient temperature is -20°F to 120°F.
- 3. The control panel shall be provided with ventilation suitable for the specified ambient conditions and as required by the equipment.
- 4. The panel shall be equipped with an internal 400W condensation heater with adjustable thermostwitch. The heater shall be a Hoffman D-AH4001 or approved alternate and the thermostwitch shall be a Hoffman Model A-TEMNC or approved alternate.
- 5. The ventilation and heater shall be sized to provide a suitable environment inside the control panel for proper and reliable operation of the equipment

housed by the panel. This design shall take into consideration all factors that affect the conditions inside the panel including but not limited to:

- Ambient Temperature
 - Sunlight on Panel
 - Heat generated inside the panel
 - Other site conditions
6. All vent openings shall be louvered and screened to prevent entrance of insects into the enclosure.
 7. Inlet vent opening shall also have a washable filter to filter out fine dirt and pollen particulates.
 8. Equip the panel enclosure with a weatherproof intake louver and a thermostatically-controlled exhaust fan to provide positive panel ventilation and heat rejection. The louver shall be a Hoffman T-EP10SS or approved alternate. The exhaust fan shall be a Hoffman Model T-FP 101SS or approved alternate. The thermostat shall be a Hoffman model A-TEMNC or approved alternate.

O. CONTROL RELAYS

1. All control relays shall be TPDT relays as manufactured by Square-D and be in the 8501 series type K or Engineer approved alternate.
2. All control relays shall have pilot lights to indicate state of relay.
3. All Control relays shall be of the tubular type and be pluggable into a standard 11-pin relay socket.

P. UNINTERRUPTABLE POWER SUPPLY (UPS)

1. All control circuits shall be powered by an UPS properly sized to provide back-up power to controls for a period of 30 minutes before falling below required voltage.
2. All UPS systems shall be manufactured by APC.

Q. GENERAL PRACTICES: Below are the requirements for the fabrication and assembly of the control panels.

1. All the panel components shall be installed in the panel in accordance with the manufacturer's recommendations and requirements.
2. All control components contained in the control panels shall be mounted on a removable sub-plate.
3. All panel components and terminal block line-ups shall be labeled with engraved marking plates.
4. All spare pump controller points shall be wired to field terminal block points.
5. 15% spare terminals shall be provided.
6. The instrument terminal strip must be separate from the control terminal strip.
7. All terminal block points shall be permanently identified with the terminal number.

8. Each end of every wire shall be permanently identified with the wire number.
9. All component, terminal block point, and wire labeling shall match the as-built drawings.
10. A complete set of as-built schematics shall be laminated to inside of outer enclosure door.
11. Control circuits shall be wired with a minimum #16 AWG stranded copper wire with MTW or approved alternate insulation.
12. Instrumentation wiring shall be wired with single pair #16 AWG twisted shielded wire.
13. Power wiring shall be sized as required for the load.
14. Different voltage level wiring shall not be bundled together or run together. Control voltage 115 VAC wiring must be run separately from 24VDC control and instrumentation wiring.

R. GROUNDING

1. A common ground bar shall be mounted on the enclosure back plate. The mounting surface of the ground bar shall have any paint removed before making final connections.

2.05 FIELD INSTRUMENTS

- A. All instrumentation to be supplied as specified in this section.
- B. Wastewater Pump Station Instrumentation (See Drawings):

Item	Qty	Description	Mfr	Model #
1	1	Submersible Level Transmitter – Wet Well	Keller America	LevelRat with 4-20mA output, complete with Protective Spacer, Drying Tube Assembly, etc to make a complete unit 50 feet cable length (Note 1)
2	5	Float Level Switch	Dwyer	FSW2-DNPN-xx (Note 2)

Note 1 - Provide minimum length signal cable as noted. Actual length requirements to be coordinated with the Contractor.

Note 2 – Standard minimum cable length of 50ft. To be ordered with cable of sufficient length to be routed from well to panel. Actual length requirements to be coordinated with the Contractor.

- C. The float switches shall be internally weighted mechanical float switches. Each float switch assembly shall include an internal weight to sufficiently hold the float in position. Each level switch shall have a switch rating of at **least** 10 amps and be

supplied with sufficient 2 conductor type SJO cable to reach the control panel with no splices. Junction boxes inside the wet well are not acceptable for any devices. Cable splices are not acceptable for any devices. Float switches shall be sealed in a solid polyurethane float for corrosion and shock resistance.

PART 3 - EXECUTION

3.01 GENERAL

- A. Coordinate all work with the engineer/owner to avoid conflicts, errors, delays, and unnecessary interference with operation of the existing system during installation, testing, turnover and startup.
- B. All new equipment shall be installed in accordance with the manufacturer's instructions and approved submittals.

END OF SECTION

SECTION 16001

ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED SECTIONS

- A. Provisions of Division 1 including general, supplementary conditions, and general requirements apply to work specified under Division 16.

1.02 WORK INCLUDED

- A. Provide all materials, labor, and equipment required to furnish and install a complete electrical system as indicated on the Drawings and as specified herein.
- B. Electrical work includes, but is not limited to, the following:
 - 1. Complete electrical distribution system for lighting and power including the electrical service and necessary feeders, motor control center, branch circuits, conduit, lighting fixtures, control switches, and receptacles.
 - 2. Excavation, trenching, and backfilling for conduit and/or cable.
 - 3. Grounding.
 - 4. Control components furnished under other Divisions of these Specifications including, but not limited to relays, thermostats, etc. shall be installed under this Division. Wire and connect all controls, complete and in working order, in accordance with wiring diagrams shown on shop drawings submitted under other Divisions.

1.03 RELATED WORK

- A. The following work shall be furnished under other Divisions of these Specifications but shall be coordinated with said Divisions by Division 16 tradesman prior to bid.
 - 1. Concrete work.
 - 2. Painting.
 - 3. Cutting and patching.
 - 4. Electrical control systems and interlock wiring as required by drawings, specifications, or manufacturer's schematics.
 - 5. Heating and ventilating equipment.

1.04 DEFINITIONS

- A. Provide: As used shall mean furnish, install, and connect, and put in good working order.

- B. Wiring: As used shall mean wire and cable, installed in raceway with all required boxes, fittings, connectors, etc. completely installed.
- C. Engineer: As used shall mean "Engineer of Record" whose seal is affixed to the contract specifications and/or drawings of Division 16.

1.5 CODES AND STANDARDS

- A. Comply with applicable local, state, and federal codes.
- B. Electrical work shall be installed in accordance with the Drawings and Specifications, 2017 NEC, and recommendations of NFPA.
- C. In event of conflict between Drawings, Specifications and such codes, Engineer shall be notified in writing prior to bid. A ruling will then be made by the Engineer in writing. All work shall be installed in strict accordance with applicable codes without additional cost to Owner.
- D. Contractor shall submit and/or file all necessary specifications and drawings as required by governing authorities.

1.06 SUBMITTALS

- A. Provide submittals on materials and equipment identified in the Specifications and Drawings prior to manufacture, order, or installation in accordance with Section 01340, Shop Drawings, Product Data, and Samples.
- B. Submittals shall include but not be limited to the following:
 - Wiring devices & cover plates
 - Light fixtures
 - Disconnect and safety switches
 - Conduit fittings
 - Distribution transformers and panels
 - Motor control center
 - Load Centers

1.07 OPERATING AND MAINTENANCE MANUALS

- A. Furnish, to the Owner, three bound and indexed sets of operation and maintenance instructions on the electrical equipment. Instructions shall also include

recommended spare parts lists.

- B. A minimum of 4 hours of training on the operation and maintenance of the electrical equipment shall be provided for the Owner's representative.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver equipment and materials to job site in original, unopened, labeled containers.
- B. Store ferrous materials to prevent rusting. Store finished materials and equipment to prevent staining and discoloring.

PART 2 - PRODUCTS

(Not used)

PART 3 - EXECUTION

3.01 SITE VISIT

- A. Visit job site prior to bid date to determine actual conditions under which work shall be done, to familiarize oneself with project, and to verify total scope of work required. Failure to do so shall not constitute a reason for an extra charge.

END OF SECTION

SECTION 16195

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Section 16001: Electrical General Provisions
- B. Section 16050: Basic Electrical Materials and Methods

1.2 WORK INCLUDED

- A. Extent and types of electrical identification are indicated herein and as follows:
 - 1. Operational instructions and warnings.
 - 2. Danger signs.
 - 3. Equipment/system identification signs.
 - 4. Conduit identification.
 - 5. Power and control wiring identification.
 - 6. Terminal marking.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, identification products shall be provided by W.H. Brady Co., Ideal Industries, Inc., Panduit, T&B, or approved equal.

2.02 MATERIALS

- A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.
- B. Cable/Conductor Identification Bands: Provide manufacturer's standard wrap-around type, vinyl-cloth, self-adhesive cable/conductor markers with either pre-numbered plastic-coated type or write-on type with clear plastic self-adhesive cover flap, numbered to show circuit identification. Provide markers for all field control wiring.

- C. Self-Adhesive Plastic Signs: Provide manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings. Signs shall be of sizes suitable for application areas and adequate for visibility, with proper wording for each application (as examples: 208V, EXHAUST FAN or DANGER – HIGH VOLTAGE).
 - 1. Colors: Unless otherwise indicated or required by governing regulations, provide orange signs with black lettering.

- D. Engraved Plastic-Laminate Signs: Provide three-layer engraving stock in sizes and thickness indicated, engraved with engraver's standard letter style of sizes and wording indicated, black and white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
 - 1. Thickness: 1/16", for units up to 20 sq. in. or eight (8") length; 1/8" for larger units.
 - 2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

- E. Underground Warning Tape: Provide four (4") inch wide detectable type, plastic, yellow warning tape with suitable warning describing type of cable/circuit over buried electrical lines.

2.03 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations, and other designations used in electrical identification work, with corresponding designations shown, specified, or scheduled. Provide numbers, lettering, and working as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION

- A. General Installation Requirements:
 - 1. Coordination: Where identification is to be applied to surfaces, which require finish, install identification after completion of painting.
 - 2. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.
 - 3. Conduit Identification: Where electrical conduit is exposed in spaces with exposed mechanical piping which is identified by a color-coded method, apply color-coded identification on electrical conduit in a manner similar to piping identification. Except as otherwise indicated, use orange as coded

- color for conduit.
4. Equipment/System Identifications: Install engraved plastic-laminate sign on each disconnect and control cabinets. Except as otherwise indicated, provide single line of text, 1/2" high lettering on 1-1/2" high sign (2" high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide identification and warning signs for each unit of the following categories of electrical work.
 - a. Electrical cabinets and enclosures.
 - b. Access panel/doors to electrical cabinets.
 - c. Control stations.
 - d. Disconnect switches.
 - B. Install signs at locations indicated or, where not otherwise indicated, at locations for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with stainless steel tamperproof fasteners.
 - C. Install danger signs on all disconnect and control cabinet exteriors.
 - D. Install danger and notice to disconnect power before removing or opening on all inner panels.
 - E. Install underground warning tape in accordance with the 2017 National Electrical Code.
 - F. Install arc-flash warnings in compliance with 2017 National Electrical Code and NFPA 70E.

END OF SECTION

SECTION 16400

SERVICE AND DISTRIBUTION SYSTEM AND GROUNDING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Service system
- B. Distribution system
- C. Grounding

1.02 RELATED WORK DESCRIBED ELSEWHERE

- A. Section 16115: Conduit
- B. Section 16120: Wire and Cable
- C. Section 16170: Grounding and Bonding

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Furnish service entrance conduit and cable and miscellaneous hardware required.

PART 3 - EXECUTION

3.01 SERVICE AND DISTRIBUTION SYSTEM

- A. The utility service shall be, 240 volts, three (3) phase, four (4) wire, open-delta high-leg from the service transformers(s) provided by the utility.
- B. The System shall commence at the service point. The service will continue through the stand mounted meter and on to the main circuit breaker disconnect switch where it will feed the Pump Control Panel.
- C. The utility service, meter & meter enclosure, and service disconnect are existing and are being reused. The existing Pump Control Panel is being replaced.
- D. Final connection at the service meter must be coordinated with the utility and Owner.
- E. All contributions-in-aid to construction for electric service will be coordinated internally at the utility.

3.02 GROUNDING

- A. Ground electrical system in accordance with Article 250, 2017 National Electrical Code, and local authorities having jurisdiction.
- B. Do not use flexible metal conduit and fittings as a grounding means. Install a green ground wire in each piece of flexible conduit and bond to conduit system at both ends.
- C. Install code size green grounding conductors in all branch circuits feeding receptacles, motors, or other permanently wired fixed electrical utilization equipment and all feeder circuits. Bond conductors to chassis or fixed equipment. All grounding conductors shall be bonded to multi-terminal ground bus at the panelboard or other distribution equipment. Grouping of grounding conductors under a single lug is not acceptable.
- D. Bond metal water service to grounding electrode conductor.
- E. All separate grounding electrodes shall be bonded together to limit potential differences between them and between their associated wiring systems.

END OF SECTION

SECTION 16480

OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 RELATED SECTIONS

- A. Section 16001: Electrical General Provisions
- A. Section 16050: Basic Electrical Materials and Methods
- C. Section 16470: Distribution Panelboard

1.02 WORK INCLUDED

- A. This section includes circuit breakers and fuses.

1.03 SUBMITTALS

- A. Provide manufacturer's product data for the following:
 - 1. Circuit breakers
 - 2. Enclosures
 - 3. Fuses (Provide complete list of all fuses and the equipment where they are used.)
 - 4. Shunt trips
- B. Provide maintenance data for products for inclusion in the Operating and Maintenance Manual.
 - 1. Include a load current and overload relay heater list compiled by Contractor after motors have been installed. Arrange list to demonstrate selection of heaters to suit actual motor nameplate full load currents.

1.04 QUALITY ASSURANCE

- A. Listing and Labeling: Provide overcurrent protective devices that are listed and labeled.
 - 1. The term "listed and labeled": As defined in the 2017 National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- B. Overcurrent protective devices and their installation shall comply with the requirements of the 2017 National Electrical Code.

- C. Circuit breakers shall comply with UL 489, NEMA AB 1, and NEMA AB 3.
- D. Fuses shall conform to NEMA FU 1.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Circuit Breakers: Subject to compliance with requirements, provide products by Cutler-Hammer; General Electric Co.; Siemens Energy & Automation, Inc.; Square D Co.; or approved equal.
- B. Fuses: Subject to compliance with requirements, provide products by Bussmann Mfg. Co., Littlefuse Co, Ferraz Shawmut, or approved equal.

2.02 MOLDED-CASE CIRCUIT BREAKERS

- A. Circuit breakers shall be molded case or insulated case, manually operated, trip-free, with inverse-time, thermal-overload protection, and instantaneous magnetic, short-circuit protection, as required. Circuit breakers shall be completely enclosed in a molded case, with the calibrated sensing element factory-sealed to prevent tampering.
- B. Thermal-magnetic tripping elements shall be located in each pole of the circuit breaker and shall provide inverse-time-delay thermal overload protection and instantaneous magnetic short-circuit protection. On frame sizes larger than 100 amperes, the instantaneous magnetic tripping element shall be adjustable and accessible from the front of the breaker.
- C. Breaker size shall be as required for the continuous current rating of the circuit. Breaker class shall be as required.
- D. Interrupting capacity of the branch circuit breakers shall be sufficient to successfully interrupt the maximum short-circuit current imposed on the circuit at the breaker terminals. Circuit breaker minimum interrupting capacities shall be as shown on drawings and shall conform to NEMA AB 3.
- E. Multipole circuit breakers shall be of the common-trip type having a single operating handle and shall have a two-position on/off indication. Circuit breakers shall have temperature compensation for operation in an ambient temperature of 104 degrees.
- F. Circuit breakers shall have root mean square (rms) symmetrical interrupting rating sufficient to protect the circuit being supplied. Interrupting ratings may have selective type tripping (time delay, magnetic, thermal, or ground fault).
- G. Breaker body shall be of phenolic composition. Breakers shall be capable of having

such accessories as handle-extension, handle-locking, and padlocking devices attached where required.

- H. Provide UL listed service entrance equipment when used for service disconnect.
- I. Circuit breakers used for switching high intensity discharge lights or fluorescent lights shall be rated for that type of service.

2.03 FUSES

- A. A complete set of fuses for all switches shall be provided. Fuses shall have a voltage rating not less than the circuit voltage.
- B. Provide Class RK5 fuses for motor branch circuits.
- C. Fuses shall be labeled showing UL class, interrupting rating, and time-delay characteristics, when applicable.
- D. Fuse holders field-mounted in a cabinet or box shall be porcelain. Field installation of fuse holders made of such materials as ebony asbestos, Bakelite, or pressed fiber shall not be used.
- E. Provide a minimum of three (3) spare fuses of each size and type fuse installed.
- F. Provide a complete list of all fuses and the equipment where they are used.

2.04 EQUIPMENT ENCLOSURES

- A. Enclosures for equipment shall be in accordance with NEMA 250.
- B. Equipment installed inside, clean, dry locations shall be contained in NEMA Type 1, general-purpose sheet-steel enclosures unless otherwise noted.
- C. Equipment installed in wet locations shall be contained in NEMA Type 3R, rainproof, sheet-steel enclosures, constructed for outdoor use to protect against falling rain, sleet, and ice unless otherwise noted.
- D. Ferrous-metal surfaces of electrical enclosures shall be cleaned, phosphatized, and painted with the manufacturer's standard finish.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install overcurrent protective devices as indicated or required, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements.

- B. Coordinate with other work, including electrical wiring work, as necessary to interface installation of overcurrent protective devices.
- C. Fasten circuit breakers without mechanical stresses, twisting or misalignment being exerted by clamps, supports, or cables.
- D. Set field-adjustable circuit breakers for trip settings as indicated, subsequent to installation of devices.
- E. Provide engraved plastic-laminate nameplates under the provisions of Section 16195, "Electrical Identification" for enclosed circuit breakers and motor controllers.

3.02 ADJUSTING

- A. Inspect circuit breaker operating mechanisms for malfunctioning and where necessary, adjust units for free mechanical movement.
- B. Adjust trip settings so that circuit breakers coordinate with other overcurrent protective devices in circuit.
- C. Adjust trip setting to provide adequate protection from overcurrent and fault currents.

3.03 FIELD QUALITY CONTROL

- A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.
- B. In the presence of the Owner or Owner's Representative, test each device and demonstrate its working as specified.

END OF SECTION

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED SECTIONS

- A. Section 16001: Electrical General Provisions
- B. Section 16195: Electrical Identification

1.02 QUALITY ASSURANCE

- A. **Qualifications of Manufacturer:** All materials and equipment used in work of Division 16 shall be produced by manufacturers regularly engaged in manufacture of similar items, and with history of successful production acceptable to the Engineer. They shall be new and be UL listed, or listed by other recognized testing laboratory where such label is available.
- B. **Qualifications of Installers:** Use adequate numbers of skilled workmen who are thoroughly trained and experienced in necessary crafts, and who are completely familiar with specified requirements and methods needed for proper performance of work of this Section.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

- A. Reference in Specifications to any article, device, product, material, fixture, form and type of construction, by name, make, or catalog number shall be interpreted as established a standard of quality, and shall not be construed as limiting competition. Any article, device, product, material, fixture, form and type of construction which in the judgment of Engineer, expressed in writing is equal to that specified, may be used.
- B. Substitution shall be approved by Engineer before purchase and/or installation. If unapproved materials are installed, work required to remove and replace unapproved items shall be done at the Contractor's expense.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Electrical drawings are diagrammatic and shall not be scaled for exact sizes or locations. They are not intended to disclose absolute or unconditional knowledge

of actual field conditions. This Division shall be prepared to relocate any outlet or device 6' in any direction without additional charge to the Owner.

- B. Equipment shall be installed according to manufacturer's recommendations.
- C. Protect work and materials from damage by weather, entrance of water, and dirt. Cap conduit during installation. Avoid damage to materials and equipment in place.
- D. Satisfactorily repair or remove and replace damaged work with new materials.
- E. Trenching and backfilling shall comply with Division 2 (Site Work) of these Specifications and provide sheathing, shoring, dewatering and cleaning necessary to keep trenches and their grades in proper condition for work to be carried on. Trenches shall be excavated 6" below elevation of bottom of conduit. Backfill shall be per Section 02210, Site Grading and Filling.
- F. Failure to route conduit without interfering with other equipment and construction, shall not constitute a reason for an extra charge. Equipment, conduit and fixtures shall fit into available space, and shall not be installed at such times and manner as to cause damage to structure. Equipment requiring services shall be readily accessible.
- G. Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
 - 1. Coordinate electrical systems, equipment, and materials installation with other project components.
 - 2. Verify all dimensions by field measurements.
 - 3. Arrange for chases, slots, and openings in other components during progress of construction, to allow for electrical installations.
 - 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 - 5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior.
 - 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 - 7. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 - 8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent

possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.

9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other systems and components, where installed exposed in finished spaces.
10. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
11. Insulate dissimilar metals so they are not installed in direct contact.

H. Conduits which pass through concrete slabs shall be sealed with concrete grout.

I. Coordinate electrical power connection requirements with all equipment suppliers. Where power requirements differ from drawing design requirements, Engineer shall be notified for clarification and installation requirements prior to installing that portion of work. Cost for equipment and labor for improperly installed electrical connections not coordinated and approved by other trades and the Engineer shall be incurred by the Electrical Contractor and shall not constitute a reason for an extra charge because of any rework.

3.02 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with Division 1, Section 01045, "Cutting and Patching."
- B. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

3.03 TESTING AND EQUIPMENT SERVICING

- A. Entire installation shall be free from improper grounds and short or open circuits. Conductors shall be tested before energizing circuit. Test to insure that entire system is in proper operating condition, and that adjustments and setting of circuit breakers, fuses, control equipment, and apparatus have been made. Correct defects discovered during tests.
- B. Equipment shall be turned over to Owner in lubricated condition with instructions on further lubrication included in operating instructions.

3.04 REMOVAL OF DEBRIS

- A. Remove surplus materials and debris caused by, or incidental to electrical work. Remove such debris at frequent intervals. Keep job site clean during

construction.

3.05 IDENTIFICATION OF EQUIPMENT

- A. Equipment shall be identified in accordance with Section 16195, "Electrical Identification."

3.06 AS-BUILT DRAWINGS

- A. Maintain one set of blue line electrical prints on site, marked to show as-built conditions and installations, prints to be turned over to Owner after job is complete.

3.07 TEMPORARY LIGHTING AND POWER

- A. Provide, maintain and remove after construction is completed, temporary lighting adequate for workman safety and temporary power for all trades including any 3 phase power required.
- B. Provide and maintain barricade lighting where required to adequately protect Owner against liability for damage to public or personnel. All wiring shall be approved for weatherproof installation.

3.08 POWER OUTAGES

- A. Coordinate all power outages with Owner and submit for approval proposed schedule of Work indicating extent, number, and length of outages required to perform Work. Contractor shall include in bid cost of overtime labor required for power outage to occur after Owner's normal hours of operation.

3.09 OTHER MATERIALS

- A. Work of this Division shall also include those items not specifically mentioned or described, but which are obviously necessary to conform to the design intent, applicable codes and to produce complete electrical system that functions properly. These materials shall be as selected by Contractor but subject to approval of the Engineer.

3.10 OTHER COORDINATION

- A. Contractor shall obtain and pay for all necessary permits and inspection fees required for the electrical installation.

- B. Contractor shall coordinate electrical service requirements with the Knoxville Utilities Board and provide any required fee, conduit, transformer pad, meter base, etc. that is required.

3.11 GUARANTEE-WARRANTY

- A. Guarantee Work to be free of material and workmanship defects for a period of one year, from date of final acceptance for the project. Repair and replace defective Work and other Work damaged thereby which becomes defective during term of Guarantee-Warranty. Furnish Owner with three written copies of Guarantee-Warranty.

END OF SECTION

SECTION 16115

CONDUIT

PART 1 - GENERAL

1.01 RELATED SECTIONS

- A. Section 16001: Electrical General Provisions
- B. Section 16050: Basic Electrical Materials and Methods

1.02 WORK INCLUDED

- A. Provide a complete conduit system to support all electrical equipment and systems. Conduit system includes conduit, couplers, connectors, fittings, boxes, covers and supports.

1.03 QUALITY ASSURANCE

- A. Listing and Labeling: Provide conduit that is listed and labeled.
 - 1. The term "listed and labeled": As defined in the 2017 National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- B. Conduit and its installation shall comply with requirements of the 2017 National Electrical Code.

PART 2 - PRODUCTS

2.01 CONDUIT

- A. Rigid Metal Conduit (RMC): Allied, Wheatland, Republic, or approved equal.
- B. Rigid Non-Metallic Conduit (PVC): Carlon, Cantex, Southern Pipe, or approved equal.
- C. Liquidtight Flexible Nonmetallic Conduit: Aflex, Electroflex, or approved equal.

2.02 CONDUIT FITTINGS

- A. Couplings and connectors: Appleton, T&B, Arlington, or O.Z. Gedney.

- B. Bushings: Appleton, T&B, O.Z., or Gedney
- C. Straps and Hangers: Appleton, T&B, Steel City, or Minerallac.
- D. Group Pipe supports: Unistrut, Kindorf, B-Line, or approved equal.
- E. Expansion Fittings: O.Z. Gedney Type AX, or equal by Appleton, or approved equal.
- F. Exposed Conduit Fittings: Appleton, Crouse-Hinds, or O.Z. Gedney,

PART 3 - EXECUTION

3.01 CONDUIT

- A. In general, conduit installation shall follow layout shown on drawings. However, this layout is diagrammatic only and where changes are necessary due to structural conditions, other apparatus or other causes, such changes shall be made without cost to Owner. Offsets in conduits are not indicated and must be furnished as required.
- B. The Contractor is responsible for field routing and locating all required raceway (conduit, cable tray, pull boxes, etc) as required.
- C. Conduit shall be installed in accordance with the 2017 National Electrical Code.
- D. Provide bushings on the open ends of conduit containing conductors. Insulated bushings shall be provided for conduits containing conductors #4 AWG or larger with an insulating ring an integral part of the bushing.
- E. Use rigid metal conduit (RMC) outdoors and above grade or concrete slab.
- F. Use rigid non-metallic Schedule 80 PVC indoors and above grade or concrete slab.
- G. Use rigid non-metallic Schedule 40 PVC when run underground.
- H. In indoor areas where installed conduit may be subjected to damage, rigid metal conduit (RMC) shall be used.
- I. When PVC conduit is used, turn up with rigid galvanized elbows and provide equipment grounding conductor in accordance with NEC Article 250.
- J. Support conduit and secure to forms when cast in concrete so that conduit will not be displaced during pouring of concrete. Stuff boxes and cork

fittings to prevent entrance of water during concrete pouring and at other times during construction, prior to completion of conduit installation.

- K. Route all conduit at right angles or parallel to walls of building.
- L. Use proper sized tools for bending. Do not heat metal conduit. Dents and flat spots will be rejected. Cut and thread conduit so ends will butt in couplings. Make threads no longer than necessary and ream pipe free of burrs.
- M. Minimum conduit size 1 inch unless otherwise required.
- N. Leave one #10 AWG or equivalent nylon pull wire in empty conduits.
- O. Use short pieces, approximately two (2') feet of flexible conduit to connect motors and other devices subject to motion and vibration. Use liquidtight flexible nonmetallic conduit where outside or subject to water spray.

3.02 CONDUIT FITTINGS

- A. Support conduit vertically and horizontally by straps or hangers. Do not exceed intervals as described in the 2017 National Electrical Code.
- B. All indoor conduit supports, brackets, mounting hardware, fasteners, etc shall be nonmetallic and corrosion resistant.
- C. Use expansion fittings, properly bonded to assure ground continuity, across expansion joints in floors and ceilings. Use double lock nuts and bushings on panel feeders at panel cans.
- D. When connections are made to motors or other equipment, not near walls or columns, provide a vertical conduit, minimum one inch, attached to floor with a floor flange, bring wiring out of this conduit by means of a conduit and flexible conduit extending to equipment junction box.

END OF SECTION

SECTION 16120
WIRE AND CABLE

PART 1 - GENERAL

1.01 RELATED SECTIONS

- A. Section 16001: Electrical General Provisions
- B. Section 16050: Basic Electrical Materials and Methods

1.02 WORK INCLUDED

- A. Wire and cable for all service, feeders, branch circuits, and instrument and control wiring rated 600 volts and below.

1.03 QUALITY ASSURANCE

- A. Listing and Labeling: Provide wire and cable that is listed and labeled.
 - 1. The term "listed and labeled": As defined in the 2017 National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- B. Wire and cable and its installation shall comply with requirements of the 2017 National Electrical Code.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Wires and cables shall meet applicable requirements of the 2017 National Electrical Code and UL for the type of insulation, jacket, and conductor specified or indicated.
- B. All conductors shall be copper with 600 volt insulation unless otherwise indicated.
- C. Cables with PVC materials are NOT permitted.
- D. Wire and cable shall be manufactured by Belden, General Cable, Essex, Encore, Rome Cable, Southwire, or approved equal.
- E. Use solid copper type XHHW/XHHW-2 for branch circuit wiring #10 AWG and smaller. No conductor for branch circuit wiring shall be smaller than #12 AWG.
- F. Use stranded copper, type XHHW/XHHW-2 for feeder and power circuits #8 AWG

and larger.

- G. Use stranded copper type XHHW/XHHW-2 #14 AWG for 120 VAC control circuit wiring.
- H. Use stranded copper type XHHW/XHHW-2 #16 AWG twisted shielded pairs for 24 VDC instrumentation wiring.
- I. Provide color coded wire and with a different color for each phase and neutral and ground as follows: 208/120 volt circuits - phases A, B, and C: black, red, and blue respectively; neutral: white; ground: green; 480/277 volt circuits – phases A, B, and C: brown, yellow, and orange respectively, neutral: gray; ground: green. Approved color tape is acceptable for feeders. Also provide color coded wire for control circuits.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Complete conduit system before pulling any wire or cable. Use cable lubricants recommended by cable manufacturer as necessary.
- B. Conductors shall be continuous from outlet to outlet or to branch circuit over-current devices. Make splices only in junction boxes. Splices shall not be made in panelboards. All control and instrumentation wiring shall be continuous between components and/or terminal boards.
- C. No splices are allowed in manufacturer supplied cables.
- D. A minimum of eight (8") inches of slack conductor shall be left in every outlet or junction box. There should also be enough slack so three (3") inches extends outside the outlet or junction box.
- E. Make splices in conductors #10 AWG and smaller diameter with insulated, pressure-type connector. Use Scotchlok, Ideal, or equal wire connectors.
- F. Make splices in conductors #8 AWG and larger diameter with solderless connectors and cover with insulation material equivalent to conductor insulation. Use Burndy compression connectors with crimpit cover, type CC, or equal.
- G. Where branch circuits homeruns exceed 70' in length for 120 volt and 150' in length for 208, 240, or 277 volt circuits, #10 AWG wire shall be the minimum size used to the first outlet.

3.02 TESTING

- A. After completion of the installation and splicing and prior to energizing the conductors, wire and cable shall be given continuity and insulation tests as herein specified.
- B. Test wiring to verify that no short circuits, open circuits, or accidental grounds exist. Continuity tests shall be conducted using a dc device with bell or buzzer.
- C. Perform insulation resistance tests on wiring #6 AWG and larger diameter using an insulation test set which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms.

END OF SECTION

SECTION 16130

OUTLET AND JUNCTION BOXES

PART 1 - GENERAL

1.01 RELATED SECTIONS

- A. Section 16001: Electrical General Provisions
- B. Section 16050: Basic Electrical Materials and Methods

1.02 WORK INCLUDED

- A. Outlet boxes.
- B. Pull and junction boxes.

1.03 QUALITY ASSURANCE

- A. Listing and Labeling: Provide outlet and junction boxes that are listed and labeled.
 - 1. The term "listed and labeled": As defined in the 2017 National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- B. Outlet and junction boxes and their installation shall comply with the requirements of the 2017 National Electrical Code.

PART 2 - PRODUCTS

2.01 OUTLET AND JUNCTION BOXES

- A. Non-metallic "FS" type boxes shall be used. Cooper Wiring Devices, Crouse Hinds, T&B/Steel City, or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Support boxes independently of conduit.
- B. Bonding jumpers shall be used around knockouts.

3.2 OUTLET BOXES

- A. Outlet boxes shall be securely anchored, set true, and plumb.
- B. Select boxes according to intended use and type of outlet. Use four (4") inches square boxes where required.
- C. If more than two conduits enter box from one direction, 4" square boxes with square-cut device covers not less than one (1") inch deep specifically designed for this purpose, shall be used.
- D. Install blank device plates on outlet boxes left for future use.

3.3 JUNCTION BOXES

- A. Pull and junction boxes shall be sized in accordance with the 2017 National Electrical Code according to number of conductors in box or type of service to be provided. Minimum size is 4-11/16" square and 2-1/2" deep.
- B. Pull boxes shall be provided where necessary in the conduit system to facilitate conductor installation. Conduit runs longer than 100 feet or with bends exceeding 270 degrees shall have a pull box installed at a convenient intermediate location.
- C. Install in locations as shown on Drawings and as required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.
- D. Install pull and junction boxes in accessible areas only.
- E. Install knockout closures in unused box openings.

3.05 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 16170
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Section 16001: Electrical General Provisions
- B. Section 16050: Basic Electrical Materials and Methods

1.2 WORK INCLUDED

- A. Grounding electrodes and conductors.
- B. Equipment grounding conductors.
- C. Bonding.

1.3 PERFORMANCE REQUIREMENTS

- A. The grounding system to earth resistance shall be less than 25 ohms.

1.04 SUBMITTALS

- A. Provide product data for grounding electrodes and connections.
- B. Provide project records documentation that includes:
 - 1. Actual locations of components and grounding electrodes.
 - 2. Test results of each individual ground rod and the entire system.

1.05 QUALITY ASSURANCE

- A. Listing and Labeling: Provide grounding and bonding materials that are listed and labeled.
 - 1. The term "listed and labeled": As defined in the 2017 National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- B. Components and installation shall comply with the requirements of the 2017 National Electrical Code (NEC).
- C. Materials shall comply with UL 467, "Grounding and Bonding Equipment."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers shall be Burndy, T&B, or approved equal.

2.02 GROUNDING ELECTRODES

- A. Ground rods shall be copper clad steel with minimum dimensions of ¾ inch diameter by 10 feet long.

2.03 CONNECTORS

- A. Exothermic welded connections shall be provided in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.
- B. Pressure connectors shall be high-conductivity-plated units.
- C. Bolted clamps shall be heavy-duty units listed for the application.

2.04 WIRE AND CABLE

- A. All grounding conductors shall be copper.
- B. The grounding electrode conductor shall be stranded.
- C. Equipment grounding conductors shall have green insulation.
- D. Bare copper conductors shall conform to the following:
 - 1. Solid conductors: ASTM B-3
 - 2. Assembly of stranded conductors: ASTM B-8
 - 3. Tinned Conductors: ASTM B-33

2.05 MISCELLANEOUS CONDUCTORS

- A. Ground bus shall be bare annealed copper bars.
- B. Braided bonding jumpers shall be copper tape, braided number 30 gauge bare copper wire, and terminated with copper ferrules.
- C. Bonding strap conductor/connectors shall be soft copper, 0.05 inch thick and two (2") inches wide, unless otherwise noted.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Grounding system shall be in accordance with Article 250 of the 2017 NEC except where the Drawings or Specifications exceed NEC requirements.
- B. Install code size green grounding conductors in all feeder and branch circuits. Bond conductors to chassis or fixed equipment.
- C. All grounding conductors shall be bonded to multi-terminal ground bus at panelboard or other distribution equipment. Grouping of grounding conductors under a single lug is not acceptable.
- D. Bond metal piping systems to equipment ground conductors of pumps, fans, electric heaters, and air cleaners serving individual systems.
- E. Bond structural steel and reinforcing steel in foundation footing to grounding electrode conductor. Bond steel together.
- F. Install ground rods at locations indicated. Install additional ground rods as necessary to achieve specified resistance to ground. Separate ground rods a minimum of one-rod length from each other and a least the same distance from any other grounding electrode. Interconnect ground rods with bare conductors buried at least 24 inches below grade.
- G. Ground rods shall be driven not less than 12 inches from structure foundations and to a depth such that the tops of the rods are not less than 12 inches below grade.
- H. Provide grounding test wells at each ground rod location. Install well pipes flush with finished grade.
- I. Locate all grounding attachments away from areas subject to physical damage. Provide protective covering as required.
- J. All separate grounding electrodes shall be bonded together to limit potential differences between them and between their associated wiring systems. This includes the power system, SCADA System, TVSS, and system grounding electrodes.

3.02 CONNECTIONS

- A. Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.
 2. Make connections with clean bare metal at points of contact.
 3. Aluminum to steel connections shall be with stainless steel separators and mechanical clamps.
 4. Aluminum to galvanized steel connections shall be with tin-plated copper jumpers and mechanical clamps.
 5. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.
- B. Use exothermic welded connections for connections to structural steel and for underground connections. Comply with manufacturer's written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. For compression-type connections, use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.
- D. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.
- E. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.
- F. Where insulated ground conductors are connected to ground rods or ground buses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.
- G. Do not use flexible metal conduit and fittings as a grounding means. Pull a green wire in each piece of flexible conduit, and screw to conduit system with lugs at both ends.

3.03 FIELD QUALITY CONTROL

- A. Use the fall-of-potential method as described in IEEE Standard 81 to measure the resistance of the following. Record the measurements and provide to the Engineer.
1. The resistance between earth and each ground rod prior to interconnection with other ground rods.
 2. The resistance between earth and the counterpoise.
 3. The resistance of the grounding system at the grounding electrode connection to earth.

Measure the ground resistance when there has been no precipitation for 5 days, without the soil being moistened by any means other than natural precipitation or natural drainage or seepage, and without chemical treatment or other artificial means of reducing natural ground resistance.

- B. Perform continuity tests at all power receptacles to ensure the ground terminals are properly grounded to the facility ground network.

END OF SECTION

SECTION 16190
SUPPORTING DEVICES

PART 1 - GENERAL

1.01 RELATED SECTIONS

- A. Section 16001: Electrical General Provisions
- B. Section 16050: Basic Electrical Materials and Methods
- C. Section 16115: Conduit

1.02 WORK INCLUDED

- A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fasteners.

1.03 QUALITY ASSURANCE

- A. Electrical Component Standard: Components and installation shall comply with the 2017 National Electrical Code.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, slotted metal angle and u-channel systems shall be provided by Allied Tube & Conduit, American Electric, B-Line Systems, Inc., Unistrut Diversified Products, or approved equal.
- B. Subject to compliance with requirements, conduit sealing bushings shall be provided by Bridgeport Fittings, Inc., Cooper Industries, Inc., Killark Electric Mfg. Co., O-Z/Gedney, Raco, Inc., Spring City Electrical Mfg. Co., Thomas & Betts Corp., or approved equal.

2.02 COATINGS

- A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be aluminum or hot-dip galvanized.
- B. Products used with the rigid non-metallic conduit installed indoors shall be non-metallic and corrosion resistant including fasteners and connectors

2.03 MANUFACTURED SUPPORTING DEVICES

- A. Raceway Supports: Raceways shall be supported with clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
- B. Fasteners: Types, materials, and construction features as follows:
 - 1. Expansion Anchors: Carbon steel wedge or sleeve type.
 - 2. Toggle Bolts: All steel springhead type.
 - 3. Powder-Driven Threaded Studs: Heat-treated steel, designed specifically for the intended service.
- C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.
- D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.
- E. U-Channel Systems: 16-gauge steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacturer.

2.04 FABRICATED SUPPORTING DEVICES

- A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.
- B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.
- C. Pipe Sleeves: Provide pipe sleeves of one of the following:
 - 1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:
 - a. 3-inch and smaller: 20-gauge.
 - b. 4-inch to 6-inch: 16-gauge.
 - c. over 6-inch: 14-gauge.

2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.
3. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.
- B. Coordinate with the structural system and with other electrical installation.
- C. Raceway Supports: Comply with the 2017 NEC and the following requirements:
 1. Conform to manufacturer's recommendations for selection and installation of supports.
 2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs, provide additional strength until there is a minimum of 200 lbs safety allowance in the strength of each support.
 3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
 4. Support parallel runs of horizontal raceways together on trapeze-type hangers.
 5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
 6. Space supports for raceway types not covered by the above in accordance with NEC.
 7. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.
 8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

- D. Vertical Conductor Supports: Install simultaneously with installation of conductors.
- E. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.
- F. Cast boxes threaded to raceways need not be supported separately except where used for fixture support.
- G. Sleeves: Install in concrete slabs and walls and for raceways and cable installations.
- H. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated.
- I. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the structure, including but not limited to conduits, raceways, cables, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:
 - 1. Fasten by means of wood screws or screw-type nails on wood; toggle bolts on hollow masonry units; concrete inserts or expansion bolts on concrete or solid masonry; and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
 - 2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.
 - 3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock- resistant fasteners for attachments to concrete slabs.

END OF SECTION